TERM ONE
SET CONCEPTS

FINITE AND INFINITE SETS

Finite sets are sets whose elements or members have a limit or are countable. These sets have the starting point and the ending point that is to say these are sets with countable number of elements.

Examples

1. A set of vowel letters
2. A set of letters of English Alphabet
3. A set of multiples of 5 between 10 and 49
4. A set of all factors of 12.
5. A set of rectangular numbers less than 36
6. A set of all colours of a light spectrum
7. A set of odd numbers which are factors of 18
8. A set of positive integers less than 13.
9. A set of prime numbers bigger than 5 but smaller than 30
10. A set of even numbers less than 10

INFINITE SETS

Infinite sets are sets whose members have no limit.
We use three dots (…) to show the infinite sets at the end or at the beginning.

Examples

1. A set of stars in the sky
2. A set of trees
3. A set of even natural numbers
4. A set of positive integers
5. A set of odd numbers
6. A set of negative integers

Exercise

Use the word "Finite set or Not finite set" to describe the following given sets

1. A set of counting numbers
2. A set of even numbers less than 25
3. A set of vowels
4. A set of Alphabetical letters
5. A set of leaves in the bush

6. A set of composite numbers from 6 to 36
7. A set of the first 10 prime numbers
8. A set of non positive integers
9. A set of composite numbers between 4 and 20
10. A set of all colours of the Uganda national flag.

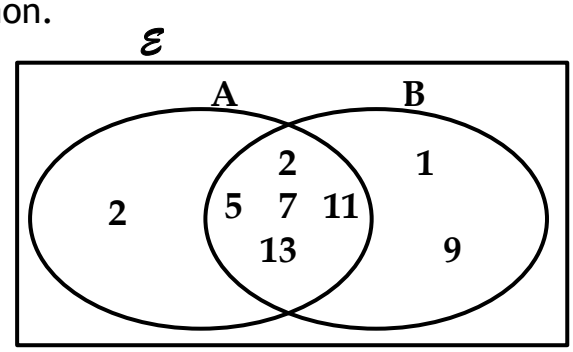
INTERSECTION SET

This is the set of common members in the given sets.

Example I

Given that **set A= {2,3, 5,7, 11, 13}**and set **B= {1,3,5,7,9,11,13}**

(a) Find, A∩B. A∩B requires you to only list the members which are common.



A∩B = {3,5,7,11, 13}

(b) Find n(A∩B).

This requires you to list and then after count the number of elements.

n(A∩B) = {3,5,7,11, 13}

∴n(A∩B) = 5

(c) Find $(A \cap B)^{/}$.

This is a set of elements which are not found in the intersection.

$(A \cap B)^{/}$ = {2, 1, 9}

(d) Find $n(A \cap B)^{/}$.

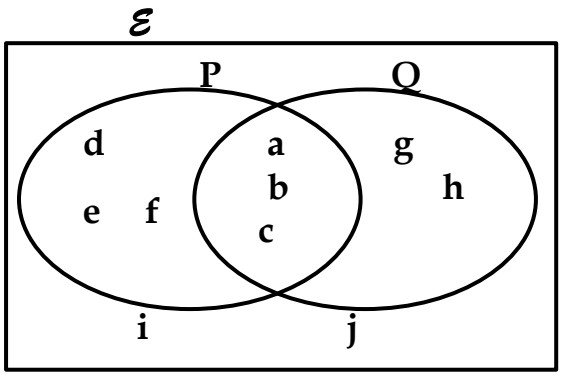
This is a set of elements which are not found in the intersection

$(A \cap B)^{/}$= {2, 1, 9}

$n(A \cap B)^{/}$ = 3

Example II

Given

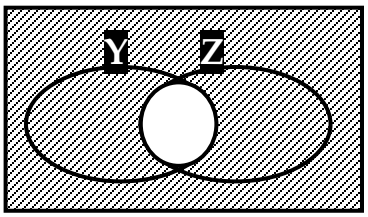


Find $n(P \cap Q)'$.

$(P \cap Q) = \{ d,e,f,g,h,i,j\}$ **$\therefore n(P \cap Q) = 7$**

Example III

Describe the shaded region.



$(Y \cap Z)'$

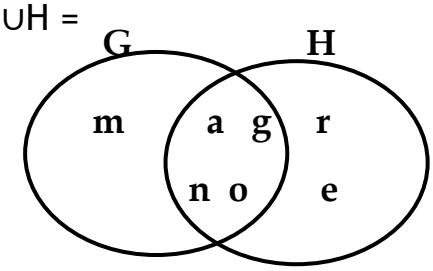
UNION OF SETS

This is a set of all the members in the two given without repeating any element.

Example I

Given that set G = {m, a, n,g,o} and set H = {o, r, a, n, g, e}. Find;

(i) G∪H =



G∪H = {m, a, n, g, o, r, e}

(ii) n(G∪H)

G∪H = { m, a, n, g, o, r, e}

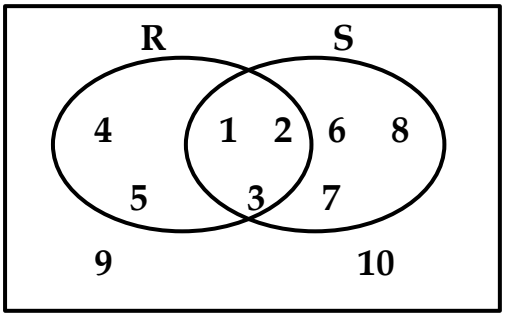
$\therefore n(G \cup H) = 7$

(iii) $(G \cup H)' = \{\ \}$

$n\ G \cup H = 0$

Example II

Given



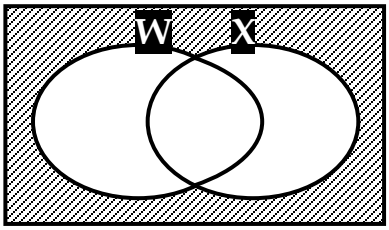
Find $n(R \cup S)' = \{9,10\}$

$=(R \cup S)' = \{9,10\}$

$\therefore = (R \cup S)' = 2$

Example III

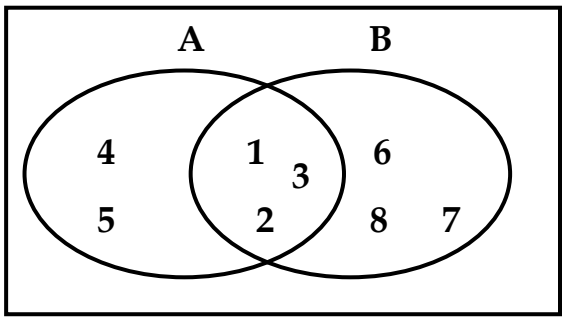
Shade the region $(W \cup X)'$ on the Venn diagram below.



APPLYING INTERSECTION AND UNION.

Example I

Given that **set A = {1,2,3,4,5}**, **A ∪B = {4,5,1,2,3,6,7,8}** and **A∩B = {1,2,3}**, find n(B).

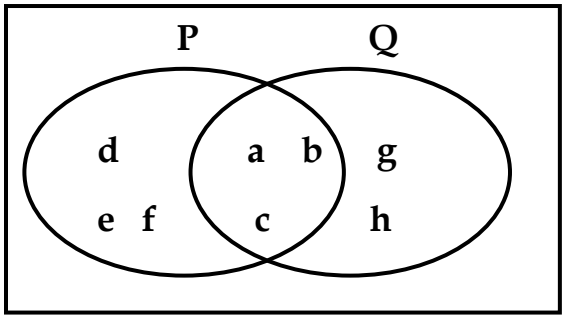


B ={1,2,3,6,7,8}

n(B) = 6

Example II

Given that set **P = {a,b,c,d,e,f}**, **P∪Q = {a,b,c,d,e,f,g,h}** and **P∩Q = {a,b,c}**, find **n(Q).**



Q={a, b, c, g, h}

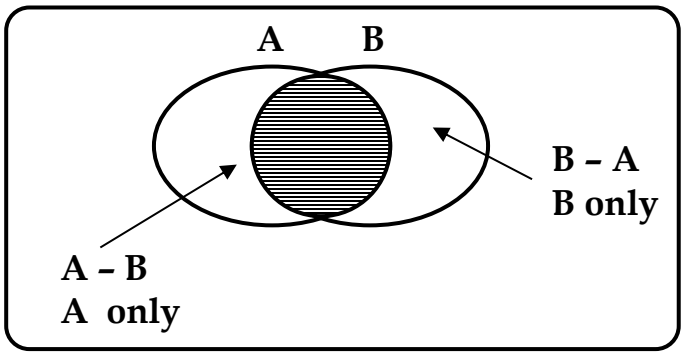
∴n(Q) = 5

DIFFERENCE OF SETS.

This is a set of elements which are in one set but not in the other. A- B the elements in set A but not in set B.

A - B = A only

B - A = B only

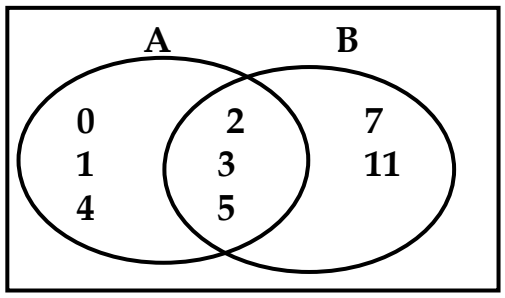


Example I

Given that A = {0,1,2,3,4,5,} and set B = {2,3,5,7,11}

Find (i) n(A – B)

(ii) n(B – A)



(i) n(A-B)

A – B = {0,1,4}

n(A – B) = 3

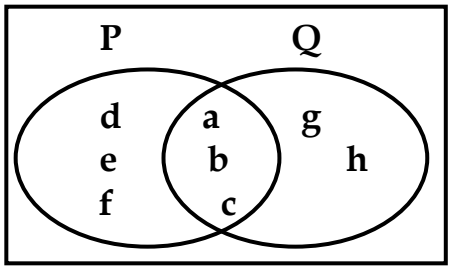
(ii) n(B – A)

B – A = {7,11}

n(B – A) = 2

Example II

Given that **P∩Q = {a, b, c}, (P- Q) = {d, e, f}**and **(Q-P) = {g, h}**. Find **n(P∪Q).**

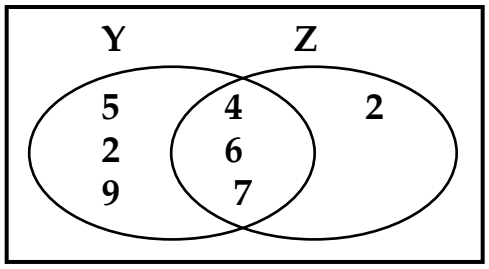


P∪Q = {d,e ,f, a, b, c, g, h}

n(P∪Q) = 8

Exercise

1. Use the Venn diagram below to answer the questions that follow.



Find;

(a) **Y∩ Z** (b) **n(Y∩ Z)**

(c) **n(Y∩ Z)/** (d) **n(Y – Z)**

(e) **n(Z – Y)**

2. Given set **P = {a,b,f, k}** and set **Q = {a,c,k,e}.** Find;

   (a)**n(P∩ Q)** (b)**n(P∩Q)/** (d)**n(P−Q)**

   (c)n(**P – Q)** (e) **n(Q – P)**

3. Given that set **K = {1,2,3, 4, 5}**, **K∪L = {1,2,3,4,5,6,8},K∩L = {2,4}**. Find **n(L).**

4. Given that set **P ={1,3,5,7,9}, (Q) = {3,5,7}, P∪Q = {1,2,3,5,7,9}.** Find **n(Q).**

SUBSETS

These are all possible sets obtained from a main set (Super set) or mother set.

LISTING SUBSETS

An empty set and the main set or super set or the given set or the mother set are subsets of any given set.

Example I

Given that **set M = {2,3}.** List down all the subsets that can be formed from set M.

{}, {2}, {3,}, {2,3}.

Example II

Given that set R = {a,b,c}. List all the subsets that can be formed from set R.

{ }, { a }, { b }, { c }, { a,b }, { a,c }, { b,c }, { a,b,c }

Example III

Given that set P = {1,2,3,4}. How many subsets are in set P?

Number of subsets = 2^n

$= 2^4$

$= 2 \times 2 \times 2 \times 2$

= 16 subsets

Example IV

There are 7 elements in a set. How many subsets are in the set?

Number of subsets = 2^n

$= 2^7$

$= 2x\ 2 \times 2 \times 2 \times 2 \times 2 \times 2$

= 128 subsets

Example V

Copy and complete the chart below.

Short form	Expanded form	Value
2^1	2	2
2^2	2x2	4
2^3	2x2x2	8
2^4	2x2x2x2	16
2^5	2x2x2x2x2	32
2^6	2x2x2x2x2x2	64
2^7	2x2x2x2x2x2x2	128
2^8	2x2x2x2x2x2x2x2	256
2^9	2x2x2x2x2x2x2x2x2	512
2^{10}	2x2x2x2x2x2x2x2x2x2	1024

Example VI

Set R has 32 subsets. How many elements are in set R?

Number of subsets = 2^n

$32 = 2^n$

2	32
2	16
2	8
2	4
2	2
	1

$32 = 2^5$

$2^5 = 2^n$

$\therefore n = 5$

Example VII

Given that $2^k = 16$, find the value of k.

$2^k = 16$

$2^k = 2^4$

2	16
2	8
2	4
2	2
	1

$16 = 2^4$

PROPER SUBSETS

These are small sets obtained from the main set excluding the universal/ super set /main set.

Here, we list all possible small sets excluding the main set / super set / mother set.

Example I

Given that set Q = {6,7}. List down all the proper subsets in set Q.

{ }, {6}, {7}

Example II

Given that set **M = {2,3,4}**

{ }, {2}, {3}, {4}, {2,3}, {2,4}, {3,4}

Example III

Given that set **N = {a,b,c,d}.** How many proper subsets are in **set N?**

Number of proper subsets = 2^n -1

= 2^4 -1

= (2 x 2 x 2 x 2) – 1

= 16 – 1

= 15 proper subsets

Example IV

Find the number of proper subsets in set T = {0,1,2,3,4}

Number of proper subsets = 2^n – 1

= 2^5 – 1

= (2 x 2 x 2 x 2 x 2) – 1

= 32 -1

= 31 proper subsets

Example V

There are **63** proper subsets in **set Z.** How many elements are in **set Z?**

Number of proper subsets = 2^n – 1

63 = 2^n – 1

63 + 1 = 2^n –1 +1

64 =2^n

2	64
2	32
2	16
2	8
2	4
2	2
	1

64 = 2^6

2^6 = 2^n

6 = n

∴n = 6

Example VI

There are 15 proper subsets in a set. How many elements are in the set?

Number of proper subsets $= 2^n-1$

$15 = 2^n-1$

$15+1 = 2^n-1+1$

$16 = 2^n$

2	16
2	8
2	4
2	2
	1

$2^4 = 2^n$

$4 = n$

$\therefore n = 4$

Exercise

1. List all the subsets in the sets below;
   (a)**{2,4}** (b)**{a,c,t}**
2. List down all the proper subsets in the sets below.
   (a) **{0,3}** (b)**{r,a,t}**
3. How many subsets can be obtained from a set with the following elements?;

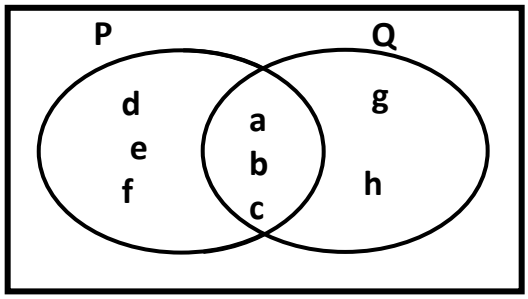
(a) **n(A) = 4** (b) **n(B) = 5** (c)**n(C) = 6**
(d)**n(D) = 3**

4. How many elements are in a set with the following subsets?;

(a)**1024** (b) **512** (c) **256** (d)**128**
(e)**64** (f)**32** (g) **16** (h) **8**

5. How many proper subsets has set **R = {a,b,c,d}**?
6. If set **N = {a,e,i,o,u}**,how many proper subsets can be obtained from set **N**?
7. How many subsets are there in set J = { 6 } ?
8. Given that Set K = {2,3,5,7}. How many subsets are in set K?
9. What is meant by the term subset?
10. If $2^h = 32$. Find the value of h.
11. There are 7 elements in a set. How many subsets are in that set?
12. If the subsets in set E are; { }, { a } , { b } , { c }, { a,b }, { a,c }, { b,c }, { a,b,c }. Find (E)
13. Given that $2^k = 16$. Find the value of K
14. Given that the subsets in set D are; { }, { 11 }, { 13 }, {11,13}. Find n(D)
15. If set S = {All vowel letters}, how many subsets can be obtained from set S?

16. Study the Venn diagram below and answer the questions that follow.



(a) How many subsets are found in set (P-Q)
(b) Find the number of subsets in set Q
(c) How many subsets can be obtained from members found in set Q but not in set P?

17. Find number of the subsets in Set D = {3,6,1,5,8}
18. Given that subsets of set Y are; { }, { 5 }. How many elements are found in set Y ?
19. If set R = {sneezing, coughing, fever}. List down all subsets in set R
20. Given the that set T = {tree, flower, fruit}. Write subset or not subset for the following;

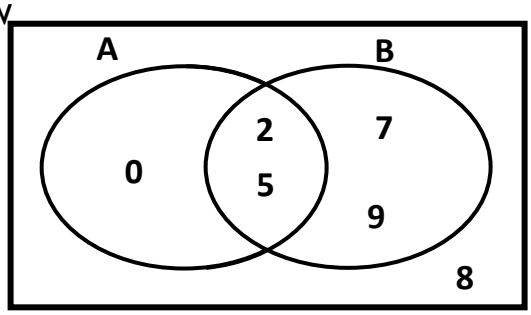
(a) {tree}
(b) {tree, flower}
(c) {fruit, branch}
(d) {flower, mango}
(e) {tree, flower, fruit}

21. Given that set N= {t,e,a}. List all the possible proper subsets in set N?
22. If set C= {The last four letters of English alphabet}, how many proper subsets are in set C?
23. Given that set W = {s,e,t,s}

(a) List the proper subsets in set W.
(b) How many proper subsets are in set W?

24. Write a correct proper subset symbol
25. List down the subsets in a set of the last three months of the year.
26. There are 15 proper subsets in a set. How many elements are in that set?

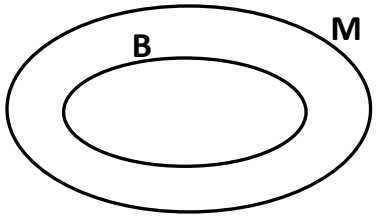
27. Study the Venn diagram below and use it to answer the questions that follow



(a) Find the number of proper subsets in;
(i) Set A complement
(ii) Complement of set B
(iii) Set A∩B
28. There are 63 proper subsets in set V. How many elements are in set V?
29. Draw Venn diagrams of sets P and Q with universal set and shade the following regions;
(a) Complement of set Q
(b) Set P complement
(c) Set $(P \cap Q)'$
(d) Set $(P \cup Q)'$
30. If n(K) = 4. Find the number of proper subsets in set K.
31. Given that set Y = {p,s,a,l,m,s}. Find the number of proper subsets in set Y.
32. List down the proper subsets in set Q = {all even numbers between 30 and 38}

Representing subsets on Venn diagrams

1. Draw a Venn diagram to show that all boys(B) are males(M)



Exercise

1. Draw Venn diagrams to show the following;

(a) All sheep are animals

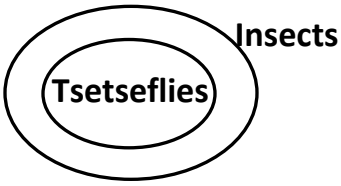
(b) All girls(G) are females(F)

(c) All eagles are birds

(d) All men(M) and women(W) are people(P)

(e) All nurses and doctors are medical workers.

2. What does the diagram below represent?



3. Write down at least three examples of subsets

4. Draw Venn diagrams to show the following statements

(a) Mangoes and oranges are fruits

(b) A is a subset of B

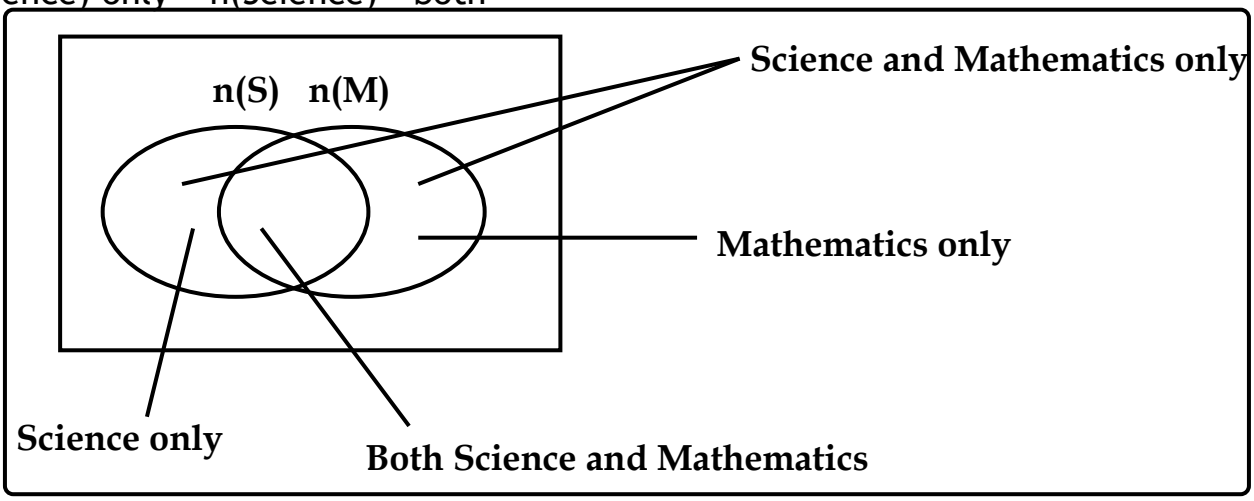
(c) Cows are animals

USING VENN DIAGRAM

To solve word problems, you need to develop skills for translating from English to Mathematics and mathematical symbols.

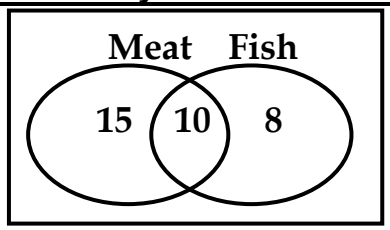
n(Science) = Science only + both

(Science) only = n(Science) – both



Example I

Study the Venn diagram carefully and answer the questions that follow.



(a) How many pupils eat meat?

n(M) = (M)only + both

=15 + 10

= 25 pupils

(b) How many pupils eat meat only?

n(M)only = 15 pupils

(c) How many pupils eat fish?

n(F) =n(F) only + both

=8 + 10

= 18 pupils

(d) How many pupils eat fish only?

n(F) only = 8 pupils

(e) How many pupils eat only one type of sauce only?

One type of sauce only = M only + F only

= 15 + 8

= 23 pupils

(f)How many pupils don't like fish at all?

If they don't like fish at all the they like meat only

Meat only = 15 pupils

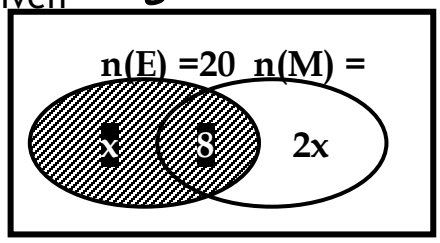
(g) How many pupils dislike meat at all?

If they dislike meat at all, then they like fish only

Fish only = 8 pupils

Example II

Given $\mathcal{E}$=



(a) Find the value of **x.**

Since n(E) is given, we use the region for n(E)

$x + 8 = 20$

$x + 8 - 8 = 20 - 8$

x = 12

(b) How many pupils like Mathematics?

n(M) = 8 + 2x

= 8 + (2 x 12)

= 8 + 24

= 32 pupils

(c) How many pupils like one type of subject only?

One type only = n(E) only + n(M) only

= x + 2x

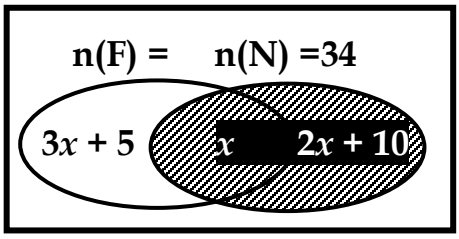
= 3x

= 3 x 12

= 36 pupils

Example III

Given $\mathcal{E}$=



(a) Find the value of **x.**

We are given n(N) = 34, so use that region.

$x + 2x + 10 = 34$

$3x + 10 = 34$

$3x + 10 - 10 = 34 - 10$

$\frac{3x}{3} = \frac{24}{3}$

$x = 8$

(b) How many pupils like football?

n(F) = 3x + 5 + x

= 4x + 5

= (4 x 8) + 5

= 32 + 5

= 37 pupils

(c) How many pupils like one type of game only?

3x + 5 + 2x + 10

3x + 2x + 5 + 10

5x + 15

5 x 8 + 15

40 + 15 = **55 pupils**

(d) How many pupils like netball but not football?

But not means only

(N) only = 2x + 10

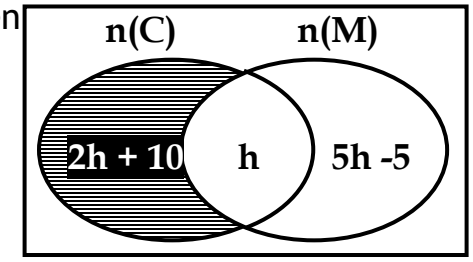
= (2 x 8) + 10

= 16 + 10

26 pupils

Example IV

Given



(a) If **32** pupils eat chicken only, find the value of h.

2h + 10 =32

2h + 10 – 10 = 32 -10

$\frac{2h}{2} = \frac{22}{2}$

h = 11

(b) Find the total number of pupils in the class.

= **2h +10 + h + 5h – 5**

= 8h + 5

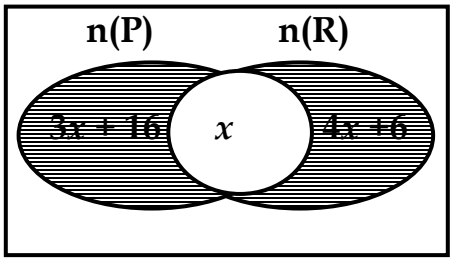
= (8 x 11) + 5

= 88 + 5

= 93 pupils

Example V

Given



(a) If 85 pupils eat one type of food only, find the value of **x**.

n(P) only + n(R) only

3x + 16 + 4x + 6 = 85

3x +4x + 16 +6 = 85

7x + 22 =85

7x + 22 – 22 = 85 -22

$\frac{7x}{7} = \frac{63}{7}$

x = 9

(b)How many pupils are in the class?

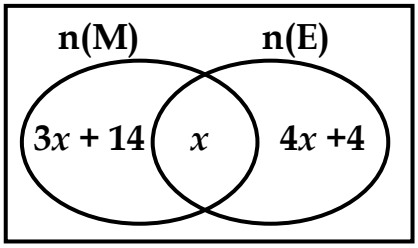
(3x + 16 + 4x + 6) + x

=85 + 9

= 94 pupils

Example VI

Given



(a) If the number of pupils who like Mathematics is equal to the number of pupils who like English, find the value of **x**.

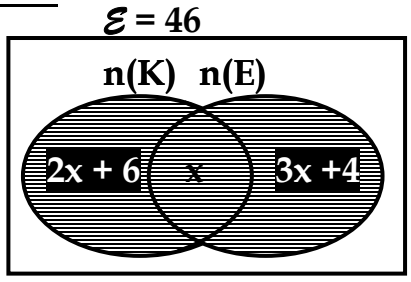
3x + 14 + x = 4x + 4 + x
4x + 14 = 5x + 4
14 - 4 = 5x – 4x
10 = x
∴ x = 10

(b) How many pupils do not like English at all?

= **3x + 14**
= (3 x 10) + 14
= 30 + 14
= 44pupils

Example VII

Given



(a) Find the value of x.

2x + 6 + x + 3x + 4 = 46
6x + 10 = 46
6x + 10 – 10 = 46 – 10
$\frac{6x}{6} = \frac{36}{6}$
x = 6

(b) How many pupils like Kiswahili?

= **2x + 6 + x**
= 3x + 6
= (3 x 6) + 6
= 18 + 6
= 24 pupils

REPRESENTING INFORMATION ON A VENN DIAGRAM.

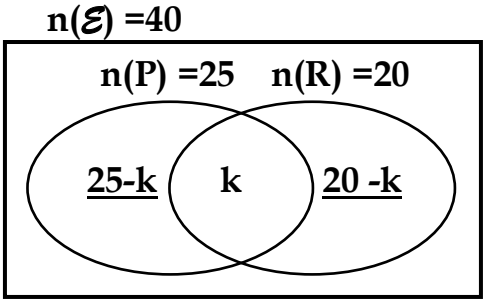
Hints

- ✓ When the word "only" is used on the number of elements in a set, we don't subtract. Just enter the information at the right region.
- ✓ If a number is put in the region for only, do not subtract.
- ✓ If you are given the number of all members of a set and you want the only region, subtract the intersection.

Example I

In a class of **40** pupils, **25** eat **posho**(P),**20** eat **rice (R)** and **K** eat both types of food.

(a)Complete the Venn diagram below.



(b) How many pupils eat both types of food?

25-k+k+20-k =40
25+20 –k+k-k=40
45 - k = 40
45 – k + k = 40 + k
45 = 40 + k
45 – 40 = 40 -40 + k
5 = k
∴k =5

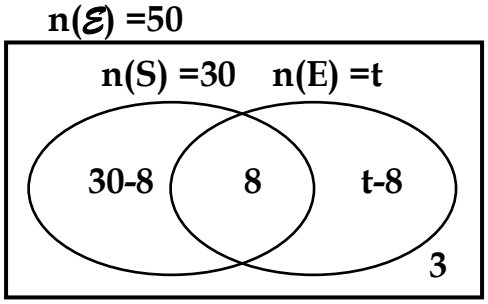
(c) How many pupils eat one type of food only?

25 –k + 20 – k
(25-5) + (20 -5)
20 + 15
35 pupils

Example II

In a class of 50 pupils, 30 pupils like Science(S), t pupils like English, 8 pupils like both Science and English while 3 pupils like none of the two subjects.

(a) Complete the Venn diagram below.



(b) Find the value of **t**.

3 + 30 + t - 8 = 50
33 – 8 + t = 50
25 + t = 50
25 – 25 + t = 50 – 25
t = 25

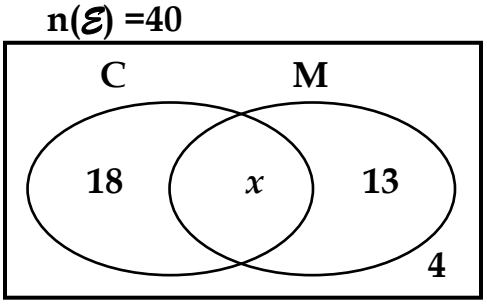
(c) How many pupils like English only?

t - 8
25 – 8
17pupils

Example III

In a class of 40 pupils, 18 pupils eat **chicken (C)** only, 13 eat **meat (M)** only, **x** pupils eat both chicken and meat while 4 don't eat any of the two dishes.

(a) Complete the Venn diagram.



(b) Find the value of x.

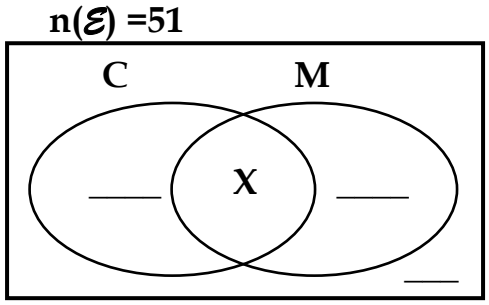
x **+18 + 13 + 4 = 40**
x **+ 35 =40**
x **+ 35 -35 = 40 – 35**
$x = 5$

(b) If a pupil is picked at random to be a class monitor, find the probability that the pupil picked eats only types of sauce only.

$$\text{Prob} = \frac{n(D.C)}{n(T.C)}$$
$$= \frac{18 + 13}{40}$$
$$= \frac{31}{40}$$

EXERCISE 1

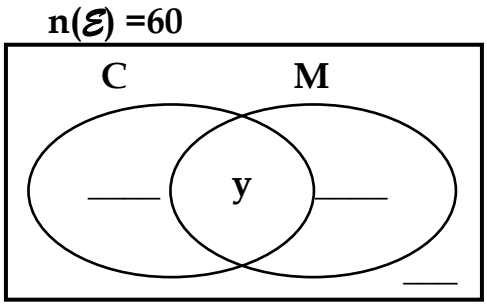
1. In a class of **51** pupils, **28** drank **Sprite (S)**, **20** drank **Mirinda (M)**, **x** drank both Sprite and Mirinda (M) while **5** did not drink any of the two sodas.
(a) Use the above information and complete the Venn diagram below.



(b) Find the value of **X**.
(c) Find the number of pupils who drank one type of soda only.
(d) If a pupil is picked at random to go and buy the sodas, find the probability that he drinks Mirinda only.

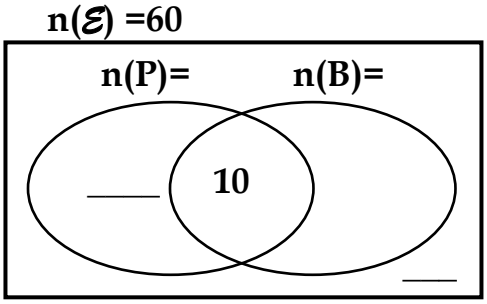
2. At a party attended by **60** guests, **42** ate **chicken (C)**, **(y+8)** ate **meat (M)** only, **y** guests ate both chicken and meat while **5** did not eat any of the two types of sauce.

(a) Use the above information to complete the Venn diagram below.



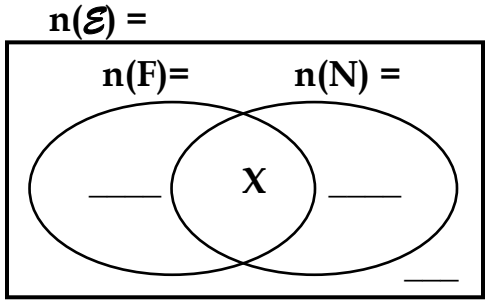
(b) Find the value of **y**.
(c) How many guests didn't eat meet at all?
(d) If a guest is picked at random, what is the probability that the guest ate meat?

3. In a village of 60 people, 30 people were served with posho (P), K people were served with beans (B) only, 10 were served with both posho and beans and 5 were not served with any of the two items.
   (a)Use the information given above to complete the Venn diagram.



   (b) Find the value of k.
   (c) How many people were served with beans altogether?
   (d)If a person is picked at random to over see the serving, find the probability that he received one item only.

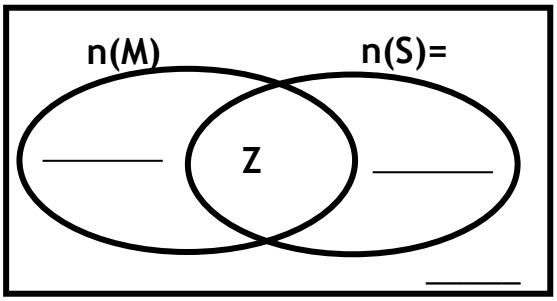
4. In a class, 30 pupils play football (F) and (x+5) play Netball (N) only, x pupils play both games while 3 play neither of the games.
   (a) Use the above information to complete the Venn diagram below.



   (b) If 27 pupils play netball altogether, find the value of X.
   (c) How many pupils play football but not netball?
   (d) If a pupil is picked at random to be a games prefect, find the probability that the prefect plays netball only.

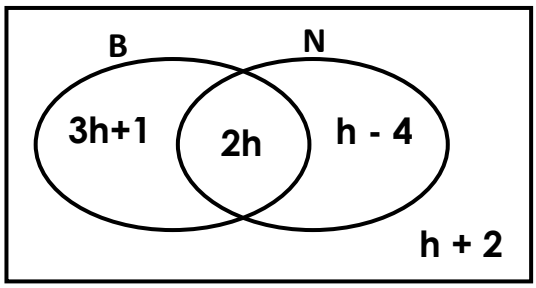
5. In a class, 32 pupils like Mathematics (M) only, z like both science and mathematics, (2z - 10) like science but not mathematics. (z – 2) like neither of the two mentioned subjects.

$n(\mathcal{E})$ =



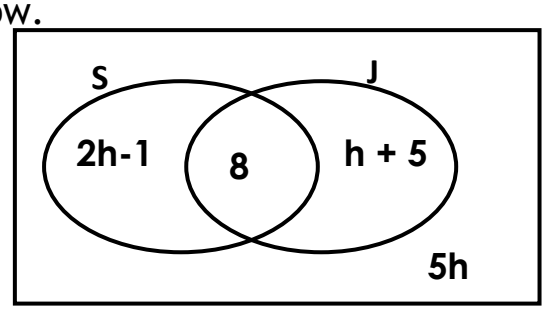
(a) Complete the Venn diagram below using the above information.
(b) If 62 pupils like one subject only, find the value of z.
(c) Calculate the number of pupils in the whole class.
(d) How many pupils do not like science at all?

6. The Venn diagram below shows the number of pupils who play basketball (B) and those who play netball (B). Study it carefully and answer the questions that follow.



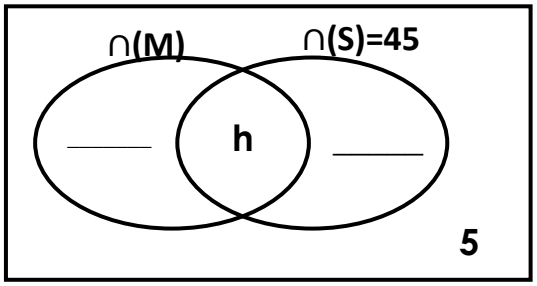
(a) If 21 pupils play only one type of game, find the value of h.
(b) How many pupils do not play netball at all?
(c) How many pupils are in the whole class altogether?

7. Study the Venn diagram below and use it to answer the questions that follow.



(a) Given that $\cap(S \cap J)^1 = 36$. Find the value of h.
(b) How many pupils are in the whole class altogether?
(c) How many pupils did not take juice?

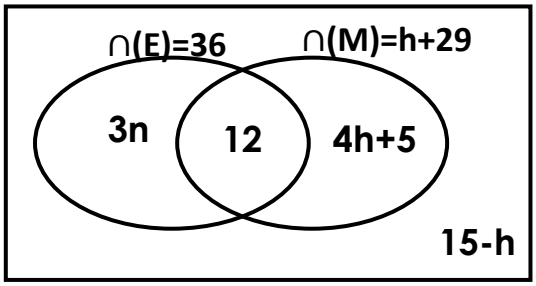
8. In a class of 65 pupils, (2h+3) like mathematics (M) only, 45 pupils like science (S) while h like both mentioned subjects.



(a) Complete the Venn diagram above.
(b) Workout the value of unknown h.

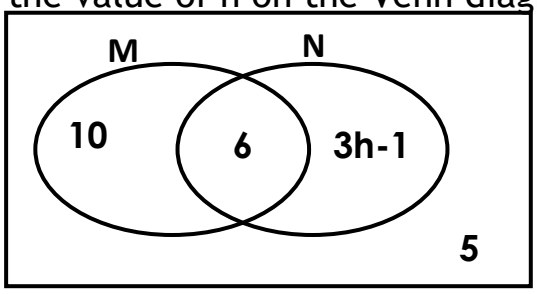
(c) What is the probability of picking a pupil at random that he/she likes mathematics to be a class monitor?

9. The Venn diagram shows the number of pupils who like different subjects as shown below.



(a) Workout the value of h.
(b) Find the value of n.
(c) How many pupils are in the whole class altogether?
(d) Find the probability of picking a pupil at random that don't study mathematics at all to be a class monitor?

10. Find the value of h on the Venn diagram below given that $\cap(M)^1=25$.



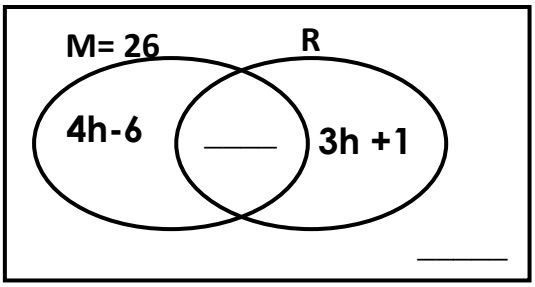
11. Given that $\cap(P)$only = 2h-4, $\cap(P\cap Q)$= 4h, $\cap(Q-P)$= 7h-2, $\cap(P\cup Q)^1$= h+8

(a) Represent the above information on a Venn diagram.

(b) If $\cap(P\cup Q)$= 46. Find the value of h.

12. At a party, 26 people ate Matooke,(M), (h+2) ate both Matooke,(M) and rice (R) while (h-3) ate none of the two mentioned kinds of foods as shown below.

(a) Complete the Venn diagram below.



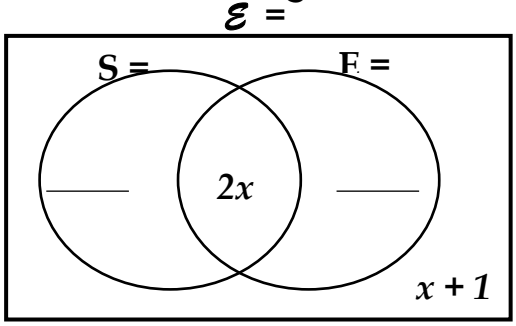
(b) Find the value of h.

(c) How many people attended the party altogether?

(d) Find the probability of selecting a person who did not eat Matooke to be a guest of honor.

13. In a P.7 class, 8x pupils like Science (S) only, 12x pupils like English (E) only, 2x pupils like both Science and English while (x +1) pupils like none of the two mentioned subjects.

(a) Complete the Venn diagram below.



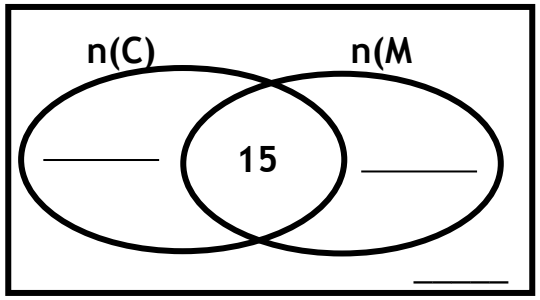
(b) Find value of **x** if $n(S \cap E)^1 = 64$.

(c) Find the number of pupils in the whole class.

14. In a village of 63 farmers, 38 farmers grow cassava, 20 grow maize only, 15 farmers grow both cassava and maize and y farmers grow neither of the two crops.

(a) Represent the above information on the Venn diagram below.

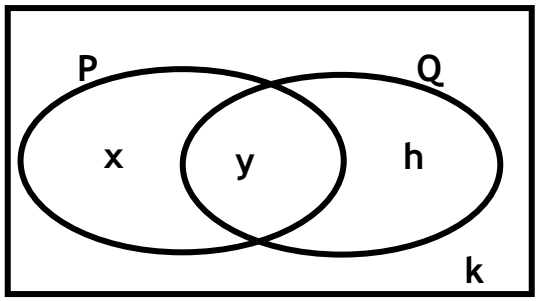
$n(\mathcal{E}) = 63$



(b) Find the value of **y**.

(c) How many farmers grow only one type of crop?

15. Study the Venn diagram below and use it to answer the questions that follow

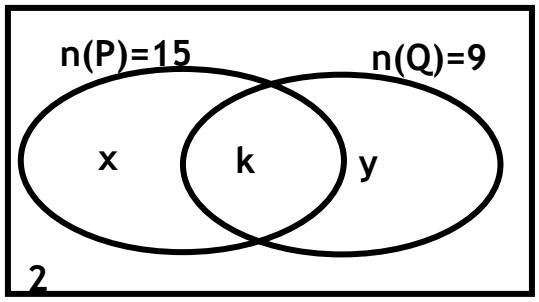


Describe the parts of the Venn diagram labelled with letters

(a) X
(b) Y
(c) h
(d) k

16. Study the Venn diagram below and use it to answer the questions that follow.

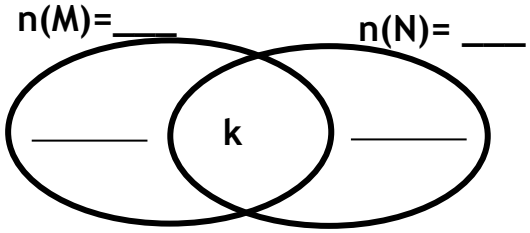
$n(\mathcal{E}) = 22$



Find the value of;

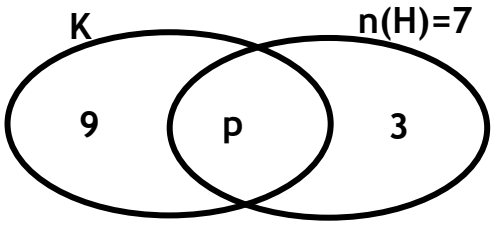
(a) X
(b) Y
(c) k

17. Given that n(M)=10 and n(N)=8, n(M∪N)=15 and n(M∩N)=k
(a) Complete the Venn diagram below correctly



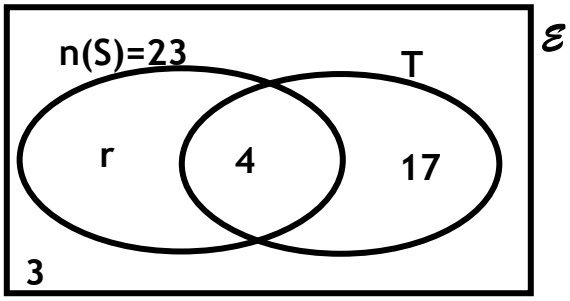
(b) Work out the value of k

18. Use the Venn diagram below to answer the questions that follow



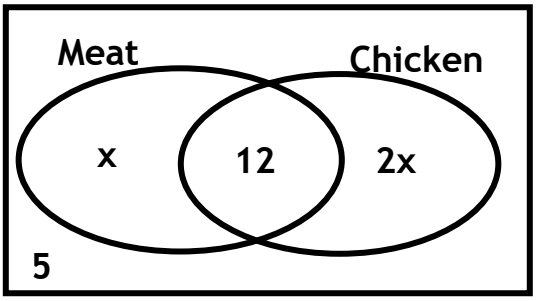
(a) Find the value of p.
(b) What is the value of k?
(c) Find n(K∪H)

19. Study the Venn diagram below and use it to answer the questions that follow



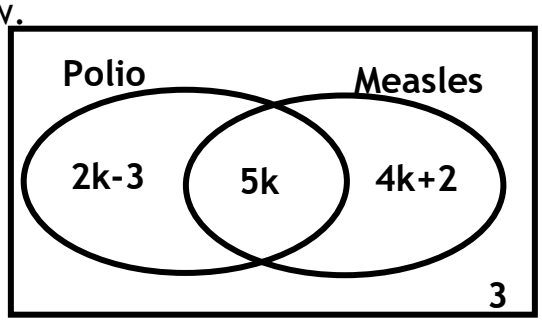
(a) Find the value of r.
(b) What is n(T)
(c) Find n(Σ)

20. The Venn diagram below shows pupils of P.7 class who like meat and chicken. Study it carefully and answer the questions that follow.



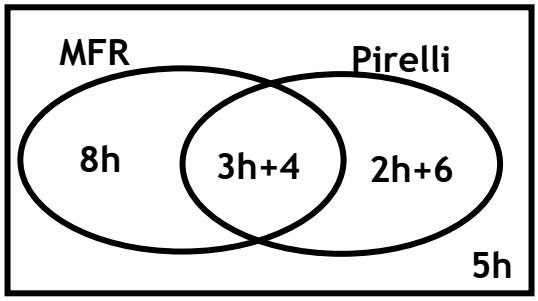
(a) If those who like only one dish are 21,
(i) Find the value of x
(ii) How many pupils are in the whole class?
(b)What is the probability of choosing a pupil at random he/she likes chicken only?

21. The Venn diagram below shows the number of children who were immunized against and measles. Use it to answer the questions that follow.



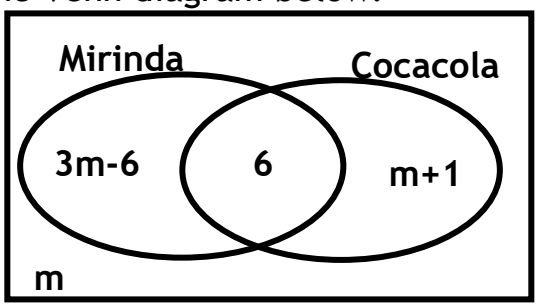
If those who were immunized against only one disease were 17,
(a)How many children were immunized against both diseases?
(b) Find the probability that the last child to be immunized was immunized against polio only.

22. The Venn diagram below shows the sales of tyres at Manisulu's auto garage during a certain month. Use it to answer the questions that follow.



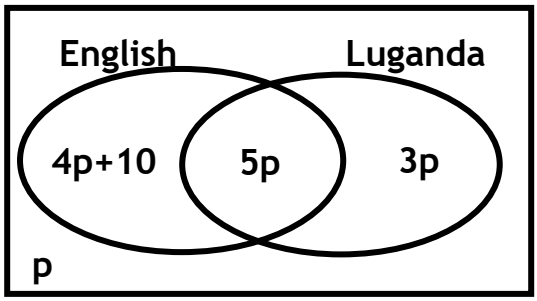
If those who bought both MRF and Pirelli tyres were equal to those who bought neither of the two tyres;
(a) Work out the value of h.
(b) How many customers bought only one type of tyres?
(c) Find the probability a customer bonus was given to a customer who bought neither of the two types of tyres.

23. At Mulembe's party, guests drank different types of soda as shown on the Venn diagram below.



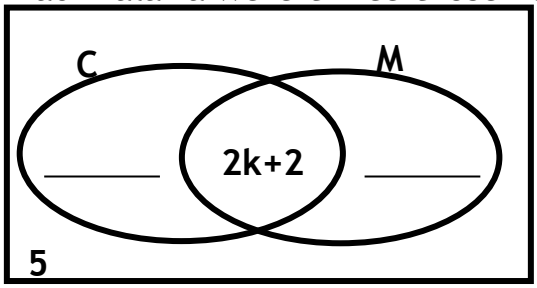
If those who took mirinda only are equal to those who didn't take mirinda,
(a) Find the number of guests who took mirinda only.
(b) Find the probability that the next guest to wed took neither of the two drinks at Mulembe's wedding.

24. The Venn diagram below shows the number of teachers who speak different languages at a certain school. Study it and use it to answer the questions that follow.



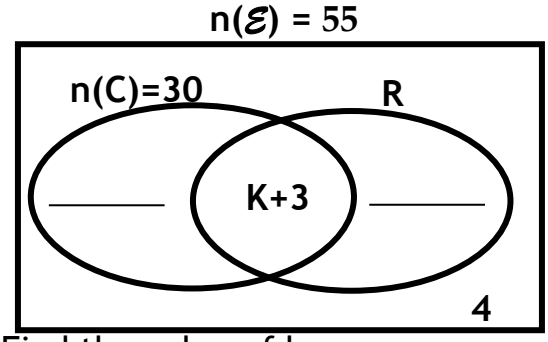
If those who speak only English are twice those who speak only Luganda,
(a) How many teachers speak only Luganda in the school?
(b) How many teachers speak only one language?
(c) What is the probability that one of the teaches who speak only English is chosen at random to be the teacher on duty?

25. At Maisha referral hospital, k patients were recorded for COVID19 (C), (2k+2) patients were recorded for both COVID19 (C) and Malaria (M) and 5 patients had none of the two in the first week of the lockdown. If those who had malaria were thrice those had only COVID19,



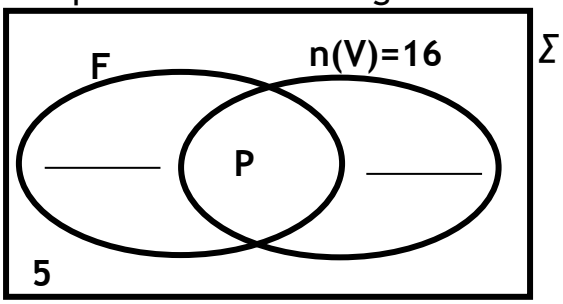
(a) Complete the Venn diagram below
(b) How many patients were recorded for both malaria and COVID19 diseases?
(c) Find the probability that the first patient in the week had only one of the diseases.

25. In a certain district with 55 leaders, 30 are civic leaders (C), (3k) are only religious leaders (R), (k+3) are both civic and religious leaders while 4 are neither of the two categories.
(a) Complete the Venn diagram below using the above information



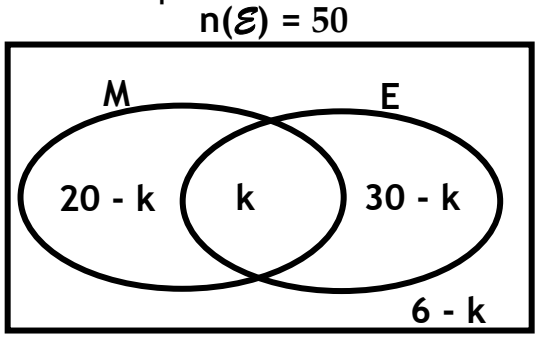
(b) Find the value of k
(c) How many leaders in the district belong to only one category?
(d) Find the probability that one of the transferred leaders is both a civic and religious leader.

26. In a class, 3p pupils like football(F) only, 16 pupils like volleyball(V), p like both games while 5 pupils like none of the two games. If the pupils who like only volleyball are 4 more than those who like football only,
(a) Complete the Venn diagram below



(b) Find the value of p
(c) How many pupils like only one game
(d) Find the probability of choosing a pupil at random who likes both games

27. The Venn diagram below shows the number of pupils who like Mathematics (M), English(E) and none of the two mentioned subjects. Use it to answer the questions that follow



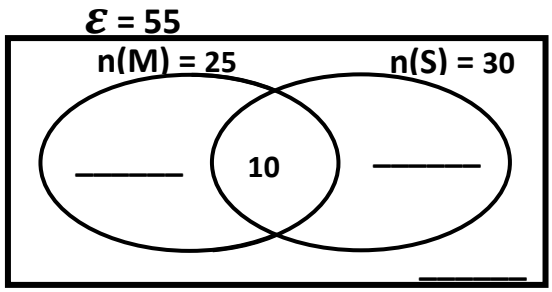
(a) Find the value of k

(b) How many pupils don't like English at all.

(c) What is the probability of picking at random a pupil that he/she likes only one subject?

29. Given that **n(M) = 25**, **n(S) =30** and **n(M∪S)^{l}= 2p**.

(a) Complete the Venn diagram below using the above information.

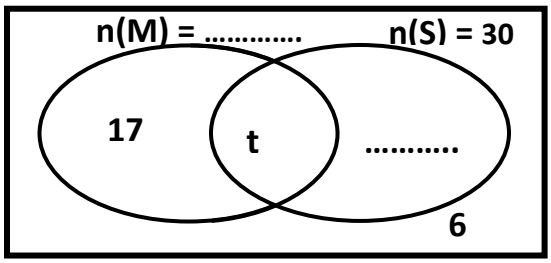


(b) How many pupils do not like science at all?

(c) What is the probability of picking a pupil to be a class monitor at random that likes neither of the two mentioned subjects.

30. In a class party, two types of drinks were served, soda (S) and mineral water (M). 30 pupils took soda and t pupils took both soda and mineral water, 6 pupils took neither of the drinks while 17 pupils took only mineral water. The number of pupils who took soda only was twice that of those who took both soda and mineral water.

(a) Use the given information to complete the Venn diagram below.

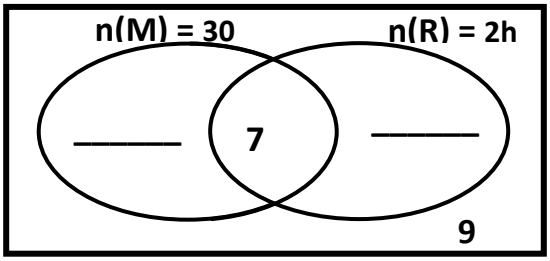


(b) Find the number of pupils who took both drinks.

(c) Calculate the total number of pupils in the class.

31. A class of 68 pupils was served Matooke (M) and rice (R). 30 pupils ate Matooke and 2h ate rice. 7 pupils ate both Matooke and Rice while 9 pupils didn't eat either of the foods.

(a) Use the given information to complete the Venn diagram below.



(b) How many pupils ate rice only?

THEME: NUMERACY
TOPIC 2: WHOLE NUMBERS

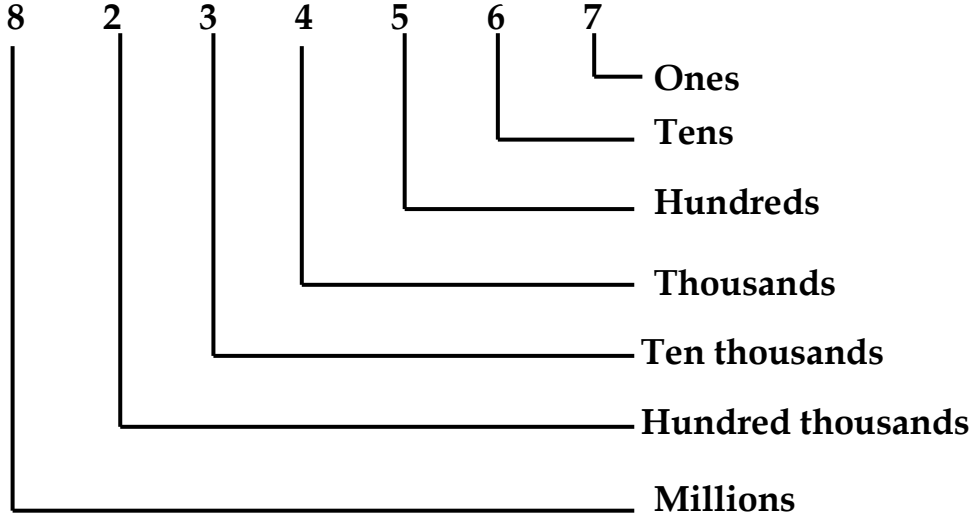
Numbers are used to communicate information concerning quantities. The number system you use is formed by using the ten digits. **0,1,2,3,4,5,6,7,8,9** Whether adding, subtracting, multiplying or dividing numbers, you must have a clear understanding of the system you work with.

PLACE VALUES

Each digit of a number has a certain place value. The position of a digit is in e.g. the units place, tens place, hundreds place and so on.

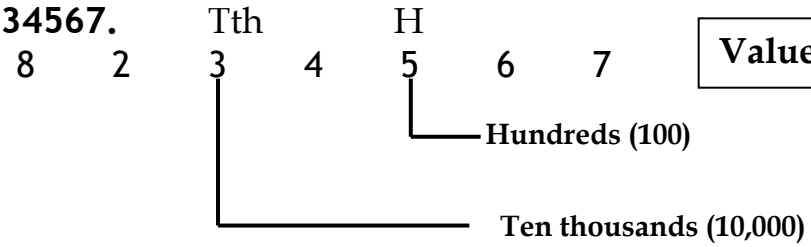
Example I

Write down the place value of each digit in the number **8234567.**



Example II

Find the sum of the place value of 3 and the place value of 5 in the number **8234567.**

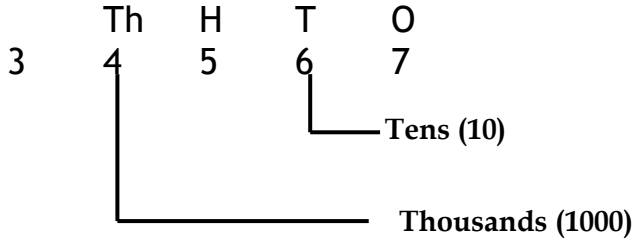


Value = D x P.V

Sum = 10,000
+ 100
10 100

Example III

Find the difference between the place value of **4** and the place value of **6** in the number **34567.**

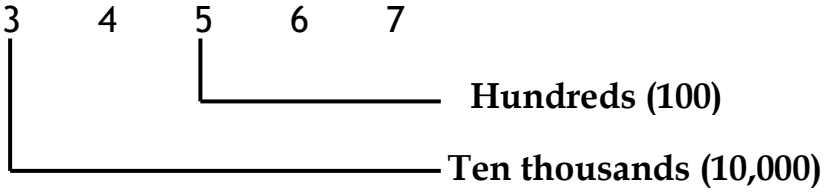


Difference

1 0 0 0
- 1 0
9 9 0

Example IV

Find the product of the place value of 3 and the place value of 5 in the number **34567**.



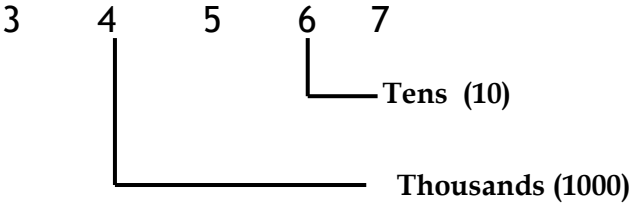
Product

10,000 x 100

= 1,000,000

Example V

Find the quotient of the place value of 4 and the place value of 6 in the number 34567.



Quotient

$\frac{1000}{10}$

= 100

Exercise

1. Write the place value of each digit in the following numerals?
(a) 21089
(b) 9248531
(c) 81,390,413
2. What is the place value of 7 in the number 5,780,240?
3. Write the place values of 6 and 2 in the numeral 965127
4. Find the product of the place value of 9 and the place value of 5 in the number 7492531
5. Find the difference between the place value of 0 and the place value of 4 in 1034567
6. Write the place values of the underlined digits in the number 9<u>5</u>7,<u>2</u>41
7. Find the quotient of the place value of 9 and the place value of 0 in the number 39507
8. Write the place value of each digit in 12,345,678
9. Work out the sum of the place value of 5 and the place value of 7 in 205367
10. The quotient of the values of 6 and 2 in a number is 300. If the place value of 2 in that number is thousands, what is the place value of 6 in that number?
11. The place value of 7 and 9 in a number is ten thousands and millions respectively. Find the sum of the values of 7 and 9.
12. Which digit is in the thousands place value in the number 4,890,765?

13. Workout the quotient of the digits in the Hundreds place value and that in ten million place value in the number 96,405,382.
14. Find the sum of the digits in the third and seventh whole number places in the number 561,204,598.
15. What position place is the digit 6 in the number 567,389,210?
16. Complete the table below correctly.

Place value name	In value form	In multiples of ten	In power form
Thousands	1000	10x10x10	10^3
Ten thousands	10,000	10x10x10x10	_____
Tens	10	_____	10^1
Millions	_____	10x10x10x10x10x10	
_____	100,000	_____	_____

VALUES

Each digit of a number has a place value. The actual digit use 0,1,2,3,5,6,7,8,9 tells how many ones, tens, hundreds, thousands and so on are there.

We get the value by multiplying a digit and its matching or corresponding place value in figures.

Write 235 using place values.

2 hundreds + 3 tens + 5ones

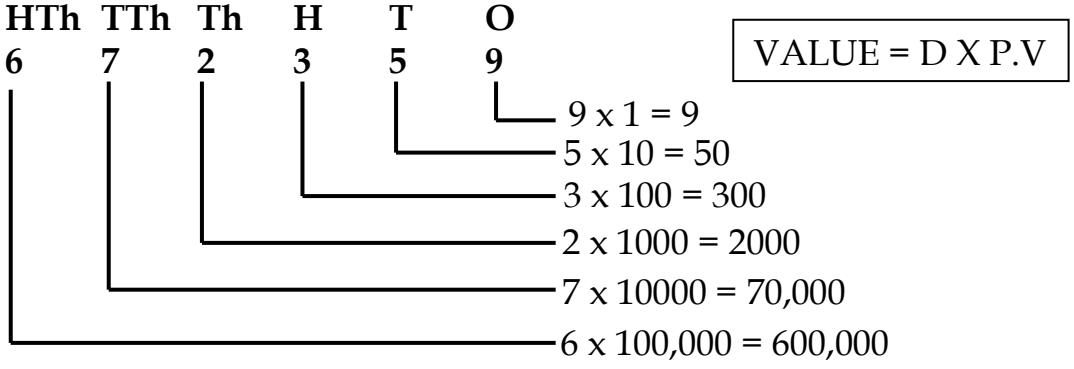
2 hundreds = 2 x 100

3 tens= 3 x 10

5 ones = 5 x 1 = 5

Example I

Find the value of each digit in the number **672359.**



Example II

Find the sum of the value of 2 and the value of 5 in the number 672359.

6 7 2 3 5 9

5 x 10 = 50

2 x 1000 = 2000

Sum = 2 0 0 0
+ 50
2 0 5 0

Example III

Find the difference between the value of 7 and the value of 3 in the number 672359.

HTh	Tth	Th	H	T	O
6	7	2	3	5	9

3 x 10 = 300

7 x 10000 = 70,000

Difference
7 0 0 0 0
- 3 0 0
6 9 7 0 0

Example IV

Find the product of the value of 2 and the value of 9 in the number 672359.

6 7 2 3 5 9

9 x 1 = 9

2 x 1000 = 2000

Product
= 2000 x 9
= 18,000

Example V

Find the quotient of the value of 6 and the value of 3 in the number 672359.

HTth	Tth	Th	H	T	O
6	7	2	3	5	9

3 x 100 =300

6 x 100,000 = 600,000

Quotient = ~~600000~~
~~300~~
= 2,000

Exercise

1. Find the value of each digit in the following numbers;
(a) 2073
(b) 79,543
(c) 2,042,617
(d) 7,183,046
2. Find the value of 2 in the number 872509
3. Find the value of the underlined digits in the number 5,930,627
4. Find the product of the values of 2 and 6 in 1,432,568
5. Write the value of each digit in the number 4,702,634
6. What value does 7 represent in the number 9,175,581?
7. Find the value of the digit in the hundred thousands place in the number 4,298,567
8. Find the product of the values of 8 and 7 in the numeral 80715
9. Find the sum of the value of 9 and the place value of 2 in the figure 930274
10. The product of the values of 5 and 3 in a number is 1,500,000. If the place value of 5 is ten thousands, work out the place value of 3 in the number.
11. Work out the quotient of the place value of 9 and the value of 2 in the number 79124
12. Find the product of the value of 5 and the place value of 9 in the number 567,890
13. Find the sum of the value of 8 in 98,453 and the value of 5 in 56,010.
14. Find the value of each digit in the sum of 49021 and 20218.
15. What value does 5 carry in the number 45,673,892
16. Complete the table below correctly.

DIGITS	PLACE VALUES	VALUES
1	Hundred thousands	_____
9	Millions	_____
4	_____	400
_____	Tens	30
2	_____	20,000
0	Ones	_____
_____	Thousands	8,000

Numbers can be written in different forms VIZ (namely);

- ✓ Standard form which is the most common.
- ✓ Expanded form which is used to describe the meaning of a number.

Numbers can be expanded using different ways;

- ✓ Using place values
- ✓ Using values
- ✓ Using powers of ten
- ✓ Using the multiples

Example I

Write 8546 in expanded form using place values.

TH	H	T	O
8	5	4	6

8546 = (8 x 1000) + (5 x 100) + (4 x 10) + (6 x 1)

Example 11

Expand **139,523** using multiples of ten.

HTH	TTH	TH	H	T	O
3	7	2	8	1	5

(3×100000) + (7×10000) + (2×1000) + (8×100) + (1×10) + (5×1)

(3×10×10×10×10×10)+(7×10×10×10×10)+(2×10×10×10)+(8×10×10)+(1×10)+(5×1)

Example II

Write 8546 in expanded for using values.

Th	H	T	O
8	5	4	6

6 x 1 = 6

4 x 10 = 40

5 x 100 = 500

5 x 100 = 500

8546 = 8000 + 500 + 6

Example III

Write **8546** in expanded form using powers of ten.

10^3	10^2	10^1	10^0
8	5	4	6

$8546 = (8 \times 10^3) + (5 \times 10^2) + (4 \times 10^1) + (6 \times 10^0)$

Example IV

What number has been expanded to give?

(a) $(5 \times 1000) + (4 \times 100) + (2 \times 10) + (8 \times 1)$

5000 + 400 + 20 + 8

5 0 0 0
4 0 0
2 0
+ 8
5 4 2 8

(b) **$(3 \times 10^4) + (8 \times 10^2) + (9 \times 10)$**

$(3 \times 10 \times 10 \times 10 \times 10) + (8 \times 10 \times 10 \times 10) + 90$

3 0 0 0 0
8 0 0
+ 9 0
3 0 8 9 0

Exercise

1. Expand 519 using powers of ten
2. Expand 9,305,714 using values
3. Expand 7,318,942
4. Expand 916,080 using multiples of ten.
5. Express 3,027,205 in expanded form
6. Write 345,678 in expanded form
7. Expand 491,073 using multiples of ten
8. What number has been expanded to give; 500,000 + 700 + 1?
9. What number has been expanded to give; $(4x10^4) + (1x10^2) + (3x10^0)$
10. What number has been expanded to give; 2ten thousands + 6hundreds + 3tens + 7ones?
11. What number has been expanded to give; 3,000,000+50,000+900+40?
12. Write 413,345 in expanded form using exponents
13. Fill in the missing value in the expansion of the number 619,203
    $(6x10^5) + (1x10^4) + (9x10^3) +$ _____ , _____, _____
14. Write $(2 \times 10^6) + (0 \times 10^1) + (5 \times 10^4) + (7 \times 10^3)$ as a single number

15. Write (3 x 100,000) + (7 x 1,000) + (8 x 100) + (1 x 1) in short
16. Expand the product of 1908 and 2 using values.
17. Expand (39105 + 49210) using exponents.

WRITING NUMBERS IN WORDS AND FIGURES

1. Write **308** in words.
   Three hundred eight

2. Write 7,207 in words.
   7 thousands 207 units
   Seven thousand two hundred seven

3. Write **101,101** in words.
   One hundred one thousand one hundred one

4. Write **two thousand, one hundred sixteen** in words.

2000 + 100 + 16

	2 0 0 0
	1 0 0
+	**1 6**
	2 1 1 6

5. Write two million seven thousand three.
   2 millions + 7 thousands + 3 units
   2,000, 000 + 7,000 + 3

	2, 0 0 0 0 0 0
	7 0 0 0
+	**3**
	2 0 0 7 0 0 3

6. Arrange the following in ascending order;
   (a)1020, 1002, 1200
   (a) **1020 (2) 1002 (1) 1200 (3)**
   1002, 1020, 1200

   (b) 2310, 2301, 1302, 1032
   2310 (4) 2301 (3) 1032 (2) 1032 (1)
   1032, 1302, 2301, 2301

   Using > or <
   (a) 5 x 100 + 2 x 1 _____ 520
   500 + 2 _____ 520
   502 < 520

   (b) 6 x 10^2 + 4 x 10 _____ 604
   (6 x 10 x 10) + (4 x 10) ____ 604
   600 + 40 _____ 604
   64 0 > 604

EXERCISE

1. Write the place value of each digit in the number 4567892.
2. Write down the value of each digit in the number 4567892.
3. Find the sum of the value of 7 and the place value of 9 in 4567892.
4. Find the value of the number in the tenth thousands place in the number 4567892.
5. Find the product of the value of 6 and the place value of 8 in the number 4567892.
6. Write 4567892 in expanded form using powers of 10.
7. What number has been expanded to give 4000 + 600 + 5?
8. What number has been expanded to give $(5 \times 10^4) + (3 \times 10^2) + (8 \times 10^0)$?
9. What number has been expanded to give 6thusands + 5 hundreds + 9 0nes?
10. Write 303,030 in words.
11. Write "fourteen thousand forty two" in figures.
12. Arrange the following numbers in descending order.
    2043,2403, 2430, 2304
13. Use > or < to complete the statement below.
    $(8 \times 10^4) + (9 \times 10^3) + (7 \times 10^2)$ _____ 89750
14. What is the value of the largest digit in the number 573,028,456?
15. Find the quotient of the sum of the values of 3 and 6 and the difference between the values of 1 and 7 in the number 93,061,754.

ROUNDING OFF

About three thousand is an example of an approximated or rounded number.

Approximate numbers are found by rounding off. The skills of place values and values are important here. Rounding off to the nearest tens, we look at the numbers in ones place value. If they are 5 or more than you add one e.g.

Round off the following to the nearest tens;

(a)3452

		RPV	Ones
3	4	5	2
6	7	4	3
5	1	2	4
4	5	9	1
3	4	5	2

3	4	5	2
+		0	←
3	4	4	0

∴3452 ≈3450

(b)

		RPV	Ones
3	4	2	5
6	7	4	6
5	1	2	7
4	4	3	8

		RPV	Ones
	5	1	2 4
+		0	←
	5	1	2 0
4	5	9	1

+		0	←
4	5	9	0

∴4591 ≈4590

RPV

342 | 5 Ones

\+ 1 | 0

343 0

∴3425 ≈3430

RPV

6 74 | 6 Ones

\+ 1 | 0

67 5 0

∴6746≈6750

RPV

512 | 7 Ones

\+ 1 | 0

513 0

∴5127≈5130

443 8

\+ 1 0

444 0

∴4438≈4440

ROUNDING OFF TO THE NEAREST HUNDREDS

Identify the number in the place value of hundreds then look at the number in the tens place value.

Example I

Round off 4738 to the nearest hundreds.

RPV

478 3

+100

480 0

∴4800≈4800

Example II

Round off 4738 to the nearest hundreds.

RPV hundreds

47 38
+ 0 00
47 00

∴**4738≈4700**

ROUNDING OFF TO THE NEAREST THOUSANDS

Identify the number in the place value of thousands and look at the numbers in the hundreds place value.

RPV hundreds

4|7 3 8
+1|0 0 0
5 0 0 0

∴**63425≈5000**

Round off 63425 to the nearest thousands.

RPV hundreds

6 3|4 2 5
+ 0|0 0 0
6 3 0 0 0

∴**63425≈63000**

ROUND OFF TO THE NEAREST HUNDRED THOUSANDS.

RPV Ten thousands

1 3 5 4 8 2
+0 0 0 0 0 0
1 0 0 0 0 0

∴**135482≈100,000**

Round off 859432 to the nearest hundred thousands.

RPV Ten thousands

8|5 9 4 3 2
+1 0 0 0 0 0
9 0 0 0 0 0

∴**85932≈900,000**

ROMAN NUMERALS

Long ago people used different things to record numbers. However, some of these things were not convenient to carry. The early Egyptians made marks on clay or on stones e.g. Nyero Rock painting in Uganda. The Romans used Roman symbols.

Numerals are symbols used for number names. Today we use the Hindu Arabic numerals whose origin is India and were used in the Arab World. The Romans used seven numerals to record information. Three of which could not be repeated.

Table I

Roman numeral	Hindu Arabic numeral
I	1
V	5
X	10
L	50
C	100
D	500
M	1000

Numerals that can be repeated but not more than three times.

Table II

Roman numeral	Hindu Arabic numeral
I	1
II	2
III	3
X	10
XX	20
XXX	30
C	100
CC	200
CCC	300
M	1000
MM	2000

Some numbers had no single symbol but used a combination of symbols to represent the number.

Table III

Roman numeral	Hindu Arabic numeral
VI	6
VII	7
VIII	8
LX	60
LX	60
LXX	70
LXXX	80
DC	600

A few Roman numerals were represented beginning with a smaller symbol which implied subtraction e.g.

5 – 1 =	**4**	**IV**	**10 – 1 =**	**9**	**IX**
50 – 10 =	**40**	**XL**	**100 -10 =**	**90**	**XC**
500 – 100 =	**400**	**CD**	**1000 – 100=**	**900**	**CM**

Table IV

Roman numeral	Hindu Arabic numeral
IV	4
XL	40
CD	400
IX	9
XC	90
CM	900

Note

The following may prove confusing but they are easy to differentiate.

A	B
IV	VI
IX	XI
XL	LX
XC	CX
CD	DC
CM	MC

Group A symbols begin with a smaller numeral which denotes subtraction e.g.

IV	=	V – I	XC	=	C – X	XL	=	L – X	CM = M -C
	=	5 – 1		=	100 - 10		=	50 -10	= 1000-100
	=	**4**		**=**	**90**		**=**	**40**	**= 900**
IX	=	X – 1	CD	=	D -C				
	=	10 – 1		=	500 - 100				
	=	**9**		**=**	**400**				

Group B symbols begin with a bigger numeral which denotes addition.

VI	= V I	XI	= X I	LX	= L X	CX	= C X
	= 5 + 1		=10 +1		=50 +10		=100+10
	= 6		**=11**		**=60**		**=110**
DC	= D C		MC	= M C			
	= 500 +100			=1000 + 100			
	= 600			**=1100**			

INTERPRETATION OF ROMAN NUMERALS

If a smaller numeral comes before a bigger numeral, circle the two numerals either at the beginning, middle or at the end of the numeral.

Example I

Write **CDXCIX** in Hindu Arabic.

(CD) (XC) (IX)

CD	XC	IX
400	90	9

4 0 0
9 0
+ 9

CDXCIX = 4 9 9

Example II

Write XLIX in Hindu Arabic numerals.

XL IX

XL	IV
40	4

XLIV = 44

If a bigger symbol comes before a smaller one, don't combine the symbols.
If two or three symbols follow each other. Write them all as one.

Example I

Write CLVII in Hindu – Arabic.

C	L	V	II
100	50	5	2

= 100 + 50 +5 +2

=1 0 0
  5 0
    5
  + 2
1 5 7 **CLVII =157**

Example II

Write **MCCLXXXVIII** IN Hindu Arabic numerals.

M	**CC**	**L**	**XXX**	**V**	**III**
1000	**200**	**50**	**30**	**5**	**3**

1 0 0 0
2 0 0
5 0
3 0
5
+ 3
1 2 8 8

Example III

Write CXC in Hindu Arabic numerals.

C	XC
100	90

100 + 90
CXC = 190

When changing Hindu Arabic numerals to Roman numerals, expand the number using values then write each value in Roman numerals.

Example I

Write 394 in Roman numerals.

394 = 300 + 90 + 4

300	90	4
CCC	XC	IV

394 = CCCXCIV

Example II

A certain building in Kampala was built in **1919**. Write the year it was built in Roman numerals.

1919 = 1000 + 900 + 10 + 9

1000	900	10	9
M	CM	X	IX

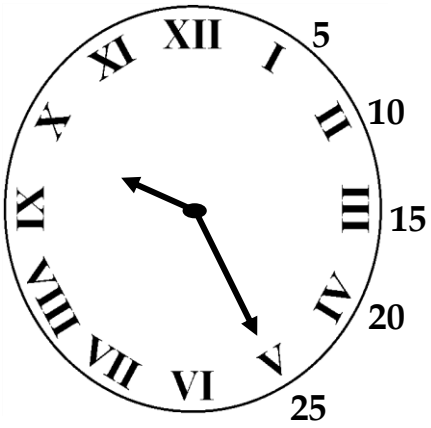
1919 = MCMXIX

ROMAN NUMERALS WITH CLOCK FACES

After noon time is represented by **pm**. Morning time is represented by **a.m**.

Example I

What morning time is shown on the clock face below?

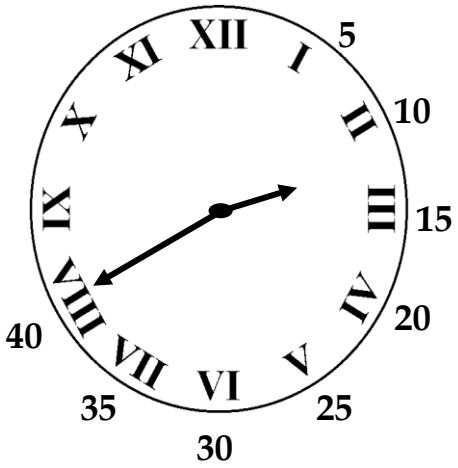


Hour hand reading	Minute hand reading	Unit
9	25	a.m

=9: 25a.m

Example II

What afternoon time is shown on the clock face below?



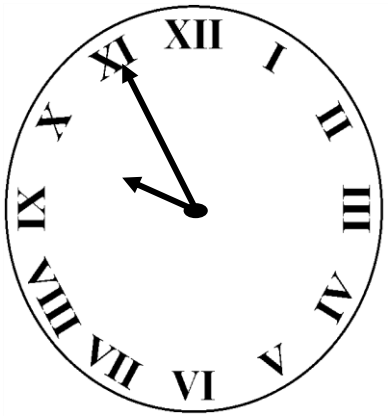
Hour hand reading	Minute hand reading	Unit
2	40	p.m

2:40pm

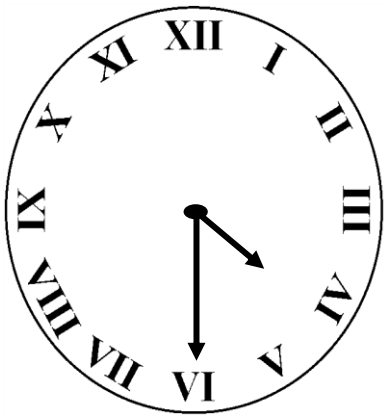
EXERCISE

1. Round off the following to the nearest tens.
   (a) 765 (b)483 (c)187
2. Round off the following to the nearest hundreds.
   (a)765 (b) 483 (c) 127
3. Round off the following to the nearest thousands.
   (a)4765 (b) 5187 (c)127
4. Round off the following to the nearest ten thousands;
   (a)63564 (b) 43526 (c) 56423
5. Round off of the following to the nearest hundred thousands;
   (a)894621 (b) 425683 (c) 992135
6. Write the following Hindu Arabic numerals into Roman numerals;
   (a) 19 (b) 44 (c) 69 (d)99
   (e) 149 (f) 194 (g)404 (h) 915
7. Write the following Roman numerals into Hindu Arabic numerals.
   (a) **CXLIV** (b) CCXCIX (c) CDXCVIII
   (d) CMXLIX (e) MDCCXCIV

8. What morning time is shown on the clock face shown below?



9. Write the afternoon time shown the clock face shown below?



10. Our teacher told us to attempt questions from pages CCXVI to CCXX. If there were 13 questions on each page, how many questions were we to attempt? (Give your answer in Roman numerals)
11. By how much is 1954 greater than 569 in Roman numerals?
12. At Wankulukuku stadium, tickets for a friendly match between Vipers and Man city fc sold were numbered from number LXXXIII to number CMXXXI. If each ticket was sold at sh. 6000, how much money was collected at the stadium that day in Hindu Arabic digits.

BASES

The most common base we use is the decimal base. Decimal comes from a Latin word **deca** which means **ten.**

In primary one, children counted from 1 to 5 before counting to 10. This was preparing them to count in fives known as base five.

Quinary base

Counting in base five

Number	Base five numeral	Number	Base five numeral
0	0	**6**	11
1	1	**7**	12
2	3	**8**	13
4	4	**9**	14
5	10	**10**	20
11	21	**12**	22
13	23	**14**	24

Example I

Convert 23five to bas ten.

2 3_{five}

3 x 1 = 3

2 x 5 = 10

= 10 + 3 = 13

23_{five} = 13_{ten}

Example II

Convert 214_{five} to base ten.

2 1 4_{five}

4 x 1 = 4

1 x 5 = 5

2 x 5 x 5

= 50 + 5 + 4

214_{five} = 59_{ten}

Example III

Convert 1011_{two} to base ten.

1 0 1 1 1_{two}

1 x 1 = 1

1 x 2 = 2

0 x 2 x 2 =0

1 x 2 x 2 x 2 =8

= 8 + 0 + 2 + 1

$11011_{two} = 11_{ten}$

Example IV

Convert 11011two to base ten.

11011_{two}

1 1 0 1 1_{two}

1 x 1 = 1

1 x 2 = 2

0 x 2 x 2 =0

1 x 2 x 2 x 2 =8

1 x 2 x 2 x 2 x 2 =16

FINDING UNKNOWN BASE

☑ Convert all the bases to base ten.

☑ If one is in base ten, then concert the other to base ten.

Example I

Given that $31_n = 22_{seven}$. Find the values of n.

$31_n = 22_{seven}$

31_n

1 x 1 = 1

3 x n =3n

3n + 1 = 14 +2

3n + 1 =16

3n + 1 – 1 = 16 – 1

3n = 15

3 3

n = 5

$2\ 2_{seven}$

2 x 1 = 2

2 x 7 =14

Example II

Given $35_k = 23_{ten}$, find the value of **k.**

3 5_k

5 x 1 =5

3 x k =3k

$3k + 5 = 23$

$3k + 5 - 5 = 23 - 5$

$\frac{3k}{3} = \frac{18}{3}$

$k = 6$

Example III

Given that $10_n = 35_{seven}$. Find the value of **n.**

1 0 1_n

1 x 1 = 1

0 x n = 0

1 x n x n = n^2

3 5_{seven}

5 x 1 =5

3 x 7 = 21

$n^2 + 0 + 1 = 21 + 5$

$n^2 + 1 = 26$

$n^2 + 1 - 1 = 26 - 1$

$\sqrt{n2} = \sqrt{25}$

$n^2 = 25$

$n = 5$

CONVERTING FROM BASE TEN TO OTHER BASES.

Here we apply the skills of prime factorize and the remainder is very important.

Example I

Convert 27_{ten} to binary base.

B	No.	R
2	27	1
2	13	1
2	6	0
2	3	1
	1	1

$27_{ten} = 11011_{two}$

Example II

Convert 36_{ten} to binary.

B	No.	R
2	36	0
2	18	0
2	9	1
2	2	0
	1	

$36_{ten} = 100100_{two}$

CONVERTING NON BASE TEN TO ANOTHER BASE

Here you change the given base.

Example I

Convert 23_{five} to binary base.

Step I

2 3_{five}

3 x 1 = 3

2 x 5 = 10

= 10 + 3

= $23_{five} = 13_{ten}$

Step II

B	No.	R
2	13	1
2	6	0
2	3	1
	1	

$23_{five} = 1101_{two}$

Example II

Convert 1101two to base three.

Step I

$1\ 1\ 0\ 1_{two}$

1 x 1 = 1

0 x 2 = 0

1 x 2 x 2 = 4

1 x 2 x 2 x 2 x 2 = 8

= 8 + 4 + 0 + 1

$=13_{ten}$

Step II

B	No.	R
3	13	1
3	4	1
	1	

$1101_{two} = 111_{three}$

PLACE VALUE OF BASES

Just like base ten, other bases have place values.

Example I

Write down the place value of each of the digits in the numbers below.

(a) 1101_{two}

1 1 0 1_{two}

Ones

Twos

Two twos

Two two twos

(b) **1 2 3_{five}**

Ones

Fives

Five fives

(c) 1 2 1 2_{three}

Ones

threes

three threes

three three threes

FINDING VALUES OF DIGITS IN A GIVEN BASE

Example I

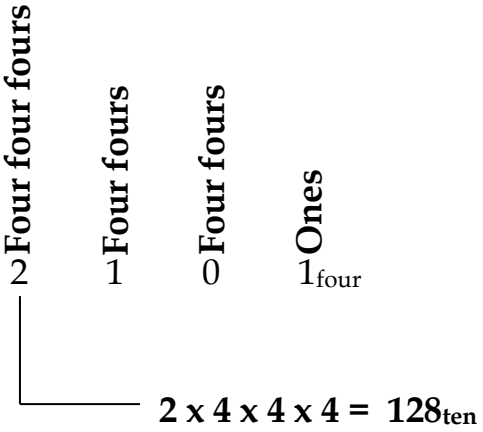
Find the value of **3** in the number **132_{five}.**

1 3 2_{five}

3 x 5 = 15_{ten}

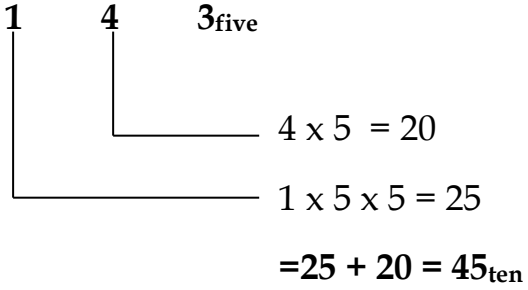
Example II

Find the value of **2** in the number **2101_{four}.**



Example III

Find the sum of the value of 1 and the value of 4 in the number 143_{five}.



FINDING NUMBER THAT HAS BEEN EXPANDED.

Example I

What number has been expanded to give **$(1 \times 5^2) + (2 \times 5^1) + (3 \times 5^0)$?**

= (1 x 5 x 5) + (2 x 5) + (3 x1)

= 25 + 10 + 3

= 38_{ten}

38ten to base five

B	No.	R
5	38	3
5	7	2
	1	

= 123_{five}

Example II

What number has been expanded to give **$(1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1\ 2^0)$?**

$(1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1\ 2^0)$

$(1 \times 2 \times 2 \times 2) + (1 \times 2 \times 2) + (0 \times 2) + (1 \times 1)$

$= 8 + 4 + 0 + 1 = 13_{ten}$

B	No.	R
2	13	1
2	6	0
2	3	1
	1	

$= 1101_{two}$

ADDITION OF BASES

Note:

We do not write a digit that is equal or greater than the base.

Example I

Add:

$^{1}3\ \ ^{1}4\ 2_{five}$ **2 + 4 = 6**

$+4\ \ 3\ \ 4_{five}$ **6 ÷5 =1 r 1**

$1\ 3\ 3\ 1_{five}$ **1 + 4 + 3 =8**

8÷ 5 =1 r 3

Example II

Work out $^{1\ 1\ 1\ 1}1\ 1\ 1\ 0\ 1_{two}$ **1+ 1 = 2**

$+\ \ 1\ 1\ 1\ 1_{two}$ **2÷ 2 = 1 r 0**

$1\ 0\ 1\ 1\ 0\ 0_{two}$ **1+ 1 +1 =3**

3 ÷2 =1 r 1

In base twelve "t" stands for 10 and "e" stands for eleven.

Example III

Add: t e t twelve **10 + 11 =21**

+ 8 t e twelve **21**

1 7 t 9 twelve

Example IV

Add: 9 e t 8 twelve

+ 4 5 t e twelve

1 2 5 9 7 twelve

SUBTRACTION OF BASES

Note

When a larger value is to be subtracted from a smaller value, we re-group one from the next place value and the one regrouped is equivalent to the base when it reaches the required place value.

Example I

Add:

$$\begin{array}{r} {}^{1}\not{2}\ \ {}^{5}1_{five} \\ -\quad 4_{five} \\ \hline 1\quad 2_{five} \end{array}$$

5 + 1 = 6
6 – 4 = 2
1 – 0 = 1

Example II

Work out $\begin{array}{r} {}^{0}1\ {}^{1}0\ {}^{1}0\ {}^{2}0_{two} \\ -\quad 1\ 1\ 1_{two} \\ \hline 0\ 0\ 0\ 1_{two} \end{array}$

Example III

Work out:

$$\begin{array}{r} {}^{0}1\ {}^{1}2\ {}^{7}3_{seven} \\ -\quad 6\ \ 5_{seven} \\ \hline 2\ \ 5_{seven} \end{array}$$

(7+3) - 5
10 – 5 = 5
(7+1) - 6 =
8 – 6 = 2

MULTPLICATION OF BASES

Example I

Work out: 111two x 11two

$$\begin{array}{r} 111_{two} \\ \times\ 11_{two} \\ \hline 111 \\ +\ {}^{1}111 \\ \hline 10101_{two} \end{array}$$

Example I

Work out: $2\ 1\ 3_{five}$

$$\begin{array}{r} \times\quad 4_{five} \\ \hline \end{array}$$

3 x 4 = 12
12 ÷ 5 = 2r2

$$\begin{array}{r} {}^{1}2\ {}^{2}1\ 3_{five} \\ \times\quad 4_{five} \\ \hline 1\ 4\ 1\ 2_{five} \end{array}$$

4x1 = 4+2=6
6÷5=1r1
4x2=8 + 1 = 9
9 ÷ 5 =1r4

Exercise

1. Convert 123_{five} to base ten
2. Express 11001_{two} to base ten
3. Given that $102_{four} = 33_n$, Find the value of n
4. Given that $26_k = 24_{ten}$. Find the value of k
5. Given that $100_m = 121_{three}$. Find the value of m
6. Convert 17 to binary base
7. Express 34_{ten} to base five
8. Convert 121_{three} to binary base.
9. Find the place value of 3 in the number 342_{five}
10. Write the place value of 1 and 2 in the numeral 102_{four}
11. Find the value of 4 in 142_{five}
12. Find the value of the underlined digit in 10101two
13. What number has been expanded to give; $(1x3^2) + (2x3^1) + (1x3^0)$
14. Find the number that has been expanded to give; $(1x2^4) + (0x2^3) + (0x2^1) + (1x2^0)$
15. Work out: 432_{five} x 333_{five}
16. Work out: $11011_{two} + 1110_{two}$
17. Work out: e t $_{twelve}$ + t e $_{twelve}$
18. Subtract 44_{five} from 102_{five}
19. Work out: $101_{five} - 11_{two}$
20. Subtract $100110_{five} - 1111_{five}$
21. Work out: $654_{eight} - 375_{eight}$
22. Work out: 432_{five} x 4_{five}
23. Work out: 123_{five} x 32_{five}
24. Work out: 1110_{two} x 11_{two}
25. Work out: 42_{five} x 21_{five}
26. Change 10110_{two} to base four
27. If $23_n = 111_{three}$, find the value of n
28. What base two numeral is equivalent to 32_{five}?
29. Given that $3kk_{four} = 58_{ten}$. Find the value of k
30. If $34_m = 31_{six}$. Find the value of m
31. Given that $15 = 23_p$. Find the value of p
32. If $204_k = 66_{eight}$. Find the value of k
33. Given that $12_h = 8_{ten}$. Find h
34. If $102_h = 33_{five}$. Find the value of h
35. Solve: $f^2 = 71_{nine}$
36. Divide: $11000_{two} \div 110_{two}$
37. Convert 17_{ten} to binary base
38. Work out: 144_{five} + ____ = 233_{five}
39. Given that 100n = 41six. Find the value of n
40. Work out: 101_{two} x 11_{two}
41. Work out: $11101_{two} + 1111_{two}$
42. What is the value of 2 seven sevens?

43. The place value of 3 in the number is five fives. Find its value
44. The place value of 3 in a number is six sixes. What is its value?
45. The place value of 1 in a number is four four fours. What is the value of the number?
46. Convert 44_{ten} to binary base
47. Change 87_{ten} to octonary base
48. Change 202_{three} to decimal base
49. Express 715_{eight} as a quinary base
50. Change 213_{four} to binary base
51. Change 203_{four} to base five
52. Express the sum of 40_{five} and 24_{five} to base six
53. Given that $24_{seven} = 102_n$. Find the value of n
54. If $224_{five} = k^2$. Find the value of k.
55. Given that $1010_{two} = 22_k$. Find the value of k.
56. If $17_n = 25_{six}$. Find the value of n.
57. Given that: $31_f = 34_{five}$. Find the value of f.
58. Find base h in $23_h = 15$.
59. Subtract 111_{two} from 1101_{two}
60. Subtract 402_{five} from 444_{five}
61. Work out: $402_{five} - 211_{three}$
62. Subtract $321_{four} - 11_{two}$

THEME: NUMERACY
TOPIC: OPERATIONS ON WHOLE NUMBERS

Vocabulary

In addition

15
+14
29 – sum

In subtraction

69
-25
44 - difference

In division

111 ÷ 3 = 37

Dividend divisor quotient

Other ways of division

111
3

In multiplication

12 factors
X5
60 - product

1. Subtract 587 from the sum of 24 and 602

Solving word problems

A list of clues used in solving word problems are summarized in the table below

Clue word	Operation
Increased by, more, added to, plus, total, sum, gain, altogether	Addition
Decreased by, less, minus, reduce, fewer, exceed, deduct, difference, how much more	Subtraction
Multiply, product, times, doubled, total, in all	Multiplication
Share, given evenly, divide, distribute, average	Division

Step 1
Find the sum

$$\begin{array}{r} 602 \\ +\ 24 \\ \hline 626 \end{array}$$

Subtract from the sum

$$\begin{array}{r} 626 \\ -587 \\ \hline 39 \end{array}$$

2. A trader earned sh.267,000 in January, sh.302,000 in February and sh.415,000 in March. What was the total amount the trader earned altogether?

$$\begin{array}{r} \text{sh.}267{,}000 \\ \text{sh.}302{,}000 \\ +\ \text{sh.}415{,}000 \\ \hline \text{Sh.}984{,}000 \end{array}$$

3. The first 8 pupils who lead in a mathematics test were given sh.6000 to share evenly. How much money did each get?

Clue: Share evenly

Operation: Division

= sh.6000 ÷ 8

= sh.750

4. During one season, 1215 boxes of apples were sold. Each crate holds 27 boxes. How many crates were sold?

No. of crates sold

$$= \frac{\text{total no. of boxes sold}}{\text{No. of boxes sin a crate}}$$

$$= \frac{1215}{27}$$

$$= 45 \text{ crates}$$

5. Last Friday, 865 women attended a village meeting. This Friday, 935 women attended the meeting. By how much did the enrolment increase?

935 women
- 865 women
70 women

6. A machine makes 150 cookies in every minute. 36 cookies are packed in a box. How many boxes of cookies would be packed, if the machine worked for 8 hours?

In a minute, it makes 150 cookies
In 8 hours(8x60min) it makes 8x60x150 cookies
In 1 box 36 cookies are packed
No. of boxes packed in 8 hours

$$= \frac{8x60x150}{36}$$

$$= 2000 \text{ boxes}$$

7. 6 sons shared 444 acres of land equally. If each son sold 12 acres, how many acres did each remain with?

No. of acres of land each got

$$= \frac{444}{6} = 74 \text{ acres}$$

No. of acres each one remained with = (74 - 12)
= 62 acres

8. Kaloli bought 8 mangoes each at sh.1500 and 6 oranges at sh.800. Find the total cost of the items.

Total cost of mangoes =sh.(1500x8)
= sh. 12000
Total cost of oranges = sh.(800x6)
= sh. 4800
Total cost of all items =sh.12000
+ sh. 4800
Sh. 16800

Exercise

1. 8 families collected sh.236,000 in February to buy a cow for Christmas. If they shared equally, find how much each family contributed.
2. The yield from 15 rows of maize with 25 plants per row was 3000 maize cobs. How many cobs on the average were there on each plant?
3. Prigrims from Congo to Namugongo matyrs shrine took 45 hours travelling by car and the rest of the journey on foot. The journey lasted for 11 days. How much time was spent travelling on foot?
4. KFM radio played the following number of records during May

WK 1	WK 2	WK 3	WK 4
312	236	169	412

In which part of the month were more records played: first two weeks or last two weeks?

5. By how much does the area of lake Victoria (82,362km^2) exceed the sum of the areas of lake Kyoga (59,596km^2) and lake Edward (19,477km^2)?
6. A supermarket received 670 boxes of oranges. Each box had 64 oranges. How many oranges in all did the supermarket receive?
7. A gas tank holds 455 litres. In the first week, 183 litres of gas were used. If at the end of the second week, there were 126 litres left, how much gas was used in the second week?
8. A plane which carries 365 passengers, is to transport 11,800 people in a tour to Israel. How many trips would the plane need to make?
9. Forty-eight cases each hold 72 seedlings. How many rows of 54 trees each can be planted in one orchard?
10. Kamukama had 4675kg of beans and he removed 175kg for home consumption and packed the rest of the beans equally in 18 sacks. Find how many kgs of beans are in each sack.
11. On Muvule's 913 hectares of land, 85 hectares are for trees, 765 hectares are for crops. The remaining hectares are for water. How many hectares are for water?
12. On a computer game, Muhindwa scored an average of 625 points every 5 minutes. How many points could he score in 30 minutes?
13. In a theatre hall, seats are arranged in 10 rows with 22 seats each. On Easter day, children occupied the rest of 7 rows for the concert.
    (a) How many people were in the hall altogether?
    (b) If each child paid sh. 1500 and an adult paid sh. 3000, how much was collected during the concert?

SUBSTITUTION OF VARIABLES

1. Evaluate: 2m + 3n where m=4 and n=6

2m +3n

= (2x4)+(3x6)

= 8 + 18

= 26

2. Evaluate: (5a+4b) ÷ a where a=2 and b=3

=[(5x2)+(4x3)] ÷ 2

=(10 + 12) ÷ 2

= 22 ÷ 2

= 11

3. Work out: t+s

t-s given that t-3 and s=2

=3+2

3-2

=5

1

= 5

Combination of operations.

1. Work out: 5 x 8 - 3

= (5x8) – 3

= 40 – 3

= 37

2. Simplify: $\frac{18-2x3}{3x3-5}$

$= \frac{18-(2x3)}{(3x3)-5}$

$= \frac{18 - 6}{9 - 5}$

$= \frac{12}{4}$

= 3

3. Work out: 224-(56÷14)x15

= 224-(4x15)

= 224-60

= 164

4. Work out: 180÷12x20x28÷56+7-2
   =(180÷12)x20x(28÷56)+7-2
   = (15x20x1/2)+7-2
   = (150 + 7) -2
   = 157 -2
   = 155

Properties of numbers

Understanding properties of numbers help you to find short cuts for doing calculations, if you add any two whole numbers, the answer is a unique whole number.

2+3=5 4+6=10

It is also true that if you multiply any two whole numbers, the answer is also a unique whole number.

3x5=15 4x7=28

Because of the above statements, the set of whole numbers is said to be closed with the respect to addition and multiplication and other properties of whole numbers are commutative.

Commutative.

The order in which you add or multiply whole numbers does not affect the answer.

2+3 = 3+2

2x3 = 3x2

Associative

In addition or multiplication, the numbers can be grouped in any order with no change in the answer.

4+(5+6) = (4+5)+6

(6x7)x8 = 6x(7x8)

Distributive

The operation of multiplication distributes over the operation of addition or subtraction.

3x(6+7) = 3x6 + 3x7 5x(3–2) = 5x3 – 5x3

(6+7)x8 = 8x6 + 8x7 (7–9)x2 = 2x7 – 2x9

Properties of 0 and 1

Adding 0, the sum is unchanged by adding
35+0 =35
Multiply by zero, the product is always 0
16x0 = 0
Multiply by 0, the product is always the original number.
12x1 = 12
Dividing by 1, The quotient is always the original number.
Dividing by 0 is impossible

1. Use the commutative property to simplify: 3a + 4a + 5a
= (3a + 4a) + 5a
= 7a + 5a
= 12a

2. Use the commutative property to simplify: 3a - 4a + 5a
= (3a + 5a) – 4a
= 8a - 4a
= 4a

3. Use distributive property to work out: 679x78 + 22x679
= 679(78 + 22)
= 679 x 100
= 67900

Tests for divisibility

-If we went to check whether a number is a factor of another number, you can divide and check whether there is a remainder. This is called divisibility test
Determine whether 35 is a factor of 1575
= 1575 ÷ 35 = 45 r 0
Since the remainder is 0, then 35 is as factor of 1575

Divisibility by 2

If a number is even, then it is exactly divisible by 2. (ends in 0,2,4,6 or 8)

Divisibility by 3

Add the digits, if the sum is divisible by 3, then the number is exactly divisible by 3.

Divisibility by 4

If the last two digits are divisible by 4, the number is exactly divisible by 4.

Divisibility by 5
If a number ends in 0 or 5, it is exactly divisible by 5

Divisibility by 6
A number is exactly divisible by 6, if it is even and the sum of its digits is divisible by 3.

Divisibility by 7
A number is exactly divisible by 7, if the last digit of a given number is subtracted from the number subtracted from the remaining digits of the given number. The result is exactly divisible by 7.

Divisibility by 8
If the last three digits are exactly divisible by 8, then the number is exactly divisible by 8.

Divisibility by 9
Add all the digits, if the sum is exactly divisible by 9, the number is exactly divisible by 9.

Divisibility by 10
If the last digit is 0, the number is exactly divisible by 10.

Divisibility by 11
A number is completely divisible by 11 if the difference between the sum of the digits in even places and the sum of the digits in the odd place is zero of a multiple of 11.

1. Which of the two numbers 441 and 336 is exactly divisible by 2

Look at the last digit if it is even, then the number is exactly divisible by 2

441	336
Odd	even

Therefore, 336 is exactly divisible by 2

2. Without dividing, show which of the numbers 4202 and 2463 is completely divisible by 3

Add the digits

4202 =4 + 2 + 0 + 2 =8

Not divisible by 3

2463 = 2 + 4 + 6 + 3 = 15 is disable by 3

Therefore, 2463 is completely divisible by 3

3. Show without dividing, which of the numbers 20403 and 92125 is exactly divisible by 9.

Add digits

2040 = 2 + 0 + 4 + 0 + 3

=9 – divisible by 9

92125 = 9 + 2 + 1 + 2 + 5

=19 – not divisible by 9

Therefore, 20403 is completely divisible by 9

4. Without dividing, show which of the numbers 2785 and 4896 is divisible by 8

Divide the last 3 digits

$2785 = \frac{785}{8}$

= 98 r 1 not exactly divisible by 8

$4896 = \frac{896}{8}$

= 112 exactly divisible by 8

Therefore, 4896 is completely divisible by 8

5. Which of the following years 2013 and 2016 is a leap year?

A leap year is one which is completely divisible by 4

2013

Divide last two digits by 4

$= \frac{13}{4}$

= 3r1 not exactly divisible by 4

2016

$= \frac{16}{4}$

= 4 is completely divisible by 4

Therefore, 2016 is a leap year.

6. Without dividing, show which of these numbers 6324 and 1327 is exactly divisible by 4

Divide the last 2 digits

63(24)

= 24÷4 = 6 (divisible by 4)

13(27)

= 27 ÷ 4 = 6r3 (not divisible by 4)

Therefore, 6324 is exactly divisible by 4

7. Show without dividing, if 4326 is exactly divisible by 7
   The last digit is 6, and the number formed by the remaining digits is 432, so double 6 to give 6 + 6 = 12
   Then subtract 12 from 432 = (432 - 12) = 420
   420 is completely divisible by 7. Therefore 4326 is exactly divisible by 7.
   For large numbers you can repeat the same procedures or steps on the last result got from after subtraction.

EXERCISE

1. Which of the numbers 4963 or 3290 is completely divisible by 2?
2. Without dividing, show which of these numbers 3538 and 4617 is exactly divisible by 3?
3. Without dividing, show which of the following numbers 3177 or 8723 is exactly divisible by 9
4. Show without dividing that 13538 is a multiple of 9
5. Show that 111 is a multiple of 3
6. Given the digits 2,3, and 4, form numbers that are exactly divisible by 4
7. Work out (17x19) – (9x17).
8. Use the distributive property to work out (385x66) + (34x385)
9. Among the following, circle the number that is exactly divisible by 6
   928 1422 1624
10. Show that 613228 is exactly divisible by 11 without actually dividing it
11. Which of the following is completely divisible by 7?

37521	50028	25014	29155

12. Which divisibility test is done by checking whether the last three digits form a multiple of a number?
13. Match the numbers in group A to their divisors in group B

Group A	Group B
77872	3
97000	8
20241	7
501743	10
6797	11

Greatest Common Factor and Lowest Common Multiple

1. One down town, bus leaves every 20 minutes and 30 minutes respectively. After how many minutes do both buses leave at the same time?
   Find the LCM of 20 and 30

M20 = {20, 40, 60, 80,---}
M30 = {30, 60, 90,---}
The two buses will leave after 60 minutes

2. Karen paid sh.1200 for a package of sweets. Shanel paid sh.1500 for a package of sweets. Each package costs the same but each costs than sh.100. How many packages did each buy?
   Find the GCF

÷	Sh.1200	Sh.1500
Sh.300	4	5

3. At a supermarket, every 10th customer obtains a free coupon, and every 15th customer obtains a surprise gift. Which customer will obtain a free coupon and surprise?
   Find L.C. M
   M_{10} = {10, 20, 30, 40, ---}
   M_{15} = {15, 30, 45, 60, ---}

<u>The 30th customer will obtain a free coupon and a surprise gift</u>

4. At Entebbe road, the traffic officer stops every 16th vehicle for a safety check. Every 20th vehicle for a passenger check. Which vehicle will be stopped for both a passenger and a safety check?
   Find the LCM
   M_{16} = {16, 32, 48, 64, 80, ---}
   M_{20} = {20, 40, 60, 80, ---}

<u>The 80th vehicle will be stopped for both a passenger and a safety check</u>

5. The LCM of two numbers is 90 and their GCF is 15. Find the second number if one of the numbers is 45.
   2nd number = $\frac{LCM\ x\ GCF}{1st\ No}$

   = $\frac{90\ x\ 15}{45}$

   = 2 x 15
   <u>= 30</u>

Standard form / scientific notation

Here, it is used to write very large numbers and very small numbers in a compact way.

The chart below shows the powers of 10.

10^9	1000	000	000
10^8	100	000	000
10^7	10	000	000
10^6	1	000	000
10^5		100	000
10^4		10	000
10^3		1	000
10^2			100
10^1			10
10^0			1
10^{-1}			0.1
10^{-2}			0.01
10^{-3}			0.001
10^{-4}			0.0001

Examples

1. Write 120,000,000 in scientific notation

= 1.2 x 10,000,000

= 1.2 x 10x10x10x10x10x10x10

= 1.2 x 10^7. Here, powers of 10 are used

The number before a decimal is always between 0 and 10

2. Write 3820,000 in scientific notation

3820,000 = 3.82 x 1000,000

= 3.82 x 10^6

3. Express 0.000856 in scientific notation

= 0.0001

0.000856

= 8.56 x 0.0001

= 8.56 x 10^{-4}

4. Write 0.0246 in scientific notation

0. 0 1

= 0.0246

= 2.46 x 0.01

= 2.46 x 10^{-2}

5. Write 92.7 in standard form

$= 92.7^{10}$
$= 9.27 \times 10$
$= 9.27 \times 10^1$

6. Write 927.3 in scientific notation

$= 927.3^{100}$
$= 9.273 \times 100$
$= 9.273 \times 10^2$

7. Which number has been standardized to give 3×10^4?
$= 3 \times 10 \times 10 \times 10 \times 10$
$= 30{,}000$

8. Which number has been standardized to give 8.2×10^{-2}?
$= 8.2 \times \frac{1}{10} \times \frac{1}{10}$
$= \frac{82}{10} \times \frac{1}{10} \times \frac{1}{10}$
$= \frac{82}{1000}$
$= 0.082$

9. Which number has been standardized to give 3.81×10^{-1}?
$= 3.81 \times \frac{1}{10}$
$= \frac{381}{10} \times \frac{1}{10}$
$= \frac{381}{100}$
$= 0.381$

10. Find the number that has been standardized as 3.2×10^3?
$= 3.2 \times 10 \times 10 \times 10$
$= \frac{32}{10} \times 1000$
$= 32 \times 100$
$= 3200$

Exercise

1. Write each number in scientific notation
   (a) 46000
   (b) 485000
   (c) 124,000,000,000
   (d) 396,000,000

2. Write each number in scientific notation
   (a) 0.125
   (b) 0.0039
   (c) 0.073
   (d) 0.00000148

3. Write the following in scientific notation
   (a) 12.5
   (b) 305.2
   (c) 927.1
   (d) 912.6

4. Which numbers have been standardized to give;
   (a) 6.15×10^6
   (b) 3.9×10^5
   (c) 4.25×10^3
   (d) 3.2×10^2

5. Which numbers have been standardized to give;
   (a) 8.2×10^{-2}
   (b) 2.6×10^{-3}
   (c) 3.81×10^{-1}
   (d) 4.96×10^{-2}
6. Find the L.C.M of 6, 9 and 12
7. Find the G.C.F of 12, 18 and 24
8. In Namayuba bus terminal, a bus to Eastern leaves after 30 minutes and one to Gulu leaves after every 40 minutes. After how many minutes will the two buses leave at the same time?
9. Kalegga spent sh.6000 to buy packets of sweets and Mayanja spent sh.7200 to buy packets of sweets. Find the greatest number of packets each bought.
10. The LCM of two numbers is 180. Their GCF is 15. Find the other number if one of them is 60.
11. The ratio between two numbers is 4:5. If their LCM is 120,
(a) Work out their GCF.
(b) What are the numbers?
12. The LCM of two numbers is 180. The ratio between the two numbers is 3:5,
(a) What is their HCD?
(b) Find the sum of the numbers.
13. The product of two numbers is 180. If their GCF is 3, find their LCM.
14. What is the least number when divided by 6, 9 or 12 leaves a remainder of 3?

Exponents and powers

$3 \times 3 \times 3 \times 3 = 81$

$3^4 = 81$

4 shows the number of the times the factor 3 is repeated

Factor form	Exponent form
2 x 2 x 2	2^3
3 x 3 x 3 x 3 x 3	3^5
5 x 5 x 5 x 5 x 5 x 5 x 5	5^7
10 x 10 x 10 x 10	10^4

3^5 (5) is called the exponent. It is the number of times the factor is repeated

(3) is called the base. It is the factor that is repeated.

Read as 3 to the exponent 5

Examples

1. Work out: $3^2 + 4^3$

   $= (3 \times 3) + (4 \times 4 \times 4)$

   $= 9 + 64$

   $= 73$

2. Work out: $(2^2 - 1)^4 - 6^2 \div 4$

   $= (2 \times 2 - 1)^4 - 6^2 \div 4$

   $= (4 - 1)^4 - 6^2 \div 4$

   $= 3^4 - 6^2 \div 4$

   $= (3 \times 3 \times 3 \times 3) - (6 \times 6) \div 4$

   $= 81 - 36 \div 4$

   $= 81 - (36 \div 4)$

   $= 81 - 9$

   $= 72$

3. If a = 3 and b = 2. Find the value of $3a^2 - 2b^2$

   $= (3 \times a \times a) - (2 \times b \times b)$

   $= (3 \times 3 \times 3) - (2 \times 2 \times 2)$

   $= 27 - 8$

   $= 19$

4. Given that a = 3 and b = -2. Find the value of $a^2 - b^3$

   $= (3)^2 - (-2)^3$

   $= (3 \times 3) - (-2 \times -2 \times -2)$

   $= 9 - (-8)$

   $= 9 + 8$

   $= 17$

Laws of indices

When multiplying terms of the same base, we maintain or keep the common base and add the powers.

When dividing terms of the same base, we keep a common base and subtract the powers.

Examples

1. Work out: $a^3 \times a^2$

   $= a \times a \times a \times a \times a$

   $= a^5$

   OR

   $= a^{(3+2)}$

   $= a^5$

2. Work out: $a^3 \div a^2$

   $= \frac{a^3}{a^2}$

   $= \frac{a \times a \times a}{a \times a}$

   $= a$

3. Work out: 100×9^0

   $= 100 \times 1$ (any number to power zero is always 1)

   $= 100$

4. Work out: $10^3 \div 10^5$

   $= 10^{(3-5)}$

   $= 10^{-2}$

Table I Powers of two

2^1	2	2
2^2	2 x 2	4
2^3	2 x 2 x 2	8
2^4	2 x 2 x 2 x 2	16
2^5	2 x 2 x 2 x 2 x 2	32
2^6		
2^7		
2^8	2 x2x 2x 2 x 2 x 2 x 2x2	256
2^9		
2^{10}		
2^{11}		
2^{12}		4096

Table II **Powers of 3**

3^1	3	3
3^2	3 x 3	9
3^3	3 x3 x 3	27
3^4		
3^5		
3^6	3 x 3 x 3 x 3 x 3 x 3	729
3^7		
3^8		
3^9		
3^{10}		59049

Use the above tables to work out the following;

1. Work out: 1024 ÷ 32
   $= 2^{10} \div 2^5$
   $= 2^{(10 - 5)}$
   $= 2^5$
   = 2 x 2 x 2 x 2 x 2
   = 32

2. Work out: 4096 ÷ 512 x 8
   $= (2^{12} \div 2^9) \times 2^3$
   $= 2^{(12 - 9)} \times 2^3$
   $= 2^3 \times 2^3$
   $= 2^{(3 + 3)}$
   $= 2^6$
   = 2 x 2 x 2 x 2 x 2 x2
   = 64

3. Work out: 27 x 243
   $= 3^3 \times 3^5$
   $= 3^{(3 + 5)}$
   $= 3^8$
   = 3 x 3 x 3 x 3 x 3 x 3 x 3 x 3
   = 6561

4. Solve: $2^n \times 16 = 64$
   $2^n \times 2^4 = 2^6$
   $2^{(n + 4)} = 2^6$
   n + 4 = 6
   n + 4 – 4 = 6 – 4
   n = 2

5. Solve: $2^n \div 16 = 1$
   Any number to power zero is 1
   $2^n \div 2^4 = 2^0$
   $2^{n-4} = 2^0$
   $n - 4 = 0$
   $n - 4 + 4 = 0 + 4$
   $n = 4$

6. Solve: $2^{3m} \div 2^{2m} = 16$
   $2^{3m} \div 2^{2m} = 2^4$
   $2^{3m - m} = 2^4$
   $3m - m = 4$
   $2m = 4$
   $\frac{2m}{2} = \frac{2}{2}$
   $m = 2$

7. Simplify: $\frac{n^3 \times n^4}{n^5}$
   $= n^{(3+4)} \div n^5$
   $= n^7 \div n^5$
   $= n^{(7-5)}$
   $= n^2$

8. Simplify: $\frac{8k^3 \times 3k^5}{12k^6}$
   $= \frac{8 \times k \times k \times k \times 3 \times k \times k \times k \times k \times k \times k}{12 \times k \times k \times k \times k \times k \times k}$
   $= 2 \times k \times k$
   $= 2k^2$

Exercise

1. Write a x a x a in short form.
2. Simplify: $n^2 \times n$
3. Simplify: $2^3 + 3^2$
4. Simplify: $4^2 + P^0$
5. Given that: a = 4 and b = 5. Find the value of $b^2 - a^2$
6. Work out: $5^2 - (2 + 3^2)$
7. Work out: $(6 + 1)^2 - 3^3$
8. Given that: a = 4 and b = 5. Find the value of:
   (a) $a^2 + 2ab + b^2$
   (b) $(a + b)^2$
9. Simplify: $3p^2 + 4p^2$
10. Simplify: $6m^3 \div 2m^3$
11. Simplify: $k^7 \times k^4$

12. Simplify: $k^7 \div k^4$
13. Simplify: $k^4 \div k^7$
14. Simplify: $\frac{k^7 \times k^4}{K^9}$
15. Work out: 16 x 64
16. Work out: 2048 ÷ 16
17. Work out: 8 x 32 x 4
18. Work out: 4096 ÷ 128
19. Work out: 6561 ÷ 27
20. Work out: 19,683 ÷ 81 ÷ 9
21. Work out: 9 x 81 x 27
22. Work out: 6561 x 9 ÷ 81
23. Work out: 59049 ÷ 243 x 81
24. Solve: $2^{2n} \times 8 = 32$
25. Solve: $3^n \times 9 = 81$
26. Solve: $3^{3n} \div 3^n = 81$

TOPIC: PATTERNS AND SEQUENCES

A square root is a number which, when multiplied by itself, gives a square number. Prime factorization is used to get the square roots.

Procedures

(a) Prime factorize the given square.

(b) Pair up common factors.

(c) Pull out a common factor per pair.

(d) Multiply the common factors pulled out to get the required square root.

Find the square root of 400

÷	400
2	200
2	100
2	50
2	25
5	5
5	1

$\sqrt{400} = 2^4 \times 5^2$

$= 2^{4 \div 2} \times 5^{2 \div 2}$

$= 2^2 \times 5^1$

$= (2 \times 2) \times 5$

$= 4 \times 5$

$= 20$

$\sqrt{400} = 20$

1. Find the square root of 49
2. Find the square root of 169
3. Find the square root of 16
4. Find the square root of 289
5. Find the square root of 324
6. Find the square root of 16
7. Find the square root of 25
8. Find the square root of 441

9. Find the square root of 64
10. Find the square root of 900
11. Find the square root of 529

Application of cube roots and square roots

1. The area of the square is 49cm^2. Find the perimeter of each side of the square.

Let the length be p

A = S x S , where S stands for Side

$49 = p \times p$

$\sqrt{49} = p^2$

$\sqrt{7} \times 7 = p \times p$

7cm = p

2. The volume of the cube is 27cm^3. Find the length of one side.

Volume = S x S x S or S^3

$\sqrt{27} = \sqrt{S^3}$

$\sqrt[3]{3 \times 3 \times 3} = \sqrt[3]{S \times S \times S}$

3cm = S Side

S^3 = Volume of a cube

$S^3 = 27\ cm^3$

$\sqrt[3]{S^3} = \sqrt[3]{27\ cm^3}$

(S) = 3 cm

3. The area of the square is 100cm^2. Find the length of one side.
4. The area of the square below is 169cm^2. Find its perimeter
5. The area of the square is 144cm^2.
   (a) Find the length of one side
   (b) Calculate the perimeter of the square
6. The area of the square is 81cm^2. Find the perimeter of the square.
7. The volume of the cube is 125cm^3. Find the length of each side.
8. The volume of the cube is 8cm^3. Find the total surface area of the cube.
9. Find the side of the cube whose volume is 64cm^3.
10. Given that the volume of the cube is 216cm^3. Find the area of each face of a cube.

Composite, square and cube numbers

Composite numbers are numbers with more than 2 factors, for example 4, 6, 8, …

Square numbers: These are numbers that can be obtained by adding the consecutive odd numbers.

For example : 1 = 1

1 + 3 = 4

1 + 3 + 5 = 9

1 + 3 + 5 + 7 = **16**

{1, 4, 9, 16, …}

Cube numbers: These are obtained by multiplying a number by itself three times.

$1^3 = 1 \times 1 \times 1 = 1$
$2^3 = 2 \times 2 \times 2 = 8$
$3^3 = 3 \times 3 \times 3 = 27$
$4^3 = 4 \times 4 \times 4 = 64$
{1, 8, 27, 64, …}

Exercise

1. List down the first five composite numbers.
2. Write down the first six square numbers.
3. Write down all the cube numbers less than 64.
4. Write down the next numbers in the sequence below
2, 3, 5, 7 - - - -
5. Fill in the missing numbers in the sequence,
1, 4, 9, 16, 25 , ___, _____
6. Find the sum of the first three composite numbers.
7. Circle the composite numbers
7,11,16, 8, 3, 20, 36, 45, 13, 21
8. Find the value of 6^3
9. Write down the first five composite numbers.
10. Find the sum of all the composite numbers less than

Squares of numbers

Simply multiply a number by itself twice to get its square.

EXAMPLE I

Find the square of 15

$15^2 = 15 \times 15$

$$\begin{array}{r} 15 \\ \times\ 15 \\ \hline 75 \\ +15 \\ \hline 225 \end{array}$$

EXAMPLE II

Work out the square of 30

$30^2 = 30 \times 30$

$$\begin{array}{r} 30 \\ \times\ 30 \\ \hline 00 \\ +90 \\ \hline 900 \end{array}$$

1. Find the square of 13
2. Find the square of 45
3. Find the square of 12
4. Find the square of 38
5. Find the square of 65
6. Find the square of 33
7. Find the square of 70
8. Find the square of 29

Triangular and prime numbers

Triangular numbers are numbers obtained by adding consecutive natural numbers.

1 = 1
1 + 2 = 3
1+ 2 + 3 = 6
1 + 2 + 3 + 4 = 10
Therefore; 1, 3, 6, 10 are triangular numbers.

A prime number is a number with two factors i.e 1 and itself
{ 2, 3, 5, 7, 11, …} is a set of prime numbers.

1. What prime numbers are less than 31?
2. List down all the prime numbers greater than 7 but less than 40.
3. Find the sum of the first five prime numbers.
4. What is the first triangular number?
5. List down all the triangular numbers between 20 and 50
6. Find the sum of the first 7 triangular numbers.
7. Write down the next numbers in the sequences below,
(a) 2, 3, 5, 7, ____, _____
(b) 1, 3, 6, 10, 15, 21, ____, _____
8. What is the next triangular number after 21?
9. Find the next prime number after 99.
10. Find the difference between the fifth triangular number and the fourth prime number.

Operations on even and odd numbers

Even numbers: These are whole numbers that leave remainder zero (no remainder) if divided by 2.

An even number can be obtained by adding two odd numbers.
1 + 3 = 4
3 + 5 = 8
5 + 9 = 14
11 + 13 = 24
1 + 7 = 8
Therefore 4, 8, 14, 24 are even numbers
Odd numbers are whole numbers that leave a remainder of one if divided by 2.

1. List a set of even numbers below 12
2. List a set of even numbers between 14 and 24.
3. List a set of the first five even numbers exactly divisible by 4.
4. What is the third even number?

5. Find the sum of the first 7 even numbers.
6. List a set of even numbers less than 30 which are exactly divisible by 4 and 3
7. List down all the odd numbers less than 30 which are exactly divisible by 3 and 5.
8. List a set of odd numbers less than 13
9. Write down all the odd numbers between 5 and 20.
10. Find the sum of all the odd numbers less than 6

Finding consecutive numbers

Consecutive numbers mean numbers following each other continuously in a certain series or sequence in ascending order.

Examples

1. The sum of three consecutive counting numbers is 36. Find the numbers?
Let the 1st counting number be m
1st number = m
2nd number = (m+1)
3rd number = (m +2)

(m) + (m+1) + (m+2) = 36
+ m + 1 + m +2 = 36
m + m + m + 1 + 2 = 36
3m + 3 = 36
3m + 3 – 3 = 36 – 3
$\frac{3m}{3} = \frac{33}{3}$
m = 11

1st number	2nd number	3rd number
m	m + 1	m + 2
11	11 + 1	11 + 2
11	12	13

Therefore; the numbers are, 11, 12 and 13

Exercise

1. The sum of three consecutive counting numbers is 93. What are the numbers?
2. If the sum of the 4 consecutive counting numbers is 86. Find the numbers.
3. The sum of 3 consecutive integers numbers is 24. What are the numbers?
4. The sum of 5 consecutive integers is 45. If the middle integer is f, find the numbers.
5. Given that the first counting number is d. What is the fourth counting number?
6. The median of 3 consecutive counting numbers is 17. What are the numbers?

7. The sum of the 4 consecutive counting numbers is 50. If the largest number is d. Find the numbers.
8. Opio planted 24 trees in 3 days. He was planting one more tree every day than the previous one. How many trees did he plant each day?
9. The sum of 3 consecutive counting numbers is 63. If the middle number is P, what is the largest number?

10. The sum of 5 consecutive counting numbers is 115. Find the numbers.

Finding consecutive even or odd numbers

Examples

1. The sum of three consecutive even numbers is 30. Find the range of the numbers.

Let the first even number be r.

1st number = (r)
2nd number = (r + 2)
3rd number = (r + 4)

Form an equation and solve for the value of the unknown

(r) + (r + 2) + (r + 4) = 30
r + r + 2 + y +4 = 30
r + r + r + 2 + 4 = 30
3r + 6 = 30
3r + 6 – 6 = 30 – 6
$\frac{3r}{3} = \frac{24}{3}$
r = 8

1st number	2nd number	3rd number
r	r + 2	r + 4
8	8 + 2	8 + 4
8	10	12

Range = Highest number – Lowest number
= 12 – 8
= 4

2. Find the 4 consecutive odd numbers whose total is 176.

Let the 1st odd number be k

1st number = n
2nd number = (n + 2)
3rd number = (n + 4)
4th number = (n + 6)

Form an equation and solve for n

(n) + (n + 2) + (n + 4) + (n + 6) = 176
n + n + 2 + n + 4 + n + 6 = 176
n + n + n + n + 2 + 4 + 6 = 176
4n + 12 = 176
4n + 12 – 12 = 176 – 12
$\frac{4n}{4} = \frac{164}{4}$
n = 41

1st number	2nd number	3rd number	4th number
n	n + 2	n + 4	n + 6
41	41 + 2	41 + 4	41 + 6
41	43	45	47

Therefore, the numbers are; 41, 43, and 45, 47

Exercise

1. The sum of 3 consecutive odd numbers is 69. Find the numbers
2. The sum of 3 consecutive odd numbers is 63. Find the range of numbers
3. The sum of 3 consecutive even numbers is 102.Find the range of the numbers.
4. A candidate read 52 pages of a book in 4 hours. If he read two more pages each hour than the previous one, how many pages did he read each hour?
5. Find the 3 consecutive odd numbers whose sum is 189.
6. Find the 3 consecutive even numbers whose total is 36. Find the product of the first and last numbers.
7. Find the 4 consecutive odd numbers whose total is 88.
8. Find the 3 consecutive odd numbers whose sum is 45.
9. The sum of 4 consecutive odd numbers is 32. What are the numbers?
10. The sum of three consecutive even numbers is 108. If their median is h. Find the rage of the numbers
11. The sum of 3 consecutive even numbers is 96. If the third number is p + 2. Find their median.
12. The sum of two consecutive even numbers is 42. If the smaller number is k+1, find the numbers.
13. The sum of the 4 consecutive odd numbers is 56. Find the difference between the fourth number and the first number.
14. The average of three consecutive odd numbers is 23. Find the numbers
15. The sum of 3 consecutive odd numbers is 105. If the middle number is h. Find the numbers.
16. The sum of two triangular numbers is 42.If one of the numbers is 6, find the other number.
17. What are the two triangular numbers whose sum is a square of 4?
18. Thomas sold a total of 24 litres of milk in 3 hours. He sold two more litres every hour than the previous one. How many litres did he sell every hour?
19. Akello scored 10 more marks each test than the previous one. If her total mark in 6 sets of tests is 390. How many marks did she get in each set?
20. The sum of 3 consecutive counting numbers is 99. If the middle number is (n - 2), find the numbers
21. The sum of 3 consecutive odd numbers is 159. Find the numbers
22. The sum of four consecutive counting numbers is (3n + 26). If the first number is n, find the median of the numbers

Find the next numbers in the series below

(a) 5, 7, 10, 15, 22, _____, _____
(b) 1, 4, 9, 16, 25, _____, _____
(c) 1, 2, 10, 37, 101, _____, _____
(d) 1, 4, 2, 5, 3, 6, _____, _____
(e) 1, 4, 10, 19, 31, _____, _____
(f) 81, 27, 9, 3, _____, _____
(g) 1, 3, 6, 10, _____, _____
(h) _____, _____, _____, 19, 16, 12, 7
(i) 0.01, 0.04, 0.07, 0.1, _____, _____
(j) Find the value of x in; 1, 3, 6, 10, 15, $\underline{2x}$

FRACTIONS

Changing recurring decimal to vulgar fraction

A recurring decimal is non-terminating decimal number where the fractional part repeats endlessly.

1. Change 0.5… to a rational number

Let k = 0.555-----

10 × k = 0.555…. x 10

10k = 5.555……

10k	=	5.555…
-k		-0.555…
9k		5.000…

$$\frac{9k}{9} = \frac{5}{9}$$

$$k = \frac{5}{9}$$

Writing **0.555…** is the same as **$0.\dot{5}$** or as **$0.\overline{5}$**

2. Express the following as vulgar fractions (write in their lowest forms):

(a) 0.4 (b) 0.045 (c) 0.8 (d) 0.13
(e) 0.2727… (f) 0.14141414… (g) 0.333…. (h) 0.7272…
(i) 0.1818… (j) 0.3636…

Recurring and non-recurring decimal

1. Express $\frac{5}{8}$ as a decimal

$$= 8\overline{)5.000}\ 0.625$$

-0
50
-48
20
-16
40
-40
00

Therefore $\frac{5}{8}$ = 0.625 (Non- recurring)

2. Convert $\frac{1}{3}$ to a decimal fraction

$$= 3\overline{)1.000}\ 0.333$$

-0
10
-9
10
-9
10
-9
1

Therefore $\frac{1}{3}$ = 0.333….. (Recurring)

0.333… is the same **as $0.\dot{3}$ or as $0.\overline{3}$**

3. Express the following as decimals;

(a) $\frac{3}{8}$ **(b)** $\frac{1}{5}$ **(c)** $\frac{2}{5}$ **(d)** $\frac{1}{4}$

(e) $\frac{2}{7}$ **(f)** $\frac{2}{9}$ $(g)\frac{3}{4}$

Application on fractions

1. Mwanje did $\frac{1}{3}$ of her work on Friday. $\frac{1}{4}$ of the remainder on Saturday and the rest on Sunday.

(a) What fraction of her work did she do on Sunday?

Fraction done on Sunday

$= (\frac{3}{3} - \frac{1}{3})\ X\ (\frac{4}{4} - \frac{1}{4})$

$= \frac{2}{3} \times \frac{3}{4}$

$= \frac{6}{12}$

$= \frac{1}{2}$

Method II

Day	Fraction done	Remaining fraction
Friday	$\frac{1}{3}$	$\frac{3}{3} - \frac{1}{3} = \frac{3-1}{3}\ \frac{2}{3}$
Saturday	$\frac{1}{4} \times \frac{2}{3} = \frac{1\,x\,2}{4\,x\,3} = \frac{2}{12} = \frac{1}{6}$	$\frac{2}{3} - \frac{1}{6} = \frac{4-1}{6}\ \frac{3}{6} = \frac{1}{2}$

(b) If she did 18 numbers on Sunday, find the total number of questions she did.

Total questions done

$= 18 \div \frac{1}{2}$

$= 18 \times \frac{2}{1}$

= 36 questions

2. Sarah spent $\frac{1}{3}$ of her money on transport, $\frac{1}{4}$ on rent, $\frac{2}{5}$ of the remainder on food and saved the rest.

(a) What fraction did she save?

Transport	Rent	Transport and rent	Remainder	Food	Transport, Rent and Food	Saved
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{3} + \frac{1}{4}$ $= \frac{4+3}{12}$ $= \frac{7}{12}$	$\frac{12}{12} - \frac{7}{12}$ $= \frac{12-7}{12}$ $= \frac{5}{12}$	$\frac{2}{5}$ of $\frac{5}{12}$ $= \frac{2}{5} \times \frac{5}{12}$ $= \frac{1}{6}$	$= \frac{1}{3} + \frac{1}{4} + \frac{1}{6}$ $= \frac{7}{12} + \frac{1}{6}$ $= \frac{7+2}{12}$ $= \frac{9}{12}$	$= \frac{12}{12} - \frac{9}{12}$ $= \frac{3}{12}$ $= \frac{1}{4}$

(b) If she saved sh.25000, how much did she have?

1 part represents sh.25000

4 parts represent sh.(25000 x 4)

= sh. 100,000

3. On a farm of 1200 hens, $\frac{2}{3}$ were sold on Monday, $\frac{3}{5}$ of the remainder were sold on Tuesday and 20 more hens on Wednesday than Thursday.

Fraction of hens sold on Wednesday and Thursday

$= (\frac{3}{3} - \frac{2}{3}) \times (\frac{5}{5} - \frac{3}{5})$

$= \frac{1}{3} \times \frac{2}{5}$

$= \frac{2}{15}$

Number of hens sold on Wednesday and Thursday

$= \frac{2}{15} \times 1200$

$= 2 \times 80$

= 160 hens

Number of hens sold on Thursday

$= \frac{160-20}{2}$

$= \frac{140}{2}$

= 70 hens

4. $\frac{3}{4}$ of the books in the library are readers. If there are 180 readers, find the total number of books in the library.
5. $\frac{2}{3}$ of the food in the store can last a school for 60 days. How long can $\frac{5}{6}$ of the food last the school?

6. $\frac{7}{10}$ of the water in the tank can last a family 42 days. How long can $\frac{1}{3}$ of the water last the family?
7. Kamba spends $\frac{2}{5}$ of his salary on fees, $\frac{1}{4}$ of the remainder on food and saves the rest.
   (a) What fraction does he save?
   (b) If he saves sh.36000, find his total monthly salary.
8. On a farm of 60 animals, $\frac{1}{3}$ are cows, $\frac{1}{4}$ of the remainder on sheep and the rest are goats. How many goats are there on the farm?
9. In a school of 300 pupils, $\frac{3}{5}$ of the pupils are boys, $\frac{1}{4}$ of the girls are in upper primary and 30% of the boys are in lower primary.
   (a) How many pupils are in upper primary?
   (b) How many more boys than girls are in lower primary?
10. In a school, 40% of the pupils are boys and the rest are girls. On a certain Thursday, $\frac{2}{5}$ of the girls were present. If only 450 girls were absent on that day. Find the total number of pupils in the school.
11. In a class, $\frac{8}{13}$ of the pupils are girls and the rest are boys. If there are 35 boys in the class. Find how many more girls than boys are in the class?
12. In a school, $\frac{1}{3}$ of the pupils were absent on Monday and $\frac{4}{5}$ of the pupils were present on Tuesday. If 10 more pupils were absent on Monday than Tuesday. How many pupils are in the school altogether?
13. At a birthday party, $\frac{1}{3}$ of the guests ate meat, $\frac{2}{5}$ of the remainder ate fish and the rest of the guests ate chicken. If those who ate chicken are 42, find the number of guests who ate fish.
14. In a club, $\frac{3}{4}$ of the people play football, $\frac{2}{3}$ of the remainder play basketball and the rest play volleyball. If volleyball had 12 players,
   (a) Find the total number of people in the club?
   (b) How many more people play football than basketball?
15. In a certain concert of 640 people, $\frac{3}{8}$ are males and the rest are females. If $\frac{2}{5}$ of the females are below 40 years,
   (a) How many females are below 40 years?
   (b) How many males are in the concert?
16. A man spends $\frac{1}{5}$ of his income on rent and $\frac{1}{3}$ of the remainder on food. If he was left with sh.48000. Calculate his total income.
17. A man spends $\frac{1}{4}$ of his salary on food and $\frac{1}{3}$ of the remainder on school fees. If he left with sh.60,000, calculate his total monthly salary.

18. In a school, $\frac{3}{5}$ of the pupils are girls and the rest are boys. $\frac{1}{3}$ of the girls are in lower section and 40 boys are in upper primary section. Find the total number of pupils in school if $\frac{3}{5}$ of the boys are in lower section.
19. A man spends $\frac{1}{4}$ of his income on rent and $\frac{4}{9}$ of the remainder on food.
(a) What fraction does he save?
(b) If he saves sh.60,000, what is his monthly income?
20. A man spends $\frac{1}{2}$ of his income on food and $\frac{8}{9}$ of the remainderbon transport and saves sh.50,000. Find his salary.
21. Uganda has a population of 300,000 people. Of these people, $\frac{3}{5}$ are females and the rest are males and $\frac{5}{6}$ of the females are girls. If $\frac{2}{3}$ of the males among the population are boys.
(a) Find the ratio of boys to girls
(b) What is the total number of boys and girls in the country?
22. In a village semester attended by 2,000 people, 25% of them are females and the rest are males. If $\frac{2}{5}$ of the females and $\frac{1}{3}$ of the males are children
(a) How many males are in the seminar?
(b) How many children attended the seminar?
23. In a village of 3,000 people, $\frac{3}{5}$ of them are males and the rest are females. If $\frac{2}{3}$ of the males are boys and $\frac{1}{4}$ of the females are girls, find the total number of boys and girls in the village.
24. A lady spends $\frac{2}{5}$ of her salary on rent, $\frac{1}{4}$ of the remainder on food and saves the rest.
(a) What fraction of her salary does she save?
(b) If she spends sh. 60,000 on food, how much does she earn?
25. $\frac{3}{4}$ of Paul's salary is sh.90,000. What is $\frac{1}{2}$ of his salary?
26. A wire is 15% painted red, $\frac{1}{4}$ painted blue, 20% of the remainder painted green and the rest painted black.
(a) Find the fraction of the wire painted green.
(b)If 60m of the wire is painted back, find the total length of the whole wire.
27. A man spends $\frac{2}{5}$ of his income on food and $\frac{2}{3}$ on clothing and 60% of the remainder on water bills and saves the rest.
(a) What is the fraction of water bills?
(b) If he saves sh.60,000, how much does he earn?

28. After serving 36 customers with $\frac{3}{4}$ of the litre milk each and 42 customers with $\frac{1}{2}$ of the litre of milk each. A business man finds that he still has $\frac{1}{4}$ of his supply left. How much milk did he have at the first?
29. Kato spent $\frac{1}{3}$ of his salary on school fees and $\frac{1}{4}$ of the remainder on rent. He again spent $\frac{1}{8}$ of what he was left with on transport. If finally, he was left with sh.42000. How much does he earn?
30. On a farm, $\frac{1}{3}$ of the animals are cattle, $\frac{1}{3}$ are sheep, $\frac{1}{4}$ of the remainder are goats and the rest are rabbits. How many animals are on the farm if 20 are rabbits?
31. A mother spent $\frac{1}{4}$ on rent and sh.40,000 more on food than rent. Calculate her total salary.
32. $\frac{1}{4}$ of the pupils in the class are absent. If 60 pupils are present, find the total number of pupils in the class.
33. A mother spends $\frac{1}{3}$ of his salary on food, $\frac{1}{4}$ on rent, and 50% of the remainder on medical care and saves sh. 90000. Find his salary.
34. In a class of $\frac{1}{3}$ of the pupils took porridge, $\frac{2}{5}$ of the remainder took milk and the rest of the pupils took tea. If those who took tea were 50;

(a) How many pupils were in the class?

(b) How many took milk and porridge?

35. After serving 20 people with $\frac{2}{5}$ of the litre of tea each and 28 people with $\frac{4}{7}$ litre of tea each, a hotelier remains with $\frac{1}{3}$ of his supply left. How much tea did he have at first?

36. In a school, the fraction of the girls is $\frac{1}{5}$ more than that of boys. The school has 280 boys.
(a) Find the fraction of the boys in the school.
(b) Calculate the total number of pupils in the school.
37. At a church party, the fraction of the guests who took soda was $\frac{2}{7}$ more than that of those who took water. If there were 150 guests who took water.
(a) Calculate the fraction of the guests who took water.
(b) How many guests attended the church party?
38. A water tank was $\frac{5}{6}$ full. When some water was sold, it remained $\frac{1}{3}$ full of water. If the tank holds 1200 litres when completely full,
(a) Find the amount of petrol sold in litres.

(b) If the water was sold using 10 litre jerrycans each sold at sh. 150, how much money was collected from the sale?

39. A petrol tank of a capacity of 4,800 litres was $\frac{3}{4}$ full. Some of the petrol was sold using 20 litre jerrycans at sh 70,000 each. After selling the petrol, $\frac{1}{6}$ of it remained.

(a) Find in litres, the amount of petrol which was sold.

(b) How much money was earned from the sale of the petrol?

More application on fractions

Vocabulary

Fill means to add

Empty means to subtract

1. Two taps A and B are connected on a tank. Tank A alone fills the tank in 4 hours and tap B alone fills the tank in 6 hours.

(a) What fraction of the tank can the two taps fill in one hour?

In one hour,

Tap A fills $\frac{1}{4}$ of the tank

Tap B fills $\frac{1}{6}$ of the tank

So tap A and tap B fill,

$$= \frac{1}{4} + \frac{1}{6}$$
$$= \frac{3+2}{12}$$
$$= \frac{5}{12}$$

(b) How long can the two taps take to fill the tank if turned on at the same time?

Since $\frac{5}{12}$ of the tank is filled in one hour,

So divide a tank into five twelves

$$= (1 \div \frac{5}{12}) \text{ hours}$$
$$= (1 \times \frac{12}{5} \text{ hours}$$
$$= \frac{12}{5} \text{ hours}$$
$$= 2\frac{2}{5} \text{ hours}$$

Method II

$$\text{Duration} = \frac{product}{sum}$$
$$= \frac{4 \times 6}{4+6}) \text{ hours}$$
$$= \frac{24}{10} \text{ hours}$$
$$= 2\frac{2}{5} \text{ hours}$$

2. Two taps E and F are connected on the same tank. Tap E alone can fill the tank in 6 minutes while tap F can empty the tank in 8 minutes. How long will the two taps when turned on at the same time take to fill the tank?

   Method I

   Fraction of the water filled in the tank in one minute

   Tap E fills $\frac{1}{6}$ of the tank

   Tap F empties $\frac{1}{8}$ of the tank

   So tap E and tap F take,

   $= \frac{1}{6} + \frac{1}{8}$

   $= \frac{4-3}{24}$

   $= \frac{1}{24}$

   Duration = $1 \div \frac{1}{24}$) minutes

   = (1 x $\frac{24}{1}$) minutes

   = $\frac{24}{1}$ minutes

   = 24 minutes

   Method II

   Duration = $\frac{Product}{Difference}$

   = $\frac{6\ x\ 8}{8-6}$ minutes

   = $\frac{48}{2}$ minutes

   = 24 minutes

3. Two taps A and B are connected on the tank. Tap A alone takes 8 hours to fill the tank. Tap B alone takes Y hours to fill the same tank. If when turned on at the same time, they take $4\frac{4}{9}$ hours to fill the tank. Find how long tap B takes to fill the same tank alone.

   Duration = $\frac{product}{sum}$

   $4\frac{4}{9} = \frac{8\ x\ y}{8+y}$

   $\frac{40}{9} = \frac{8y}{8+y}$

   40 (y + 8) = 9 x 8y

   40y + 320 = 72y

   40y – 40y + 320 = 72y – 40y

   320 = 32y

   $\frac{320}{32} = \frac{32y}{32}$

   10 = y

   Tap B takes 10 hours to fill the tank

4. Two taps G and H are connected on a tank. Tap G takes 3 hours to fill the tank while tap H takes X hours to empty the same tank. If turned on at the same time, the two taps take 12 hours to fill the tank. Find how long tap H take to empty the tank.

   Duration = $\frac{product}{difference}$

   $12 = \frac{3\,x\,X}{X-3}$

   $12(x - 3) = 3x$

   $12x - 36 = 3x$

   $12x - 3x - 36 = 3x - 3x$

   $9x - 36 = 0$

   $9x - 36 + 36 = 0 + 36$

   $9x = 36$

   $\frac{9x}{9} = \frac{36}{9}$

   $x = 4$

   Tap H takes 4 hours to empty the tank.

5. Taps F and E are connected to a water tank. Tap F can fill the tank in 2 hours while tap E can empty the tank in 3 hours. One day when the tank was $\frac{1}{3}$ full of water, the taps were opened at the same time. How long did it take to fill the tank?

   Duration = $\frac{product}{difference}$

   $= \frac{2\,x\,3}{3-2}$ hours

   $= \frac{6}{1}$ hours

   = 6 hours

   Fraction of the tank empty or one to fill

   $= \frac{3}{3} - \frac{1}{3} = \frac{3-1}{3} = \frac{2}{3}$

   Time to fill

   $= (\frac{2}{3} \times 6)$ hours

   = (2 x 2) hours

   = 4 hours

6. Two taps A and B are connected on a water tank. Tap A can fill the tank in 3 hours while tap B can fill the same tank in 4 hours. How long can they take to fill the same tank if both taps are turned on at the same time?
7. Two taps A and B are connected on a water tank. Tap A can fill the tank in 3 hours while tap B can empty the same tank in 4 hours. How long can the both taps take to fill the same tank if turned on at the same time?

8. Ondoga can slash a compound in 5 hours while Debra can slash the same compound in 6 hours. How long can the two men take to slash the same compound if they work together at the same rate?
9. Two taps Y and Z are connected on the same water tank. Tap Y can fill the water tank in 4 hours while tap Z can empty the same tank in 5 hours. One day when the tank was $\frac{3}{10}$ full, the two taps where turned on. How long did they take to fill the tank?
10. Two taps M and N are connected on the same tank. Tap M takes 4 hours to fill the tank while tap N takes K hours to empty the tank. If they take 20 hours to fill the tank, find the time tap N takes to empty the same tank.
11. Two girls Anna and Rose slash the compound. Anna alone takes 12 minutes to slash the compound while Rose takes h minutes to slash the same compound. If they take $5\frac{5}{11}$ minutes to slash the compound, find the time Rose takes alone to slash the compound.
12. A man takes 10 hours to plough a garden. A woman takes 15 hours to plough the same garden. How long will it take the two workers plough if they have worked together?
13. Tap A takes 9 min to fill the tank and tap B takes 18 min to fill the tank.

(a) What fraction of the tank can both taps fill in one minute if they are opened at the same time?

(b) How long can both taps take to fill the tank if they are opened together at the same time?

PROPORTIONS

What you are looking for is sometimes placed on the right hand side

In this proportion, when you increase one item, the other also increases.

1 book costs sh.3500

2 books cost sh.7,000

3 books cost sh.10500

As the books you buy increase, the mount you pay also increase.

Also as the number of books you buy decrease, the amount you pay also decrease.

Whether you are increasing or not, the unit cost remain the same.

Exercise

1. 6 tomatoes cost sh.1500. Find the cost of 8 similar tomatoes.

   6 tomatoes cost sh.1500

   1 tomato costs sh. $\frac{1500}{6}$ = sh.250

   1 tomato costs sh.250

   8 tomatoes cost sh.250 x 8

   = sh.2000

2. 5 mangoes cost sh.7500. How many mangoes can one buy with sh.22500?
   Let the mangoes to be bought be y
   Sh.7500 buy 5 mangoes
   Sh.22500 buy y mangoes

   $\frac{sh.7500}{sh.22500} = \frac{5}{y}$

   $\frac{75}{225} = \frac{5}{y}$

   $\frac{75y}{75} = \frac{225\ x\ 5}{75}$

   y = 15 mangoes

3. Naume's car uses 8 litres of petrol for every 50km. How much petrol does he need to cover a journey of 325km?
4. A cyclist covers 70km in $2\frac{1}{2}$ hours. How long will he take to cover 21km at the same speed?
5. The cost of 5 bars of soap is sh.17500. Find the cost of 3 similar bars of soap.
6. Four packets of milk cost sh.9600. What is the cost of seven similar packets of milk?
7. Musa's car uses 12 litres of petrol to cover 70km. How much petrol does he need for a journey of 315km?
8. 6 kg of rice cost sh.14,000. How many kg of rice can one buy with sh.35,000?
9. A cyclist covers 60km in 1 hours. How long will he take to cover 140km?
10. A motorist covers 180km in 3 hours. How long will he take to cover 300km?
11. Given that  represent 24 ducks. Find the number of ducks represented by  ?
12. Naume scored 8 points in 12 games. How many points would you expect her to score in 18 games?
13. Aklam walked 9 blocks in 15 min. How long will it take for him to walk 12 blocks at the same time?
14. Junior bought 12 biscuits. If he paid sh. 1,000 for every 3 biscuits, how much did he spend altogether?

INDIRECT PROPORTION

In this proportion, when one item increases, the other decreases e.g
If you increase speed, the time reduces and when you reduce speed, the time taken will increase.

Exercise

1. 10 men can dig a pit in 6 days. How many men will do the same work in 5 days?
2. 8 boys can mop a building in 6 hours. How long will 12 boys take to do the same work?
3. 12 girls can dig a garden in 15 hours. How many more hours will 9 girls take to do the same work working at the same rate?
4. Four boys can dig a garden in 6 days. How many more boys are needed to do the same work in 2 days?
5. Nine workers can slash a farm in 10 hours. If 3 workers leave the group, how long will the remaining workers take to slash the same farm?
6. 12 men can paint a house in 15 hours. How many men are needed to paint the same house in 6 days?
7. Six tractors can plough a garden in 9 hours. How long will it take 3 tractors to plough the same piece of land?
8. 10 men can paint a house in 12 days. If two men leave the group, how long can the same work take?
9. 16 girls take 3 hours to slash a school compound. How long can the same work take if 4 girls don't turn up for work?
10. 8 boys can dig a shamba in 12 hours. If two more boys join the group, find how long they can take to dig the same shamba.
11. In 20 minutes, a car covers a distance of 48km. What distance does it cover in one hour?
12. One dozen of plates cost sh.72000. Find the cost of half a dozen of books.
13. A dozen of pencils cost sh.1800. Find the cost of $1\frac{3}{4}$ dozens.
14. A car uses 30 minutes to cover 90km. How many km will the car cover in $1\frac{1}{2}$ hours?
15. 6 litres of paint can cover an area of $120m^2$. How many litres of paint are required to cover an area of $36m^2$.
16. A driver covered a distance of 480km in 6 hours. What distance does she cover in 9 hours?

17. 5 metres of cloth can make 2 shirts. How many similar shirts will 20 metres make?
18. Anita's car uses 12 litres of fuel to cover 70km. How much fuel does she need to cover a journey of 315km?
19. 25 girls can construct a road in 8 days. How many girls will construct the same road in 10 days working at the same speed?

20. 18 boys can sweep a compound in 30 minutes. How many more boys are needed to sweep the same compound in 20 minutes working on the same speed?
21. 9 workers can slash a compound in 15 days. If 3 workers leave the group, how long will the remaining workers take to slash the same compound working at the same rate?
22. 20 boys can sweep the compound in 15 days. If 10 more boys join the group, how long can the same work take?
23. It takes 12 women 4 days to dig a shamba. How long will it take 8 women to do the same job?
24. 9 men can build a wall in 14 days. How long will 7 men take to build the same wall working at the same rate?
25. There is enough food to last 20 days for 60 girls. How long will the same food last if there were 100 girls.
26. 5 men take 6 days to dig a trench. How long will 3 men take to do the same piece of work working at the same speed?
27. 5 boys repair a road in 20 days. How many days will the four boys take to complete the same work?
28. 8 girls take 16 minutes to sweep the compound. How many less girls are needed to sweep the same compound in 32 minutes working at the same speed?
29. 5 tractors take 15 hours to plough a piece of land. How many more hours will 3 tractors take to plough the same piece of land?
30. 6 men take 15 days to construct a house. How many more men are needed to construct the same house in 6 days working at the same rate?
31. 12 tractors can take 4 days to cultivate a piece of land. If four tractors were taken for servicing, how much longer will the cultivation take?
32. A man's car uses 8 litres of petrol for every 50km. How much petrol does he need for a journey of 325km?
33. 8 boys can dig a shamba in 12 hours. If two more boys join the group, find how long can take to dig the same shamba?

PERCENTAGES

A percentage is a special fraction whose denominator is 100.
A percentage means every a hundred or out of 100
% is the symbol for the percentage

Example

1. Anna walks 60% of her journey
   The symbol 60% means 60 out of 100
   60% = $\frac{60}{100}$ in fractional form
2. Write 27 out of 50 as a percentage
   = $\frac{27\ x\ 2}{50\ x\ 2}$
   = $\frac{54}{100}$

3. Express $\frac{3}{4}$ as a percentage
   = $\frac{3\ x\ 25}{4\ x\ 25}$
   = $\frac{75}{100}$

4. Express $12\frac{1}{2}$% as a fraction
   = $\frac{12}{100}$ + ($\frac{1}{2}$ x $\frac{1}{100}$)
   = $\frac{12}{100}$ + $\frac{1}{200}$
   = $\frac{24+1}{200}$
   = $\frac{25}{200}$
   = $\frac{1}{8}$

5. Write 46.5% as a fraction
   = $\frac{46.5\ x\ 10}{100\ x\ 10}$
   = $\frac{465}{1000}$
   = $\frac{93}{200}$

6. Write $22\frac{1}{2}$% as a decimal
   = 22.5%
   = $\frac{22.5\ x\ 10}{100\ x\ 10}$
   = $\frac{225}{1000}$
   = 0.225

7. Write 7.5% as a decimal

$7.5\% = \frac{7.5 \times 10}{100 \times 10}$

$= \frac{75}{1000}$

$= 0.075$

Exercise

1. What is 40% as a fraction in its lowest terms
2. Write $\frac{3}{5}$ as a percentage
3. Write 0.5% a s a fraction in its simplest form
4. Express $7\frac{1}{2}\%$ as a fraction
5. Write 22.5% as a fraction
6. Write 12.5% as a decimal
7. Express $33\frac{1}{3}\%$ as a fraction
8. Write 2.5% as a fraction
9. Write $\frac{7}{8}$ as a percentage
10. Express 0.375 as a percentage

Examples

Note: Be careful of what percentage is given and the what is required.

1. Find the value of x in $\frac{x}{100} = 5\%$

$\frac{x}{100} = \frac{5}{100}$

$X = 5$

2. Given that $\frac{3}{4} = y\%$. Find the value of y

$\frac{3 \times 25}{4 \times 25} = y\%$

$\frac{75}{100} = y\%$

$75\% = y\%$

3. Given that $42\% = \frac{42}{k}$. Find the value of k

$42\% = \frac{42}{k}$

$\frac{42}{100} = \frac{42}{k}$

$k = 100$

4. In a class there are 24 boys and 36 girls. By what percentage are the girls more than boys?
   Total number of pupils
   = 24 + 36 = 60 pupils
   Difference in pupils
   = 36 – 24 = 12
   = $\frac{12}{60}$ x 100
   = 20% more

5. Express 20cm as a percentage of 125cm
   = $\frac{20cm}{125cm}$ x 100
   = 4 x 4
   = 16%

6. Express 120 metres as a percentage of 2km
   1km = 1000m
   2km = 2000m
   = $\frac{120m}{2000m}$ x 100
   = 24%

Exercise

1. Express 17 out of 25 as a percentage
2. Amos got 39 marks out of 50 in an interview. What percentage was this?
3. Express 30 seconds as a percentage of 4 minutes
4. Of 45 pupils in a class, 27 are girls. What percentage are boys?
5. Ojambo got 38 out of 50 in a test while Joel got 17 out of 20. Who got the bigger mark?
6. 90% of mass of an orange is water. If an orange has a mass of 120g. How much water is in the orange?
7. In a school of 270 pupils, 70% have paid school fees. How many pupils have paid school fees?
8. A mathematics test was given to a class of 50 pupils and 45 pupils passed the test. What percentage of the pupils failed the test?

Finding percentage parts

1. 10% of a number is 17. Find the number
   = 17 ÷ 10%
   = 17 ÷ $\frac{10}{100}$
   = 17 x $\frac{100}{10}$
   = 17 x 10
   = 170

10% represents 17

1% part represents $\frac{17}{10}$

100% represent $\frac{17}{10}$ x 100

= 170

2. 20% of a number is 40. What is 60% of the number.
   Be careful of which percentage is given and what is required
   Let the number be r
   20% of r = 40
   $\frac{20}{100}$ x r = 40
   $\frac{20r}{100}$ = 40
   $r = 40 \times \frac{100}{20}$
   $r = 2 \times 100$
   $r = 200$

   = 60% of r
   = $\frac{60}{100}$ x 200
   = 60 x 2
   = 120

3. In a class, 80% pupils are day scholars and the rest are boarders. If there 16 boarders, how many pupils are in the class?
4. In a school, 85% of the pupils are Ugandans and the rest are foreigners. If there are 120 foreigners, find the total number of pupils in the whole school.
5. A car broke down after covering 75% of its journey. If it was remaining with 30km to complete the journey,
   (a) find how long the whole journey was.
   (b) How many kilometres had the car covered before the breakdown?
6. A Baby coach bus taking pupils to Iganga broke down after covering 60% of the journey. The bus covered the remaining journey in 1 $\frac{1}{2}$ hours moving at a speed of 80km/hr. How far is Iganga from the school?
7. A school bus taking pupils to the game park covered 75% of the journey in 1 $\frac{1}{2}$ hours. The bus travelled at a steady speed of 80km/hr. How far was the school from the game park?
8. A taxi broke down after covering 70% of its journey. How long was the whole journey if the taxi was left with 72km to complete the journey?
9. In a school, 55% of the pupils are girls and the rest are boys. If there are 360 boys in the school, find the total number of pupils in the whole school.
10. Mugisha spent 30% of his salary on food. If he remained with sh.210,000 find Mugisha's salary.
11. Nakato spent 80% of the questions she was asked in an interview. If she failed 4 questions, find the number of questions she was asked altogether in an interview
12. On a farm, 78% of the animals are cows and the rest are goats. If there are 66 goats on the farm, find how many cows are on the farm.
13. 30% of Shakira's pocket money is sh.90,000. Find Shakira's pocket money.
14. In a taxi park, 90% of the taxis are made in Japan. If 27 taxis are not made in Japan, find the total number of taxis in a taxi park.

15. 20% of the water in the tank is full. If 400 litres of water are needed to fill the tank. Find the capacity of the tank when it is completely full.
16. A jerrycan of cooking oil is 70% full. If 6 litres of cooking oil is needed to fill the jerrycan, find the capacity of the jerrycan when completely full.
17. If 15% of 10% of a number is 9. Find the number.

Finding the number

1. In a class, there are 10% more girls than boys. If there are 27 boys, find the total number of pupils in the class.

Girls	Boys
100% + 10% = 110% $\frac{110}{2}$ = 55%	100% - 10% = 90% $\frac{90}{2}$ = 45%
?????	27 boys

Let the total number of pupils in the class be f

45% of f = 27

$\frac{45}{100}$ x f = 27

$100 \times \frac{45f}{100} = 27 \times 100$

45f = 2700

$\frac{45f}{45} = \frac{2700}{45}$

F = 60

There are 60 pupils in the class

2. In a village, there are 20% more women than men. If there are 300 men, find the total number of women and men in the village.
3. In a class, 20% of the girls are boarders while $33\frac{1}{3}$ of the boys are day scholars. The percentage of the girls in the class is 60%. The class has 10 boys who are day scholars.
   (a) How many pupils are in the class?
   (b) Find the number of girls that are boarders
4. In a village, 80% of the women are not employed while 70% of the men are employed. The percentage of the women in the village is 70% and the village had 126 men who are employed.
   (a) How many men and women are in the village?
   (b) How many women are employed?
5. In a school, 60% of the boys are in lower primary classes while 70% of the girls are in upper primary classes. The percentage of boys is 40%. The school has 72 girls in lower primary classes,
   (a) Find the number of pupils in the whole school
   (b) How many are in upper primary classes?

6. In a village, there are 30% more women than men. If there are 210 men in the village, find the total number of people in the village
7. In a school, there are 10% more male teachers than female teachers. If there are 18 female teachers, find the total number of teachers in the whole school.
8. At St.Peter's primary school, there are 20% more day scholars than boarders. If there are 800 boarders, find the total number of pupils in the whole school.
9. In a class, there are **40%** more girls than boys. If there are **75** boys in the class.
   (a) What is the total number of pupils in the whole class?
   (b) How many more girls than boys are in the class?

Percentage decrease and increase

An increase is the quantity that is added.
A decrease is the quantity that is subtracted.
Increase = New quantity – Old quantity
% increase = $\frac{increase}{Old\ quantity}$ x 100

Exercise

1. The cost of a kg of posho was increased from sh.2000 to sh.2500. Calculate its increase
   Increase = New cost – Old cost
   = sh.2500 – sh.2000
   = sh.500
2. The number of pupils in a class increased from 60 to 72. Calculate the percentage increase.
   Increase = New – Old
   = 72 – 60
   = 12
   % increase = $\frac{Increase}{Old}$ x 100
   = $\frac{12}{60}$ x 100
   = (2 x 10) %
   = 20%
3. When 400 is increased by p% it becomes 440. Find the percentage p.
4. Increase 600kg of posho by 10%
5. Increase 1200 by 12 $\frac{1}{2}$ %
6. A man bought a hen at sh.12,000 and later sold it at an increment of 30%. Calculate the selling price of the hen.

7. After an increment of 20%, a trader sold a radio at sh.72,000. Calculate the original cost of the radio.
8. What number when increased by 30% becomes 3120?
9. A man's salary was increased by 30% to sh.312,000 per month. What was the man's monthly salary before the increment?
10. After an increment of 10%, a trader sold a radio at sh.66,000. Find the original cost of the radio.
11. What number when increased by 20% becomes 4800?
12. The cost of sugar was increased from sh.3600 by 20%. Calculate the cost of the sugar after the increment.
13. When 3,000 is increased by y% it becomes 3150. Find the percentage y
14. In Osopotoiti p/s, there were 600 pupils last year. This year the number of pupils increased by 10%. How many pupils are in the school now?
15. The cost of the rice increased from sh.4000 per kg to sh.5000 per kg. Calculate the percentage increase.
16. Increase 1800 by 20%
17. Increase 4000 by 10% by 5%
18. Increase 9,000 by $33\frac{1}{3}$%
19. The man's salary was increased by $12\frac{1}{2}$% to become sh.675,000, what was his original salary before increase?
20. A worker's salary was increased by $12\frac{1}{2}$% to become sh.450,000. Calculate his original salary.

Percentage decrease

Decrease = Old quantity – New quantity

% decrease = $\frac{Decrease}{Old\ cost}$ x 100

Exercise

1. The cost of a tray of eggs decreased from sh.10500 to sh.7500 due to lock down for COVID-19. Calculate the decrease

   Decrease = Old cost – New cost

   = sh.10500 – sh.7500

   = sh.3000

2. When 1500 is decreased by K%, it becomes 1275. Find the percentage K.
   Decrease = Old quantity – New quantity
   = sh.1500 – sh. 1275
   = sh. 225

   % decrease =($\frac{Decrease}{Old}$ x 100)%
   = ($\frac{225}{1500}$ x 100)%
   = 15 %

3. Decrease sh.8,000 by 10% then by 10%
4. Decrease 1400 by 20%
5. A trader bought a tray of eggs at sh.9,000 and later sold it at a loss of 20%. Calculate the selling price of the tray of eggs
6. After a reduction of 5%, the cost of beans became sh.3800. Calculate the original price of the beans.
7. By selling an item at sh.63,000, a trader realized a reduction of 10%. Calculate the original cost of the item.
8. Decrease 1800 by 22 $\frac{1}{2}$%
9. Decrease 7000 by 7 $\frac{1}{2}$%
10. Decrease 2400 by 15%
11. Decrease 16,000 by 20% then by 10%
12. The cost of a fish decreased from sh.15,000 per kg to sh.12,000 per kg. Calculate the decrease.
13. A bunch of bananas decreased from sh,20,000 to sh.15,000. Calculate the percentage decrease.
14. When 300 is decreased by x% , it becomes 240. Find x
15. The cost of a kg of posho sh.2,000. If it was later later decreased by 25%. Find the cost of posho then.
16. After a reduction of 20%, the cost of a shirt became sh.32,000. Calculate the original cost of the shirt.
17. By selling an article at sh.42,000, a trader realized a reduction of 30%. Calculate the original cost of an article.
18. After a decrease of 10%, the cost of a bar of soap became sh.3600. Calculate the original cost of the bar of soap

PROFIT AND LOSS

A profit is again obtained after selling an item.
Profit = Selling price – Buying price
% profit = $\frac{Profit}{Buying\ price}$ x 100

Exercise

1. Auma bought a watch at sh.32,000 and later sold it at sh.35700. Calculate the profit she made.
   Profit = Selling price – Buying price
   = sh.35700 – sh.32000
   = sh. 3700

2. Dina bought a pair of shoes at sh.32,000 and later sold it at sh.35200. Calculate her percentage profit.
   Profit = Selling price – Buying price
   = sh.35700 – sh.32000
   = sh. 3700

   % profit = $\frac{Profit}{Buying\ price}$ x 100

   = $\frac{sh.3200}{sh.32000}$ x 100

   = 10%

3. Nabudere sold a radio at sh.55000 making a profit of sh.7000. Calculate the buying of the radio.
4. Atwine bought a dress at sh.27,000 and sold it making a profit of sh.4500. Calculate the selling price of the dress.
5. A trader bought a dozen of books for sh.6000. He later sold each book at sh.700. Calculate his profit.
6. A trader bought a tray of eggs for sh.7500. She sold each egg at sh.300. Calculate the profit she made.
7. A trader bought a 50kg bag of sugar at sh.180,000. He sold each kg at sh.4140. Calculate the percentage profit he made.
8. Amos bought a bag at sh.25,000 and later sold it making a profit of 20%. Find the selling price of the bag.
9. By selling a hen at sh.44,000, a trader realized a profit of 10%. Find the original cost of the hen.
10. A trader bought a 50kg bag of rice at sh.200,000. He sold the rice making a profit of 20%. Calculate the selling price of rice.
11. Nakamya bought an article at sh.8,000 and later sold it at sh.10,500. Calculate the profit.
12. Lubyayi sold an item at sh.12,000 and made a profit of sh.2400. Calculate the buying price of an item.
13. Masari bought a book at sh.4000 and sold it making a profit of sh.500. Calculate the selling price of the book.
14. Nansikombi bought $1\frac{1}{2}$ dozen of books at sh.36,000. If she sold each book at sh.sh.2500. Calculate her profit she made.
15. Amongin bought a tray of eggs at sh.9,000 and sold each egg at sh.500. Calculate the profit she made.

16. An article was bought at sh.100,000 and sold at sh.120,000. Calculate the percentage profit.
17. A trader bought a 25kg bag of posho at sh.50,000. He sold each kg of posho at sh.2200. Calculate the percentage profit he made.
18. Amon bought a shirt at sh.30,000 and later sold it making a profit of 15%. Find the selling price.

19. Raban bought a 50kg bag of beans at sh.190,000. He sold the beans making a profit of 25%. Find the selling price of each kg of beans.
20. By selling an article at sh.390,000, Zahara made a profit of 30%. Calculate the original cost of the item.

Percentage loss

A loss is obtained when the buying price is greater than the selling price

Loss = Buying price – Selling price

% loss = $\frac{Loss}{Buying\ price}$ x 100

Exercise

1. A trader bought a cabbage at sh.3500 and later sold it at sh.3,000. Find the loss.

   Loss = Selling price – Selling price
   = sh.3500 – sh.3000
   = sh.500

2. Zzipora bought a bag at sh.15,000 and later sold it at.sh.13,500. Calculate the percentage loss.

   Loss = Selling price – Selling price
   = sh.15000 – sh.13500
   = sh.1500

   % loss = $\frac{Loss}{Buying\ price}$ x 100
   = ($\frac{sh.1500}{sh.15000}$ x 100)%
   = 10%

3. A trader bought 50 mangoes for sh.40,000. He later sold each mango at sh.750. Calculate the loss the trader made.
4. Dina bought a fish at sh.15,000 in the morning. She sold it in the evening making a loss of sh.1500. Find the selling price of the fish.
5. Laban sold an item at sh.4500 making a loss of sh.600. Find the buying price of an item.
6. Zipora bought a bag at sh.15,000 and later sold it at.sh.13,500. Calculate the percentage loss.
7. Asher sold a dress at sh.16,000 making a loss of sh.4,000. Calculate percentage loss he made.

8. Jethro bought a radio at sh.60,000 and sold it at a loss of 5%. Find the selling price.
9. A trader sold a watch at sh.36,000 making a loss of 20%. Find the original cost of the watch.
10. A trader bought a bunch of bananas at sh.20,000 and later sold it at sh.18,000. Find the loss the trader made.
11. Kamuntu bought a dozen of pineapples at sh.18,000. She later sold each pineapple at sh.1300. Find the loss he made.
12. Bobson bought a cluster of ripe bananas at sh.4,000 and later sold making a loss of sh.700. Calculate the selling price.
13. Achola sold a doll at sh.6700 making a loss of sh.1,300. Find the buying price of the doll.
14. Namajjo bought a hen at sh.20,000 and later sold it at sh.15,000. Find the percentage loss.
15. Namugala sold a skirt at sh.7,200 making a loss of sh.800. Calculate the percentage loss.
16. A trader bought a bar of soap at sh.3,000 and sold it at a loss of 10%. Calculate the selling price.
17. After selling a book at sh.4800, a trader realized a loss of 20%. Find the original cost of the book.
18. A lady bought a dress at sh.5,500. She later sold it and made a loss of sh.15,000. At what price did she sell the dress.

Application of profit and loss

1. Awori bought a pair of trousers at sh.40,000. He sold it to Wafula making a profit of 10%. Wafula later sold the trouser to Mukungu making a loss of 20%.

(a) Calculate the amount of money Wafula paid for the trouser.

Amount Wafula paid

= 100% + 10% = 110%

= 110% x sh.40000

= $\frac{110}{100}$ x sh.40000

= 11 x sh.4000

= sh.44000

(b) How much did Mukungu pay for the trouser?

= 100% - 20% = 80%

= 80% x sh.44000

= $\frac{80}{100}$ x sh. 44000

= sh. 8 x sh.4400

= sh.35200

2. Namondo sold a watch at sh.77,000 making a profit of 10% to Kiggundu. Kiggundu later sold the watch to Lelziege at a loss of 5%.
   (a) How much did Namondo buy the watch?
   Let the buying price be z
   (100% + 10%) x z = sh.77000
   110% x z = sh.77000
   $\frac{110}{100}$ x z = sh.77000
   $\frac{11z}{10}$ = sh.77000
   $10\ x\ \frac{11z}{10}$ = sh.77000 x 10
   $11z$ = sh. 77000 x 10
   $\frac{11z}{11} = \frac{sh.770000}{11}$
   z = sh.70000

   (b) How much did Lelziege pay for the watch?
   = 100% - 5% = 95%
   = $\frac{95}{100}$ x sh. 77000
   = 95 x sh.770
   = sh.73150

3. A trader sold two hens at sh.72,000 making a loss of 10%. How much must he have sold them to make a profit of 20%?
4. Mbayo bought a goat at sh.160,000 and sold it at a profit of 25%. How much profit did he make?
5. Ndagire made a profit of 20% after selling a bag at sh.48,000. How much was the profit?
6. Koole sold a chair at sh.77,000 making a profit of 10%. How much was the profit?
7. Nakato sold a dress at sh.7200 making a loss of 20%. How much was the loss?
8. Nakirya bought a book at sh.4,000 and sold it at a profit of 15%. How much was the loss?
9. Nairuba bought a fish at sh.25,000 and sold it at a loss of 10%. How much was the loss?
10. A trader sold a coat at sh.63,000 making a loss of 10%. How much should he have sold a coat to get a profit of 10%
11. Albert sold a pair of shoes at sh.48,000 making a loss of 20%. For how much would he have sold the pair of shoes to get a profit of 15%?
12. Musoke sold a case at sh.225,000 making a loss of 25% to Phiona. Phiona sold the case at a profit of 10% to Nakato.
    (a) How much did Musoke buy the case?
    (b) How much did Musoke pay for the case?

13. Mugoba sold a radio to Amuge at sh.630,000 making a loss of 10%. Amuge later sold the radio to Malanga at a profit of 15%
    (a) Find the amount Mugoba bought the radio.
    (b) How much did Malanga pay for the radio?
14. Namuli bought a bicycle at sh.240,000 and sold it to Nankya making a profit of 10%. Nakya later sold the bicycle to Nkonde at a loss of 5%. How much did Nkonde pay for the bicycle?
15. Ssebi bought a necklace at sh.30,000 and sold it to Chemongesi at a loss of 10%. Chemongesi sold the necklace to Chondo at a loss of 15%. How much did Chondo pay for the necklace?
16. Rebecca bought a mobile phone and sold it to Andrew at a profit of 10%. If Andrew paid sh.264,000 for the mobile phone, how much did Rebecca buy the mobile phone?
17. Kangave sold a set of chairs to Juma at sh.920,000 making a profit of 15%. Juma then sold it to Kato at a loss of 5%
    (a) How much did Kangave sell the set of chairs?
    (b) How much was Juma's loss?
18. Jolly bought a laptop at sh.800,000 and later sold it to Rita at a loss of 10%. Rita later sold the same laptop to Akullo at a profit of 20%. How much money did Akullo pay for the laptop?
19. After selling a jerrycan of cooking oil at sh.80,000. Bashaija made a loss of 20%. Find the buying price of the jerrycan of the cooking oil>
20. Clinton bought a shirt at sh.50,000 and later sold it to Bashaija at a profit of 20%. Bashaija also sold it to Denis at a loss of 10%. How much money did Denis pay for the shirt?
21. Jane sold a book to Brinton at sh.1200 making a loss of 20%. Brinton later sold it to Naume at a profit of 10%.
    (a) Calculate the amount of money Jane paid for the book.
    (b) Calculate Brinton's selling price for the book.
22. The marked price of a radio was sh.60,000. The trader sold it at a profit of 20% to Ruth. Ruth later sold it to Ankson at a loss of 10%. How much did Ankson pay for the radio?
23. Henry and Tom buy and sell mangoes. One day, each of them bought 600 mangoes at the same price. Tom sold each mango at sh 300 while Henry sold his 5 mangoes for sh 2,000. If Tom made a loss of sh 20,000, how much profit did Henry make on each mango?

DISCOUNT

A discount is a reduction in the trader's profit so as to attract many customers.

It is obtained by subtracting the selling price from the marked price or original price

Discount = Marked price – Selling price

% discount = $\frac{Discount}{Marked\ price}$ x 100

1. The marked price of a coat was sh.15,000. A trader sold it at sh.14,500. Find the discount

   Discount = Marked price – Selling price

   = sh.15000 – sh.14500

   = sh.500

2. The marked price of a counter book is sh.4,000. If the trader sold it at sh.3800. Find the percentage discount.

   Discount = Marked price – Selling price

   = sh.4000 – sh.3800

   = sh.200

   % discount = $\frac{Discount}{Marked\ price}$ x 100

   = $\frac{sh.200}{sh.4000}$ x 100

   = 5%

3. A trader sold a radio for sh.48,000 after allowing a discount of sh.2,000. Find the marked price of the radio.
4. The marked price of a blanket is sh.75,000. If the trader allowed a discount of sh.7,000. Find the selling price.
5. The marked price of a ball was sh.30,000. If a trader sold it at a discount of 10%, how much was the discount?
6. An item was reduced was reduced by sh.12,000. Naturinda paid sh.36,000 for the item. Calculate the percentage discount.
7. Alupo paid sh.38,000 for a phone after getting a discount of 5% on the marked price. Find the marked price.
8. Amon bought a shirt at 20% discount. If he paid sh.2000, find the original price of the shirt.
9. The marked price of a ball was sh.30,000. If the trader sold it at a discount of 10%, how much was the discount?
10. The marked price of a watch was sh.60,000. If the trader sold it at a discount of 15%. Calculate the selling price.
11. Nayiga paid sh.72,000 for an item after getting a discount of 10%. How much would she have paid if she had been given a 15% discount?
12. The marked price of a 5-litre jerrycan of cooking oil is sh.30,000. If a trader sells it at sh.28,500, find the discount.

13. The marked price of a doll is sh.18,000. Find the selling price if the trader allows a discount of sh.1,500.
14. The selling price of an item is sh.6,400 after a discount of sh.800. Find the marked price of the item.
15. The marked price of an article was sh.8,000. If it was sold at sh.7,200, find the percentage discount.
16. A shirt was sold at sh.22,400 after allowing a discount of 5,600. Calculate the percentage discount
17. The marked price of a dress is sh.40,000. If a trader sold it at a discount of 5%, how much as the discount?
18. The marked price of the pair of shoes was sh.50,000. If the trader sold it at a discount of 10%. Find the selling price.
19. Nalloda was given a discount of sh.700 on an item. If he paid sh.6300. Find the percentage discount.
20. Simon paid sh.64,000 for a suit after getting a discount of 20% on the marked price. Find the marked price.
21. Asiimwe paid sh.27,000 for a shirt after getting a discount of 10%. How much would he have paid if he had been given a 5% discount?
22. The total expenditure on certain items in the shop was sh.38,000. If the customer was given a discount of 20%, find his change if he had gone with a fifty thousand shilling note ?

SIMPLE INTEREST

The money borrowed, lent or deposited in a financial account like SACCO or bank is called principal(P).
The percentage used to calculate the extra money or interest is called the rate(R).
The period one spends with or keeps the money is called Time(T).
The time is in years if the rate is given per year or annum.
The time remains in months if the rate is given as per month.
The extra money paid after a certain period of time is called simple interest (S.I)
$S.I = P \times T \times R$
The total amount of money one pays back or withdraws from his/her account is called Amount (A).
$A = P + S.I$

Exercise

1. Nathan deposited sh.200,000 in a bank at an interest rate of 5% p.a for 9 months. Calculate the simple interest.
   Note that time will change to years since the rate is in p.a

   S.I = P x R x T

   = sh.200,000 x $\frac{5}{100}$ x $\frac{9}{12}$

   = sh.500 x 5 x 3

   = sh.7500

2. Obote deposited sh.600,000 in a bank which offers an interest rate of 10% per month for 6 months. Calculate the simple interest he got after 6 months.

   S.I = P x R x T

   = sh.600000 x $\frac{10}{100}$ x 6

   = sh.60000 x 6

   = sh.360000

   Note: The time remains in months since the rate is per month

3. Bashaija deposited sh.800,000 in a saving account for a period of 6 months at an interest of 8% per annum. How much money did he get after the end of 6 months?
4. Hilda borrowed sh.120,000 from a bank which offers an interest rate of $2\frac{1}{2}$% per annum. Calculate the amount of the money he paid back after 9 months.
5. Wepukuli deposited a certain amount of money in a back which offers an interest rate of 10% per annum for 6 months. If he received a simple interest of sh.20,000, find the principal he deposited in the bank.
6. Mpyangu borrowed a certain amount of money in a bank at an interest rate of $7\frac{1}{2}$% for 9 months. If the money yielded an interest of sh.20,250, find the amount of money Mpyangu borrowed from the bank
7. Christiana borrowed a certain amount of money from the bank which offers an interest rate of $12\frac{1}{2}$% p.a for a period of 6 months. If she paid back sh.170,000, find the amount of money she borrowed from the bank.
8. Havard deposited sh.150,000 in a savings bank which offers an interest rate of 5% per annum for a period of time. If the money yielded an interest of sh.2,500. Find how long did the money stay in the bank.
9. Jonathan borrowed sh.500,000 from the bank which offers an interest rate of 8% p.a. If she paid back sh.520,000. Find the time she spent with the loan.
10. Boaz deposited sh.400,000 in a savings bank for a period of 9 months. If the money yielded an interest of sh.21,000, find the interest rate.
11. Zakaria sold 12 hens and deposited all the money in his savings account. Find the amount of money he got on his account after 6 months at a rate of 10%. If she sold each hen at sh.25,000.

12. A man deposited sh.360,000 in a bank which offers an interest rate of 5% per annum for 8 months. Calculate the interest he got.
13. A farmer deposited sh.800,000 in a savings bank which offers an interest rate of $7\frac{1}{2}$% p.a for 6 months. Calculate the simple interest he got.
14. A trader borrowed sh.180,000 from a bank at an interest rate of $12\frac{1}{2}$% for $1\frac{1}{2}$ years. Calculate the amount of money he paid back after $1\frac{1}{2}$ years.
15. Jane borrowed a certain amount of money at an interest rate of 8% p.a for 3 years. If the money yielded an interest of sh.120,000, find the amount of money she borrowed.
16. Opendi deposited sh.80,000 in a village SACCO. At the end of two years, he got an interest of sh.16000. Calculate the SACCO's rate.
17. Aguti deposited sh.240,000 in a savings bank which offers n interest rate of 5% per annum. If the money yielded an interest of sh.24,000, find the time the money stayed in the bank.
18. Complete the table carefully and correctly.

Principal	Rate	Time	Simple Interest	Amount
Sh.40000	$2\frac{1}{2}$%	5yrs	_____	_____
Sh._____	20%	2yrs	Sh.32000	_____
Sh._____	$12\frac{1}{2}$%	4yrs	_____	Sh.67500

19. Tina deposited sh.1,200,000 in a savings bank that offers an interest rate of 3% per month. Calculate the amount of money he had on the account after 4 months.
20. Generous borrowed a certain amount of money from a bank which offers an interest of 6% per annum for 8 months. If she paid the bank sh.499,200, find the amount of money Generous borrowed.
21. Peruth bought 40 shares from a village SACCO at a simple interest rate of 20% per year. Each share costs sh.6,000. Calculate the total amount of money she had in the SACCO after $2\frac{1}{2}$ years.
22. Draleba borrowed money from the bank which offers a simple interest rate of $2\frac{1}{2}$% per year. After 9 months, her account had amounted to sh.163,000. Calculate the money she deposited in the bank.
23. A trader deposited a certain amount of money in the bank which offers an interest rate of 10% per annum. If he withdrew the total amount of sh.86,000 after 9 months, calculate his simple interest.
24. A farmer borrowed some money from the bank at a rate of 10% per annum. If he withdrew the total amount of sh.980,000 after a period of 4 years, how much money did he deposit?

25. Mary borrowed some money from the bank at a rate of 12% per year for 2 years. If she paid a total amount of sh.992,000, find the money she borrowed.
26. Victoria deposited a certain amount of money in a bank which offers an interest rate of $3\frac{1}{2}$% per year. If the money amounted to sh.57000 in a period of 4 years. Find the interest she got?
27. A trader deposited a certain amount of money to the bank which offers an interest rate of 20% per annum for $1\frac{1}{2}$hours. If he withdrew amount of sh.494000.
    (a) How much did he deposit in the bank?

    (b) How much interest did he have on his account after $1\frac{1}{2}$years?

29. A farmer deposited some money in certain bank which offers an interest rate of $3\frac{1}{2}$% per year. After 6 months, he withdrew amount of sh. 814000 in total.

(a) How much did he deposit in the bank?

(b) How much was his interest?

INTEGERS

Word statements involving integers

1. A man arrived at a bus station 35 minutes before the normal departure time of the bus. If the bus arrived 12 minutes late, for how long did the man stay at the bus station?
   Before = negative
   Late = positive
   Duration = Late – before
   = +12 – (-35)
   = +12 + 35
   = 47 minutes

2. In an interview, 2 marks are awarded for every correct response and 1 mark subtracted for every wrong response. An interviewee attempted 50 questions. If he got 42 questions correct,
   (a) How many questions did he fail?
   Wrong questions = 50 – 42
   = 8 questions

(b) How many marks did the interviewee score?

Marks scored = (2x42) – (1x8)

= 84 – 8

= 76 marks

(c) If the interviewee scored 85 marks, how many questions did he answer correctly?

Let the questions he passed be k

Correct questions	Wrong questions	Total
K	50-k	50

Marks scored = (C.Q x 2) – (W.Q x 1)

85 = (k x 2) – [(50 - k) x 1]

85 = 2k – (50 – k)

85 = 2k – 50 + k

85 = 2k + k – 50

85 = 3k – 50

85 + 50 = 3k – 50 + 50

135 = 3k

$\frac{135}{3} = \frac{3k}{3}$

45 = k

= 45 questions

3. A pupil gains 5 marks for a correct answer and loses 3 marks for a wrong answer. If the test had 20 questions and the pupil got 76 marks, how many questions did the pupils fail?
4. A teacher arrived 32 minutes before the scheduled time for a staff meeting. If the meeting started 15 minutes late, for how long did the teacher wait?
5. The family of Mzee Mpiima arrived at the airport 30 minutes before the arrival of the plane. Due to bad weather the plane arrived 20 minutes late. For how long did the family of Mzee Mpiima wait at the airport?
6. In a quiz, a teacher awards 5 marks for every correct response and deducts 2 marks for every wrong response. If the quiz had 20 questions and Nambi answered 16 questions correctly,
   (a) How many marks did she score?
   (b) If Nambi scored 65 marks, find the number of questions she answered wrongly.
7. In a test, a teacher awards 2 marks for every correct answer and subtracts one mark for every wrong answer. The test had 50 questions. If a pupil scored 76 marks, how many questions did the pupil answer correctly?
8. While marking a test of 25 questions, a teacher awarded 5 marks for every correct answer and deducted 3 marks for every wrong answer
   (a) A pupil made 5 wrong answers, how many marks was he given?

(b) If Opio was given 69 marks in the test, find the number of correct answers he made.

9. A teacher awarded 2 marks for every correct answer and deducted 1 mark for every wrong answer. If the test had 10 questions,
   (a) How many marks were given to a pupil who got 3 wrong answers?
   (b) Find the number of wrong answers Mukasa made if he was given 8 marks.
10. How many wrong answers were made by a pupil who got 5 correct answers in a test of 20 questions. If a teacher awarded her 4 marks for a correct answer and deducted 2 marks for a wrong answer, how many marks was she given?
   (c) Another child was given 50 marks in the same test, how many wrong answers had he made?
11. In a test of 15 questions, a teacher awarded 5 marks for each correct answer and deducted 2 marks for each wrong answer.
   (a) How many marks does a child with 10 correct answers get?
   (b) A pupil was given 54 marks, how many correct answers did he make?
12. A teacher awarded 6 marks for a right response and deducted 4 marks for a wrong response while marking a test of 35 questions. If a pupil got 180 marks, how many wrong responses did the pupil make?
13. Pupils did a mathematics exam of 32 questions with 20 short answers in section A and 12 structured questions in section B. A teacher awarded 2 marks for a correct response in section A and deducted 1 mark for a wrong response. In section B, he awarded 5 marks for correct responses each and deducted 2 marks for wrong response. How many marks does a pupil get who got 4 wrong responses in section A and 2 wrong responses in section B?
14. During an interview of teachers, both Mathematics and English papers were issued to each of them and marks were awarded as shown in the table below

Paper	Marks for every correct answer	Marks for every wrong answer
Mathematics	3 marks	1 mark
English	4 marks	2 marks

If the total number of questions in both examination papers is 40 questions and the ratio of the number of questions in the mathematics paper to those in English paper is 3:5, calculate the total number of wrong responses a teacher made for the paper who got 33 marks in Mathematics and 70 marks in English.

CLOCK ARITHMETIC

It is also known as the modular or finite system.
Finite comes from a Latin word finite which means remainder.
In every finite the highest number is one less than the finite

Finite 5	0	1	2	3	4				
Finite 6	0	1	2	3	4	5			
Finite 7	0	1	2	3	4	5	6		
Finite 8	0	1	2	3	4	5	6	7	
Finite 9	0	1	2	3	4	5	6	7	8

When the sum of the addends is more than the finite, you divide with the finite and the remainder is the answer.

Addition and subtraction of finites

1. Add: 3 + 4 = ___ (mod. 5)
   3 + 4 = 7 ÷ 5 = 1 rem 2
   Therefore; 3 + 4 = 2 (mod.5)

2. Solve: 4 + 5 = y (finite 6)
3. Work out: 2 – 3 = ___ (mod. 5)
4. Solve: 4 + k = 2(finite 5)
5. Solve: m – 5 = 4(finite 6)

Multiplication and division of finites

1. Work out: 4 x 3 = ___ (finite 5)
2. Work out: 1 ÷ 4 = ___ (finite 5)
3. Work out: 2 ÷ 3 = ___ (finite 5)
4. Solve: 2p + 3 = 4 (finite 5)
5. Add: 6 + 5 =___ (finite 9)
6. Add: 2 + 3 + 4 = ___ (finite 5)
7. Solve: 4 + 5 = k (finite 7)
8. Work out: 3 – 4 = ___ (finite 5)
9. Work out: 1 – 5 = ___ (mod. 6)
10. Solve r – 3 = 5 (finite 6)
11. Work out: 5 x 3 = ___ (finite 6)
12. Solve: 3 + n = 1 (mod 5)
13. Work out: 2 x 3 x 4 = ___ (mod 5)
14. Work out: 2 ÷ 4 = ___ (finite 5)
15. Solve: 3p + 1 = 3 (mod 5)

Application of finite system

1. A teacher shared a certain number of books to some of his pupils. When he gave out 7 books to each, 5 books remained and when he gave out 9 books to each, 4 books remained. Find the least number of books a teacher shared.
   5(finite 7) = { 5, 12, 19, 26, 33, **40**, …}
   4 (finite 9) = { 4, 13, 22, 31, **40**, …}
   = 40 books
2. Today is Friday, what day of the week will it be 45 days from now?
   Coding table

M	T	W	T	F	S	S
1	2	3	4		5	6

   Note that the order of assigning numbers does not matter
   For the word will, we shall add
   Day + No of days = ___ (finite 7)
   5 + 45 = ___ (finite 7)
   50 ÷ 7 = 7 rem 1
   1(finite 7)
   1 stands for Monday
   Therefore, the day will be Monday
3. Today is Friday 21st May 2020. What day of the week will 19th August 2020 be?
   Coding table

M	T	W	T	F	S	S
2	3	4	5	6	0	1

   Remaining days in May = 31 – 21 = 10 days
   Number of days in June = 30 days
   Number of days in July 31 days
   Number of days entered in August = 19 days
   Total number of days = 10 + 30 + 31 + 19 = 90 days
   Day + No of days = __ (finite 7)
   6 + 90 = ___ (finite 7)
   96 ÷ 7 = 13 rem 5 (finite 7)
   5(finite 7)
   5 stands for Thursday
   Therefore, the day will be Thursday

4. A farmer shared a certain number of eggs to pupils who visited his farm for study purpose. When he gave out 6 eggs each, 3 eggs remained. When he gave out 5 eggs each, 4 eggs remained and when he gave out 8 eggs each, 5 eggs remained. Find the least number of eggs that the farmer shared.
5. Today is Friday, what day of the week will it be 45 days from now?
6. Today is Saturday, what day of the week was it 136 days from now?

7. Today is Friday 21st May 2020. What day of the week will 19th August 2020 be?
8. Today is Wednesday 17th June 2020, what day of the week was it 10th April 2020?
9. It is May now. What month of the year will it be 56 months from now?
10. It is November now. What month of the year was it 306 months ago?
11. Find the least number of sweets when divided among 8 boys leaves a remainder of 4 sweets, when divided by 9 girls leaves a remainder of 6 sweets.
12. Find the least number of books which when divided by 12 girls leaves a remainder of 3 books, when divided by 10 girls leaves a remainder of 5 books and when divided by 11 girls leaves a remainder of 9 books.
13. Today is Wednesday. What day of the week will it be 79 days from now?
14. Today is Monday. What day of the week was it 55 days from now?
15. Today is Saturday 12th May 2020. What day of the week will it be 2nd July 2020?
16. Today is Thursday 27th April 2020. What day of the week was 16th January 2020?
17. It is June now. What month of the year will it be 99 months from now?
18. It is September now. What month of the year was it 67 months ago?

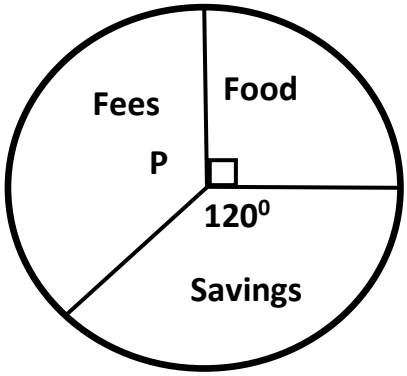
THEME: INTERPRETATION OF GRAPHS AND DATA
TOPIC: DATA HANDLING

PIE CHARTS

Information in a pie chart is represented in sectors.
The angle sum of all sectors is 360^0.
The angles of a pie chart are also known as angles at a point.
Pie charts can also be called circle graphs.
A pie chart is divided into sections or slices to represent numerical proportion of each item.
The items can be expressed in fractions, percentages or degrees.
The total of the percentages is 100%
The total of the fractions is a whole.

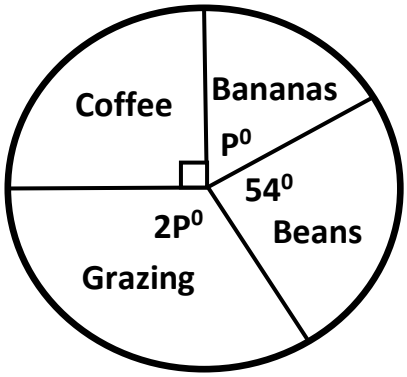
Exercise

1. The pie chart below shows how Mr.Kaliro spends his monthly income of sh.540,000. Use it to answer the questions that follow



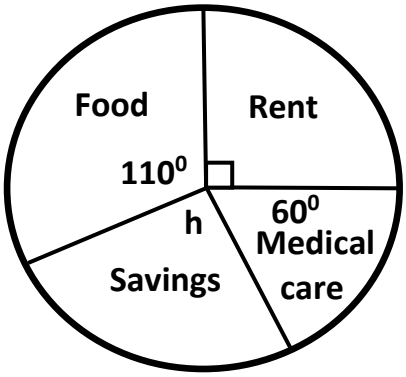
(a) Find the value of p.
(b) How much does he spend on fees?
(c) How much more does he save than he spends on food?
(d) What fraction of his salary is spent on food?
(e) What percentage of his salary is saved?

2. The pie chart below shows how a farmer uses his land. Use it to answer the questions that follow



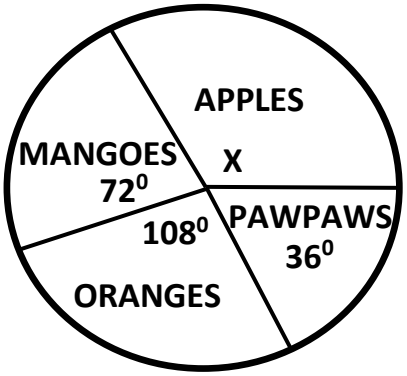
(a) Find the value of p.
(b) If he uses 18 acres for banana growing, find the total acres of land a farmer uses.
(c) Express acres of land used to grow coffee as a percentage of the whole land.

3. The pie chart below shows how Kato spends his monthly salary. Study it carefully and use it to answer the questions that follow



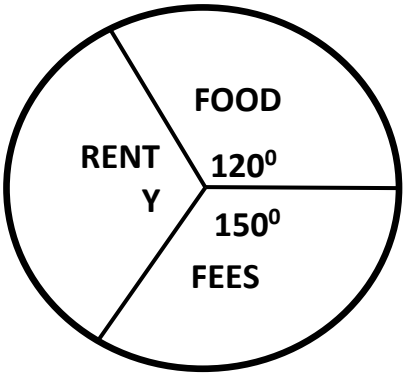
(a) Find the value of h.
(b) If he spends sh.18,000 on Rent more than on clothing, how much does he earn per month?
(c) How much money does he save?

4. The pie chart below shows some of the fruits a farmer brought at Nakasero market to sell.



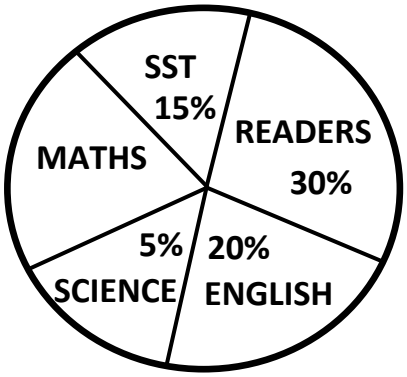
(a) Find the value of x.
(b) If he bought 800 apples, find the total number of fruits he brought to sell.
(c) How many oranges did he sell at the market?

5. The pie chart below shows how Mr.Chamba spends his monthly salary. Study it and answer the questions that follow



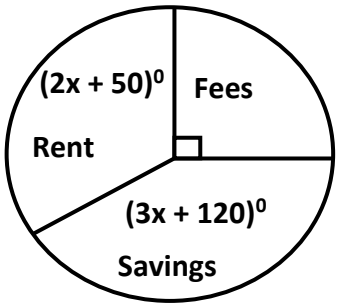
(a) Find the value of x.
(b) If he spends sh.30,000 on food than on rent, find Mr.Chamba's monthly salary.
(c) How much does he spend on fees?
(d) Express the amount spent on rent as a fraction on its simplest form.

6. The pie chart below shows the different textbooks in the library. Use it to answer the questions that follow



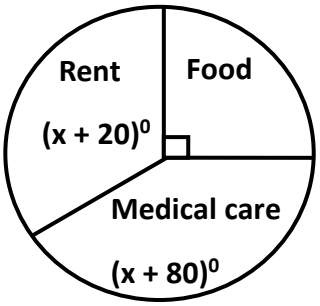
(a) What is the percentage of textbooks in the library is for mathematics?
(b) If there are 72 mathematics textbooks, find the total number of textbooks in the library.
(c) What angle is for English textbooks?

7. Study the pie chart below and use it to answer the questions that follow



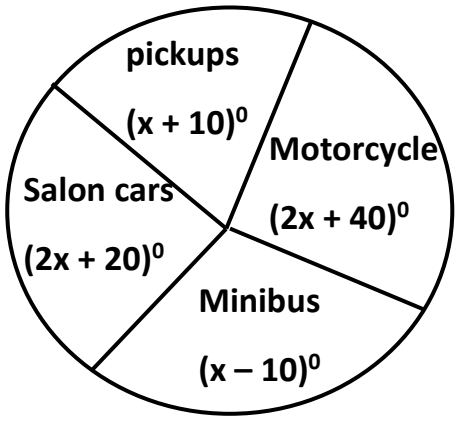
(a) If he spends sh.72,000 on rent, calculate his total monthly salary.
(b) How much does he save?

8. Study the pie-chart below and use it to answer questions that follow.



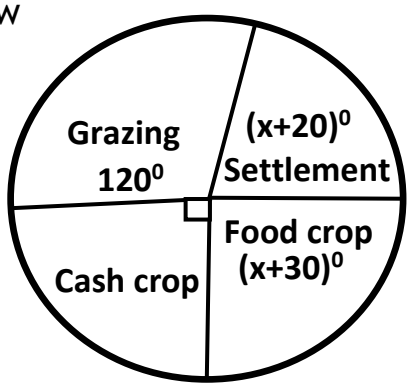
(a) Find the value of **x**.
(b) If he spends **sh. 120000** more money on medical care than Rent, how much does he earn?
(c) Express the sector for food as a fraction to its simplest form.

9. The pie chart below represents vehicles which were imported in the country last year. Use it to answer questions that follow.



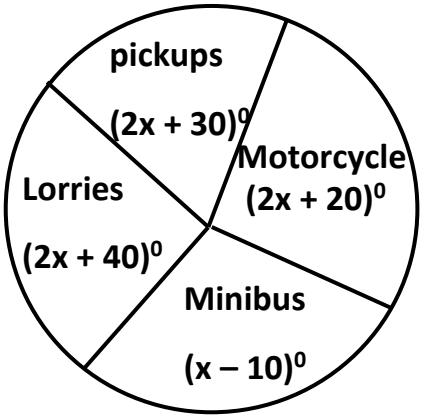
(a) Find the value of x.
(b) If the number of pickups which were imported was 200. What was the total number of vehicles imported?
(c) What percentage of the imported vehicles was a salon car?

10. Study the pie chart below and use it to answer the questions that follow



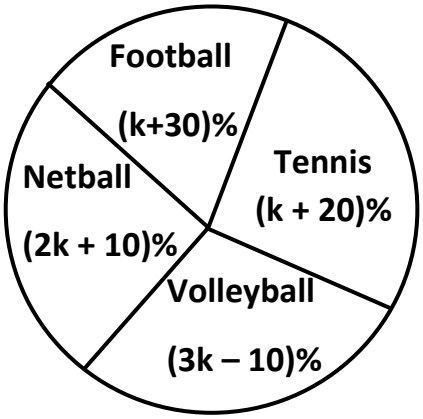
(a) If a farmer uses 60 acres on food crop, find the size of his land?
(b) How many acres does he use for grazing animals?

11. Study the pie chart below and use it to answer the questions that follow



(a) Find the value of x.
(b) If there are 160 more pick ups than minibus, how many vehicles are in the park altogether?
(c) How many lorries are in the park altogether?

12. The pie chart below shows the number of pupils who prefer different games at Nkogero primary school. Use it to answer the questions that follow.

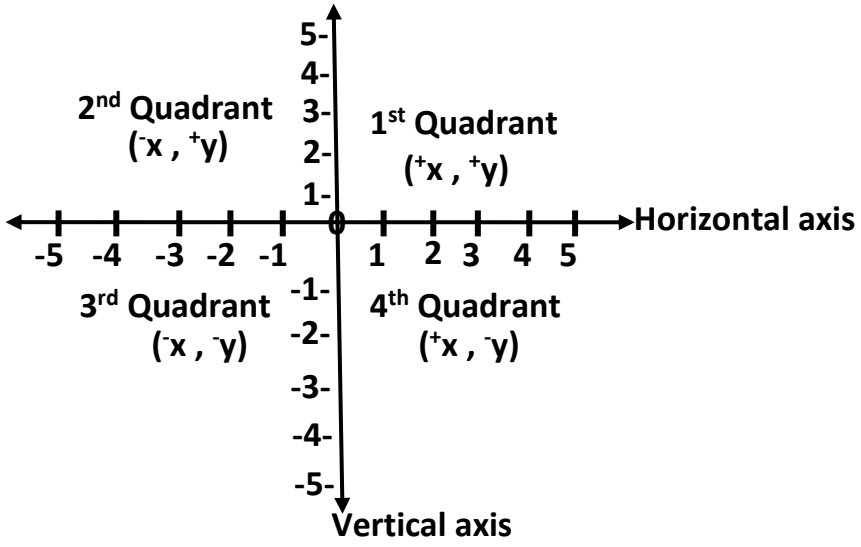


(a) Find the value of k

(b) If there are 96 more pupils who prefer Netball than football, how many pupils are there altogether?
(c) How many pupils prefer volleyball?

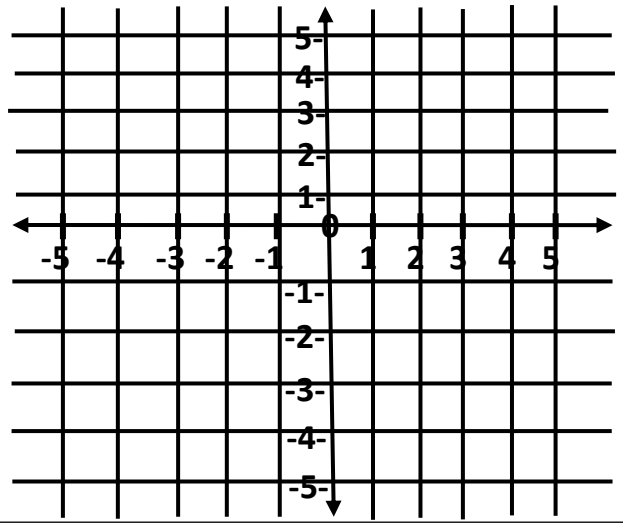
GRAPHS OF ORDERED PAIRS OF COORDINATES

The point where the two number lines intersect is called the origin.
The two number lines are the vertical and horizontal axes.
These number lines are also called axes.
The number plane is divided into 4 quadrants



Integers are coordinates on a grid A($^{-}$4, $^{+}$5)
Where these two coordinates intersect, is point A.
Order is very important here, first locate coordinate on the horizontal axis, then on the vertical axis and where they intersect is the required point and so is for reading coordinates of the points.

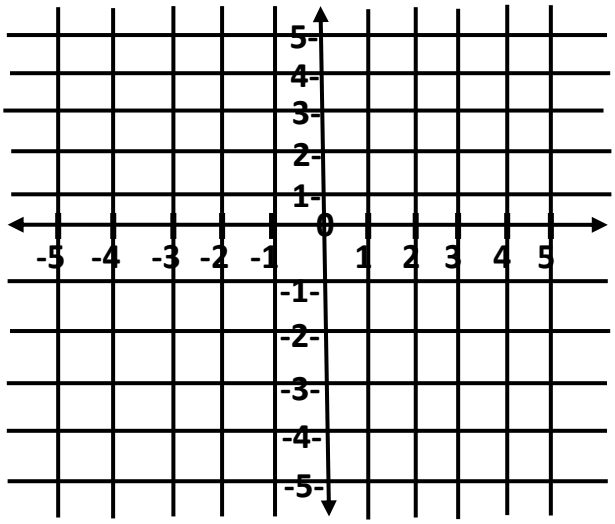
1. Plot the following points on the grid below
   A(3,2), B(-3,-2), C(4,-4), D(-4,3)



A(+3, +2) – 1st quadrant
B(-3 , -2) – 3rd quadrant
C(+4, -4) – 4th quadrant
D(-4, +3) – 2nd quadrant

2. (a) Plot the following points on a grid below

A(-1, -2) B(1,4) C(3, -2) D(0,1) E(2,1)



(b) Join points A to B, B to C, and D to E

(c) Name the shape you have formed.

3. (a) Plot the following points A(4, -4), B(-4, -4), C(-4,4), D(4, 4)
   (b) Join point A to B, B to C, C to D and D to A.
   (c) Name the geometric figure formed.

5. The coordinates of the vertices of a rectangle ABCD are given A(6,2),B(6,-4), C(-4,-4). What are the coordinates of point D?

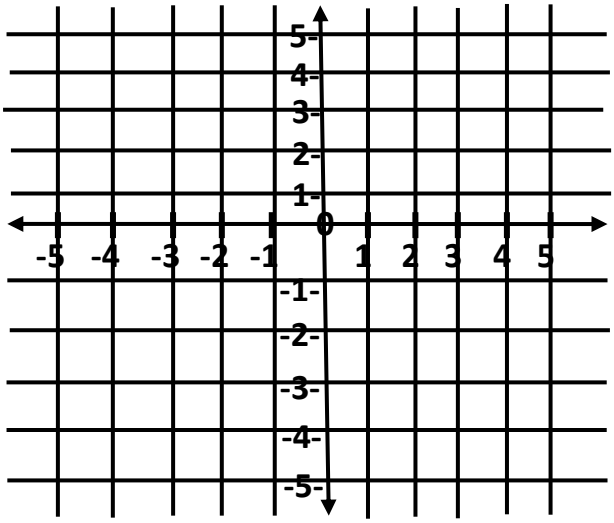
4. Draw a grid of 8 by 8, Plot the following coordinates, join the points and name the figures formed. Calculate their area and perimeter.

1) A(-3, 3),B (3,3),C(3,-4), D(-3,-4).
2) P(-2,3), Q(1,3), R(3,-2),S(-4,-2).
3) W(0,3), X(3,1), Y(0,-4), Z(-3,1).
4) A(-1,2), B(-4,-3), C(3,-3).
5) A(0,4), B(5,4), C(3,-1), D(-2,-1).
6) A(-2,3), B(1,3), C(4,-2), D(-2,-2).
7) P(-3,-3), Q(1,-3), R(3,3).
8) A(-3,0), B(0,5), C(3,0),D(0,-5).

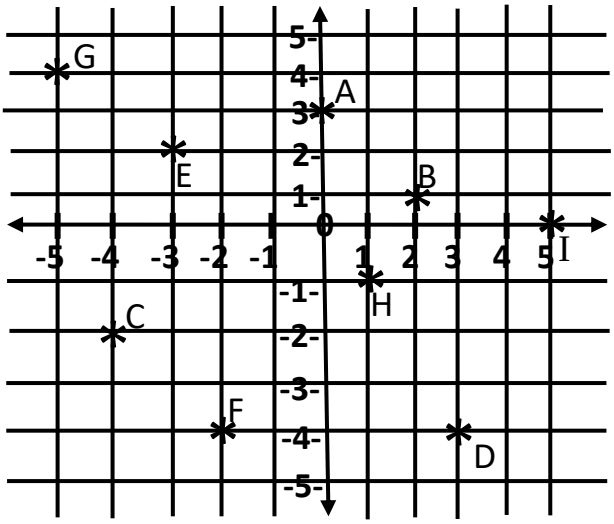
5. Plot the following coordinates on the grid, A(-5,4), B(1,4), C(1,1), D(5,1), E(5,-2), F(-5,-2). Join points, A to B, B to C, C to D, D to E, to F, F to A. Find the perimeter of the figure formed.

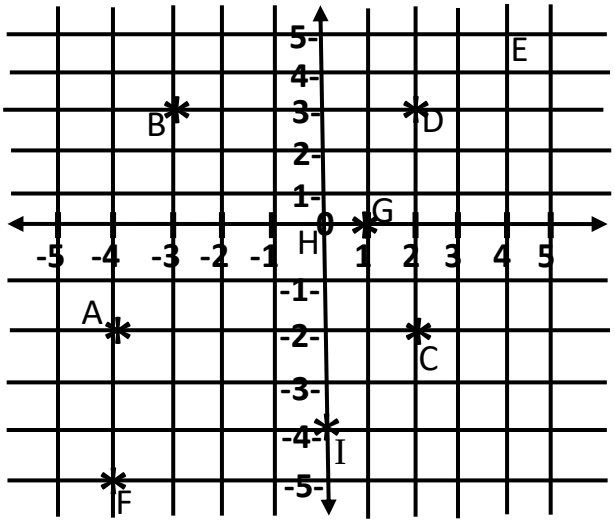
6. Plot the given points on a grid below

A(0,-2)	B(-2,0)	C(-2,-1)	D(-1,-2)	E(1,1)
F(3,2)	G(-5,0)	H(2,-6)	I(0,6)	J(-3,0)
K(-5,5)	L(3,3)	M(-4,-4)	N(-4,-3)	P(-3,0)



7. Write down the coordinates of the points on the following grids





8. A letter is drawn by joining the points on a number plane
   Join (-6, -2) to (-6, 4)
   Join (-3,4) to (-3, -2)
   Join (-6, 1) to (-3, 1). What letter of the alphabet has been formed.
9. Draw a grid and plot the following A(-2,3), B(5,3), C(-2, -1) and D(1, -1)

10. Given that y = 3x – 2. Complete the table below

X	-2	_____	0	_____	5
Y	_____	-5	_____	4	_____

11. Given that y = -3x + 5. Complete the table below

X	-2	-1	0	1	2
Y	_____	_____	_____	_____	_____

12. Given that y = -2x + 3. Complete the table below

X	_____	_____	_____	_____
Y	-2	-1	0	1

13. Given that y = 1 – x. Complete the table below

X	-3	_____	-1	0	_____
Y	4	3	_____	_____	-1

14. Given that y = x + 1. Complete the table below

X	0	3	5	_____	6	_____
Y	1	_____	_____	9	_____	12

15. Given that y= x – 2. Complete the table below

X	_____	1		-3	0	_____
Y	2	_____	-6	_____	_____	-4

16. Given that y = 2 – 3x. Complete the table below

X	____	1	____	-2	-3	____	____	4
Y	2	____	-4	_____	11	-7	5	____

17. Use the equation x + y = 8. Complete the table below

X	-8	____	_____	0	____	_____	5
Y	____	12	10	____	6	4	_____

MEDIAN, RANGE, MODE AND MEAN(AVERAGE)

Median is a number that lies in the middle when the given data is arranged either in ascending or descending order.

Exercise

1. Find the median of 5, 7, 2, 8 and 7.
2. Work out the median of 30, 40, 50, 30, 40, 60, 70 and 30.
3. The table below shows the marks scored by different pupils in a mathematics test. Work out the median mark.

Marks scored	30	40	60	70	80
Number of pupils	3	2	2	1	2

4. P.7 boys stood in a straight line for a healthy parade. If Juma was the 7^{th} boy from either side of the line, how many boys stood in the line?
5. Jane Mary stood in a line of girls. If she was the 13^{th} from one side and the 20^{th} from the other side. Find the total number of girls in the line.
6. Aditte was given a bundle of five thousand shilling notes numbered consecutively. If the median note was the 19^{th} numbered AP3306492,
   (a) find the serial numbers of the first and the last notes
   (b) How many notes was she given?
   (c) How much was she given?
7. Find the median of 5, 4, 0, 6, 4, 2, 7
8. Find the median of -1, 0, 1, 2, 4, -3
9. The median of 9 consecutive integers is -3. Find the integers.
10. Enaga was standing in a line of policemen. If he was the 39^{th} from either side of the line, find the number of policemen who were in the line.
11. A farmer planted a pawpaw tree in a line of oranges. If the pawpaw tree was the 17^{th} from either side of the line, find the number of trees in the line.
12. A bus was parked in a line of vehicles. If it was the 15^{th} from one end and the 24^{th} from the other end. How many vehicles were parked in a line?
13. Tito was given a bundle of ten thousand shilling notes numbered consecutively. If the 11^{th} note was the median note numbered AZ2273524, find the serial numbers of the first and last note.

RANGE

Range is the difference between the largest and the smallest number in the given data.

To determine the largest or smallest number, you have to arrange the data in ascending or descending order for the case of integers.

Exercise

1. Find the range of -2, 4, 2, 0, 3,2 and 4.
2. Find the range of 50, 40, 30, 70, 30, 80, 60.
3. The range of certain number of consecutive numbers is 8. If the smallest integer is -3, find the integers.
4. Mbuga lives on the 13^{th} floor of the building. The difference between Muhinda's floor and Mbuga's floor is 7. Find the floor on which Muhinda lives.
5. This mountain is at -5486m and the peak is at +4201m. What is the full height of the mountain?
6. The temperature of Mt.Rwenzori at midnight was -15^0C, by midday the temperature was at $+12^0C$. By how much did the temperature change?
7. Find the range of 3, 7, 8, 4, 5, 1, 11
8. Find the range of -1, 0, 1, 2, 4, -3
9. The range of a certain consecutive integers is 3. If the smallest is -7, find the integers.
10. Nandijja lives on the 5^{th} floor on a certain building. Apophia lives above Nandijja . If the range between Apophia's floor and Nadijja's floor is 11, find the floor Apophia lives at.
11. The base of Mt.Kilimanjaro is -3670m and its peak is +4235m. What is the full height of Mt.Kilimanjaro?
12. The swallowest lake in Uganda is lake Victoria. It's bottom is -419m and its surface is +214m. How deep is lake Victoria?

13. The temperature at midnight on Mt.Elgon is -13^OC and the temperature at midday is 14^OC, find the change in temperature.
14. The deepest lake in Uganda is lake kyoga. The surface of this lake is at +446m while the bottom is at -1485m. How deep is lake kyoga?

MODE

This is the number that appears more than the rest of the numbers.
Modal frequency is the number of times the mode appears.

Exercise

1. Find the mode of 30, 40, 50, 30, 40, 60, 70, 30.
2. Given the numbers 9, 3, 4, 9, 4, 2, 9, 1
3. The table below shows marks scored by P.6 pupils in a mathematics test.

Marks	72	85	90	95	96
No of pupils	4	12	1	4	5

   (a) What was the modal score?
   (b) What was the modal frequency?
4. Find the mode of 1, 0, 3, 4, 4, 3, 4, 1.
5. Given the marks 60, 55, 50, 60, and 70. Find the modal frequency.
6. The table below shows the ages of P.6 pupils in a certain school.
   (a) Find the modal age.
   (b) What is the modal frequency?
7. The table below shows the different types of food prepared in a restaurant and the customers who ate it.
   (a)What was the modal food eaten?
   (b) What was the modal frequency?

MEAN / AVERAGE

This is the result of equal distribution or sharing.

$$\text{Mean} = \frac{\text{Sum of items}}{\text{Number of items}}$$

$$\text{Mean} = \frac{\text{S.O. I}}{\text{N.O. I}}$$

Examples.

1. The average of 5 numbers is 6. Find the sum of the 5 numbers.

$$A = \frac{\text{S.O. I}}{\text{N.O. I}}$$

$$6 \times 5 = \frac{\text{S.O I}}{5} \times 5$$

S.O I = 30

2. The average mass of 6 girls is 45kg and the average of other 4 girls is 50kg. Find the average age of all the girls.

No of girls	Average	Total
6	45kg	(6x45)kg = 270
4	50kg	(4x50)kg =200

Average = $\frac{\text{S.O.I}}{\text{N.O.I}}$

$= \frac{270\text{kg} + 200\text{kg}}{6+4}$

$= \frac{470\text{kg}}{10}$

= 47kg

3. The average mass of 64 boys is 50kg. When their teacher is included the average becomes 51kg. What is the mass of the teacher?

No. of people	Average	Total
14 boys	50kg	(14x50kg) = 70
15 people	51kg	15x51 = 765

Teacher's mass = $T_{15} - T_{P4}$

= (765- 700)kg

= ***65kg***

4. The mean number mangoes eaten by six boys was $6\frac{1}{2}$. Five of the boys ate 9,5,3,5 and 11 mangoes. What was the median number of fruits eaten?

Mean x No. of boys $= 6\frac{1}{2} \times 6$

3

$= \frac{13}{2} \times \frac{6}{}$ ***= 39 mangoes.***

Total number of mangoes eaten by five boys.

= 9+5+3+5+11

= 33 mangoes.

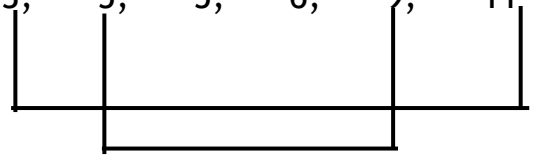
No. of mangoes eaten by sixth boy.

= 39-33

= 6 mangoes.

Median

3, 5, 5, 6, 9, 11



$\frac{5+6}{2} = \frac{11}{2}$

$5\frac{1}{2}$ *mangoes*

EXERCISE.

1. 10 pupils scored an average of 63 marks in a test. The scores for nine of them were 90,80,70,80,60,50,80,30 and 40. What was the score of the tenth pupil?
2. The average of 3,4,5,6 and x is 4. Find the median.
3. The average age of 3 girls is 15 years and the total age of two of the girls is 35 years. How old is the third girl?
4. The average mass of 6 boys is 45kg. The average mass of 5 of the boys is 43kg. Find the mass of the sixth boy.
5. The average age of 7 men is 42 years. If one of them leaves the group their average age becomes 40 years. How old is the seventh man?
6. Calculate the average of 2k, (2k - 1), 4 and 9.
7. The table below shows the number of apples sold by a canteen attendant in a week.

Days of the week	Mon	Tue	Wed	Thur	Fri	Sat
No. of apples sold	18	20	19	13	____	14

If the mean number of apples sold in the week was 17 apples, how many apples were sold on Friday?

8. The mean of score 8,9,6,4 and x is 6. What is the median score?
9. The ages of seven children are 7,3,6,2,5,1 and 4. Find the mean age.
10. The table below shows marks obtained by pupils in a mathematics test.

Marks	80	29	35	3a
No. of pupils	4	3	2	3

(a) If the mean mark was 70, find the value of a.

(b) Find the median mark.

11. The mean of 3 numbers is 3 and the sum of the smallest and middle numbers is 5. Find the largest number.

12. The mean mass of a class of 30 boys is x kg.When the two boys with a total mass of 150kg are absent, the mean mass of those present is 2kg less than the mean mass of the whole class. Find the value of x.
13. In a class of boys and girls, the average age is $15\frac{1}{2}$ years. The class has 12 boys whose average age is $16\frac{3}{4}$ years. Find the size of the class if the average of girls is 15 years.
14. The average weight of 3 boys is 43kg. When two other boys join them, the average weight becomes 40kg. If the 5th boy if 7kg less than the 4th boy, find the weight of the fifth boy in kg.

Probability. (chance)

This is an extent at which something is to happen. Probability ranges from 0 to 1.

- All things that can't happen have a probability zero e.g A man becoming a woman.
- All things that have to happen surely e.g man dying the probability is 1. The sun raising from the East is 1.
- The rest of the items the probability can be measured and its in a fractional form.

  Probability = $\frac{\mathbf{n}(D.C)}{\mathbf{n}(T.C)}$

Example 1

A dice is tossed once. What is the probability of a composite number appearing on top?

T.C = (1,2,3,4,5,6)

D.C = (4, 6)

Prob = $\frac{\mathbf{n}(D.C)}{\mathbf{n}(T.C)}$

$= \frac{\mathbf{2}}{\mathbf{6}}$

Example.2

The probability that Byekwaso will pass PLE is $\frac{5}{8}$. What is the probability that he will fail PLE?

Prob = 1- $\frac{5}{8}$

$= \frac{8}{8} - \frac{5}{8} = \frac{3}{8}$

Example.3

In a bag there are 8 red pens, 6 black and 4 green pens. What is the probability of picking a green pen from the bag at random?

n(T.C) = 8+6+4 18

n(D.C) = 4

Prob = $\frac{n(D.C)}{n(T.C)}$ $\frac{4}{18}$

Example.4

In a class of 40 pupils, the probability of picking a girl at random is $\frac{3}{5}$. How many boys are in the class?

Probability of picking a boy.

1- $\frac{3}{5}$ $\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$

No. of boys. $\frac{2}{\cancel{5}_{1}} \times \cancel{40}^{8}$

= 16 boys.

Example.5

A number is selected at random from the set.

B = (3,6,9,12,15,18,21). Find the probability that the number is even.

(D.C) = (6,12,18)

n(D.C) = 3

n(T.C) = 7

Prob = $\frac{n(D.C)}{n(T.C)}$

$= \frac{3}{7}$

Example.6

A number is chosen from the numbers 1 to 9. Find the probability that the number chosen is a triangular number.

T.C = (1,2,3,4,5,6,7,8,9)

n(T.C)= 9 (D.C)= (1,3,6)

n(D.C) = 3

$$\text{Prob} = \frac{n(D.C)}{n(T.C)}$$

$$= \frac{3}{9}$$

Example.7

The pupils scored the following marks in a mathematics test 12,3,39,61,40,10,28,40,15 and 52. Find the probability of a pupil selected at random from this group having obtained a mark below the mean mark.

$$\text{Mean} = \frac{S.O.I}{N.O.I}$$

$$= \frac{12+3+39+61+40+10+10+28+40+15}{10}$$

$$= \frac{30\cancel{0}}{1\cancel{0}} \qquad \underline{= 30}$$

D.C = (12,3,10,28,15)

n(D.C) = 5

n(T.C) = 10

$$\text{Prob} = \frac{n(D.C)}{n(T.C)}$$

$$= \frac{5}{10}$$

EXERCISE.

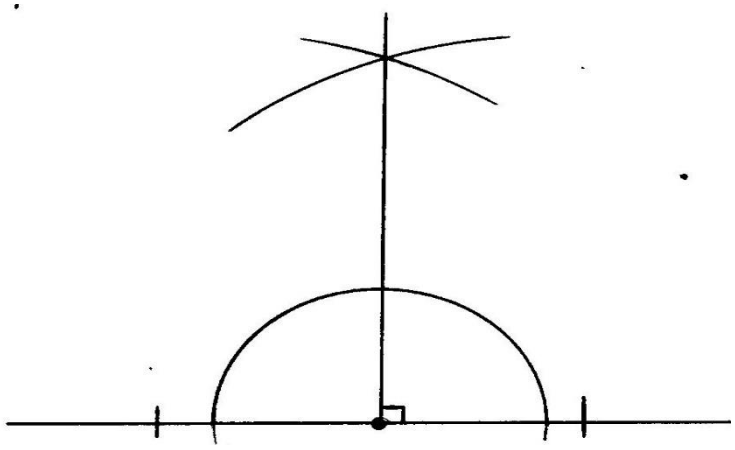
1. A coin was tossed once. Find the probability that a head will appear on top.
2. Logose is celebrating her twelfth birthday next week. Find the probability on a day which begins with letter "T"
3. Musa is celebrating his 36th birthday next month. What is the probability that he will celebrate?
4. A box contains 10 pennies, 5 dimes and 5 nickles. What is the chance of picking a nickle at random from the box?
5. In a village of 1000 parents, 896 have children in secondary schools while the rest have children in primary schools. What is the probability of picking a parent who has a child in a primary school at random to chair the village meeting?
6. A number is selected at random from **set A = (1,2,3,4,5,6,7,8,9)**. Find the probability that the number is a square.

7. In a class of 120 pupils, the probability of picking a pupil in the boarding section is $\frac{2}{3}$. How many pupils are day scholars in this class?
8. Seven children had the following ages. 7,3,6,2,5,1 and 4. Find the probability of selecting a child whose age is below the mean age.

THEME: GEOMETRY
TOPIC: GEOMETRIC CONSTRUCTION
Constructing angles

Angles can be constructed using a ruler and a pair of compasses, however not that all the angles can be constructed by the above instruments

Therefore, there are two main angles that we draw with a pair of compasses and the ruler i.e 90^0 and 60^0



Other angles that can be made from the knowledge of 90 degrees include;

45^0 from bisecting the angle of 90.

135^0 -The supplement of angle of 45^0

Other angles that can be made from the knowledge of 60^0

30^0 – bisecting the angle of 60^0

15^0 from bisecting the angle of 30^0

120^0 from the supplement of 60^0

150^0 from the supplement of 30^0

75^0 from bisecting the angle of 150^0

105^0 from supplement of 75^0

Exercise

1. Using a sharp pencil, a long ruler, and a protractor only, draw the following angles.

(a) 60^0 (b)130^0

(c) 30^0 (d)150^0

(e) 90^0 (f)15^0

(g) 105^0 (h) 55^0

(i)135^0 (j) 85^0

(k) 45^0

2. Using a sharp pencil, a long ruler, and a pair of compasses only, construct the following angles

(a) 60^0 (b) 120^0

(c) 30^0 (d) 150^0

(e) 90^0 (f) 15^0

(g) 105^0 (h) 75^0

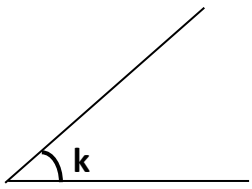
(i) 135^0 (j) 330^0

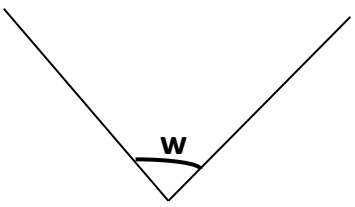
(k) 45^0

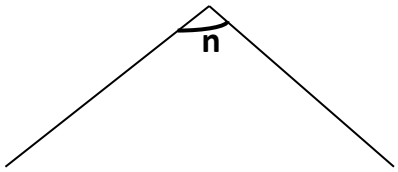
Bisecting angles

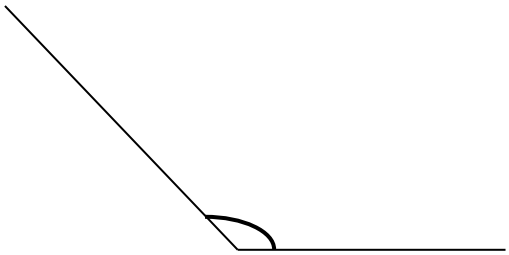
To bisect an angle, is to divide the given angle into two parts or angles, here we use a pair of compasses, a ruler and a pencil

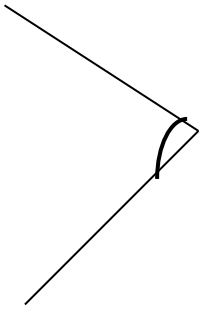
1. Using a pair of compasses, a ruler and a sharp pencil, bisect the following angles below

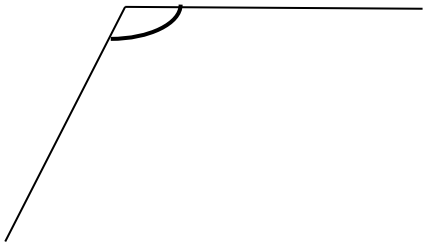












Construction of polygons

Triangles

1. Using a pair of compasses, a ruler and a sharp pencil only,
   (a) Construct triangle ABC in which AB= 6cm, line BC= 7cm and AC = 5cm. Measure all of its angles
   (b) Construct triangle PQR in which line PQ = 8cm, angle PQR = 60^0 and line QR = 6cm. Measure angle P, R and line PR.
   (c) Construct triangle EFG in which line EF = 7cm, angle FEG = 45^0 and angle EFG = 75^0. Measure angle G.
   (d) Construct triangle ABC in which line AB=7cm, line AC=5cm and angle A=135^0.
   (e) Construct a triangle ABC in which AB=6.5cm, angle ABC=60^0, and angle BAC=90^0.Measure line BC.
   (f) Construct a triangle ABC in which line AB = 7cm, angle ABC = 45^0 and BAC=60^0.Measure angle C.
   (g) Construct a triangle ABC in which AB=6.5cm, angle ABC=60^0, and angle BAC=90^0. Measure line BC.
   (h) Construct a triangle ABC in which line AB = 7cm, angle ABC = 45^0 and BAC=60^0.Measure angle C.

(i) Construct triangle ABC where by Line AB= 6cm, angle A=105^0, and ABC=30^0. Measure length AC.

(j) Construct a triangle XYZ where line XY=7cm, angle XYZ=45^0, and angle YXZ=60^0. Drop a perpendicular line from Z to meet line XY at point A. Measure line ZA.

(k) Construct triangle XYZ in which XY=7cm, angle YZX==60^0, and angle YXZ=30^0. Measure angle Y and line YZ.

(l) Construct triangle ABC in which angle ABC=90^0, line BC=7cm, and angle BCA=30^0.Measure lines AB and AC.

(m) Construct triangle ABC in that line AB=7cm, angle BAC=60^0, and angle ABC=45^0.Drop a perpendicular line from C to meet line AB at point Q. Measure line CQ.

(n) Construct triangle ABC in which line AB=7cm, angle ABC=120^0, and angle BAC=30^0.Drop a perpendicular bisector from C to meet line AB at point Z. Find the area of the triangle above.

(o) Construct a triangle RST in which Rs = 7.2cm, angle SRT = 105^0 and angle RST = 30^0. Drop a perpendicular line from T to meet line RS at M. Measure line TM

(p) Construct a triangle LMN in which line LM = 5cm, line MN = 8cm angle LMN = 120^0. Drop a perpendicular from N to meet line LM at S. Measure NS.

(q) Construct triangle WYZ in which line WX = 9cm, angle XWY = 90^0 and angle WXY = 30^0. Measure line WY and angle WYZ

Parallelogram

A parallelogram is a special quadrilateral formed by two opposite parallel lines with equal length.

It is a four-sided polygon or shape.

It has opposite angles equal.

It has opposite sides equal and parallel.

The sum of any two adjacent angles of a parallelogram is equal to 180^0.

The sum of all interior angles is 360^0. (The interior angle sum of quadrilaterals is 360^0)

Its equal sides of a figure are labelled with the same marks.

The measure of the height of a parallelogram is the distance between its opposite sides drawn either inside or outside the figure.

The base is defined to be one of the two chosen opposite sides.

Exercise

1. Using a pair of compasses, a ruler and a sharp pencil only, construct a parallelogram ABCD where AB = 7cm, AD = 5cm and angle BAD = 120^0
2. Construct a parallelogram PQRS where line PQ = 7cm, line QR = 5cm and angle PQR = 75^0. Drop a perpendicular from S to meet PQ at U. Measure line SU.

Rhombus

It has all sides equal and opposite.
The angles on its baseline is equal to 180^0.
Its angles bisect at 90^0.

Exercise

1. Construct a rhombus ABCD where AB = BC = 6cm and angle BAD = 60^0. Measure diagonal BD
2. Construct a rhombus KLMN whose diagonals are 14cm and 10cm. Measure the length LM
3. Construct a rhombus ABCD where line AB = 6cm and angle BAD = 45^0. Measure diagonal BD.
4. Construct a rhombus KLMN whose diagonals are 8cm and 6cm. Measure KL.

Trapezium

Isosceles trapezium

Two opposite sides are parallel and equal
Two base angles are equal.

Exercise

1. Construct a parallelogram ABCD where line AB = 7cm angle ABC = 60^0 and BC = 3.5cm
2. (a) Using a pair of compasses, a ruler and a sharp pencil only, construct a parallelogram **RSTU** whereby $\overline{\mathbf{RS}}$**= TU = 7cm**, **ST = RU = 5cm** and angle **S= 120^0**.
   (c) Measure diagonal **RT**.
3. Using a pair of compasses, a ruler and a sharp pencil only, construct a parallelogram PQRS where line PQ = 8cm, angle PQR = 120^0, and PS = QS = 6cm. Measure line PR.
4. Using a pair of compasses, a ruler and a sharp pencil only, construct an isosceles trapezium PQRT in which angle RQP = 120^0, line PT = 5cm and line PQ = 8cm. Drop a perpendicular line from point P to meet line TR at S. Measure line PS and TR
   Find the area of the trapezium

Right angled trapezium

1. Construct a trapezium ABCD where line AB = 8cm, angle BAD = 60^0 angle ABC = 90^0, line AD = 6cm and line Ab is parallel to line CD. Measure line length BC.
2. Construct a trapezium PQRS where line PQ = 7.5cm, angle QPS = 45^0 angle PQR = 90^0, line PS = 5cm and line PQ is parallel to line RS. Measure RS.

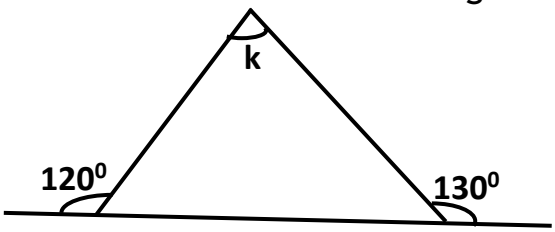
Kite

Its diagonals bisect at 90^0. (The diagonals of a kite are perpendicular to each other)
Two pairs of adjacent sides are equal.
One pair of its opposite angles are equal
The area of a kite is equal to a half of the lengths of its diagonals.

1. Construct a kite WXYZ where diagonal line WY = 8cm, diagonal XZ = 12cm. The two diagonals intersect at point O. Line ZO = 4cm. Measure line XY.
2. Construct a kite ABCD where diagonal AC = 6cm, diagonal BD = 10cm. The diagonals intersect at point O. Line DO = 3cm. Measure line BC.
3. Using a pair of compasses, a ruler and a sharp pencil only, construct a kite PQRS where by PQ = QR = 5cm, line PR = 8cm and line QS = 12cm. Measure line PS.
4. Using a pair of compasses, a ruler and a pencil only, construct a trapezium MNOP where by angle MNO is 60^0, MP = NO = 4.5cm and MN = 8.5cm. Measure the diagonal MO.

Angle properties

1. Find the value of k in the figure below



180^0
$- 120^0$
60^0

180^0
$- 130^0$
50^0

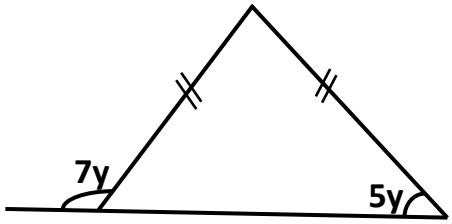
$k + 60^0 + 50^0 = 180^0$

$k + 110^0 = 180^0$

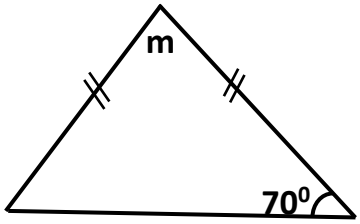
$k + 110^0 - 110^0 = 180^0 - 110^0$

$k = 70^0$

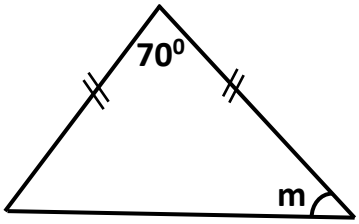
2. Find the value of y in the figure below



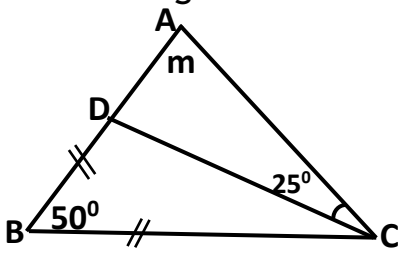
3. Find the value of m in the figure below



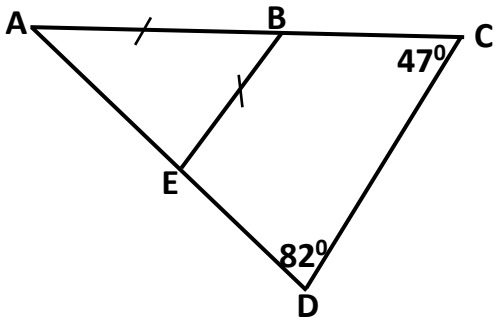
4. Find the value of m in the figure below



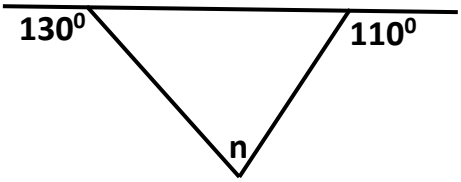
5. Find the size of angle CAB in the figure below



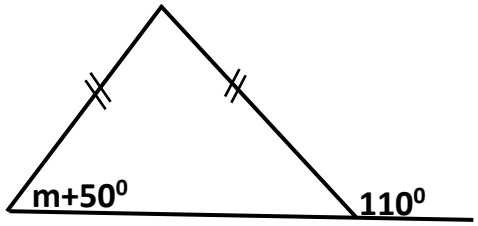
6. Find the size of angle CBE in the figure below



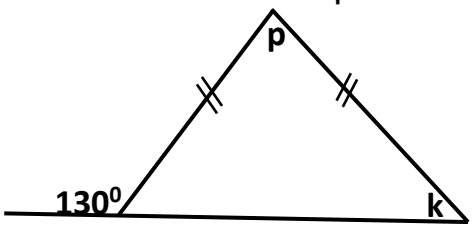
7. Find the value of n in the figure below



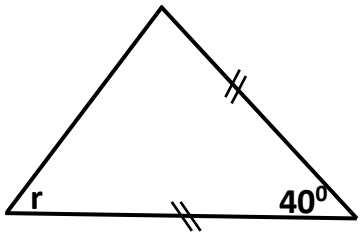
8. Find the value of m in the figure below



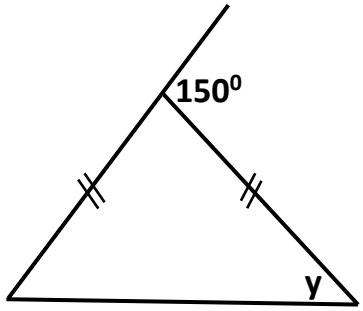
9. Find the value of k and p in the figure below



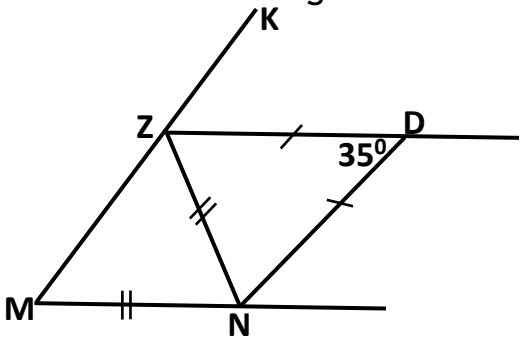
10. Find the value of r in the figure below



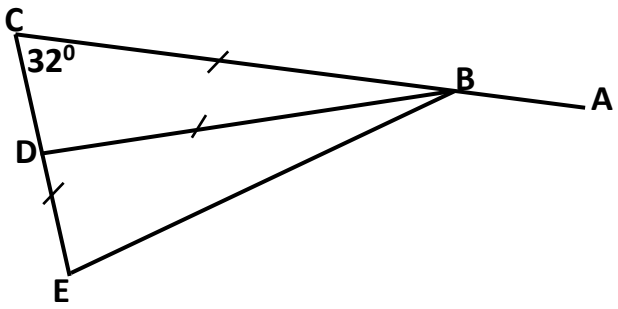
11. Find the value of y in the figure below



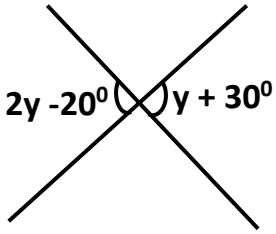
12. Find the size of angle KZN in the figure below



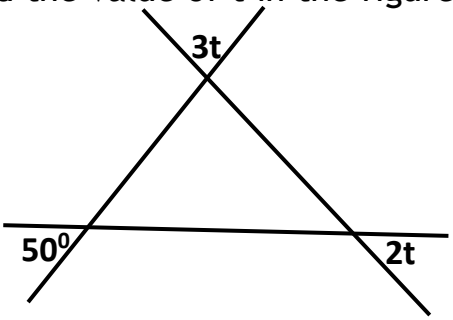
13. Work out the size of angle ABE



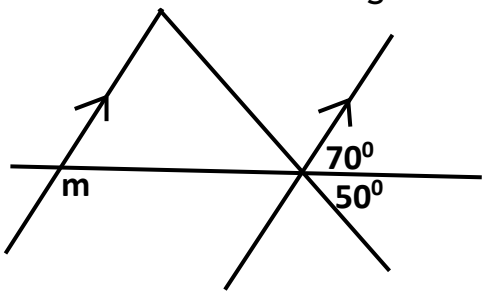
14. Find the value of t in the figure below



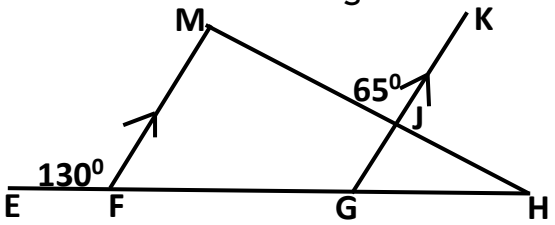
15. Find the value of t in the figure below



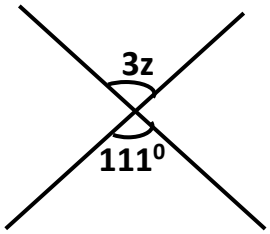
16. Find the value of the figure below



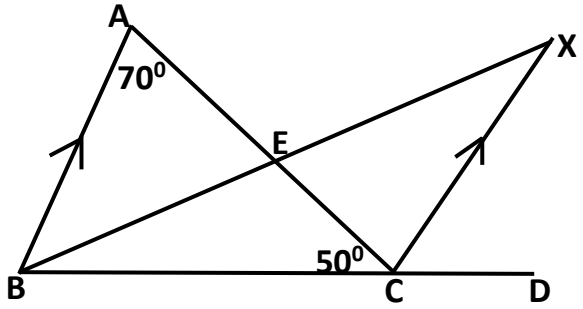
17. Find the size of angle GHJ in the figure below



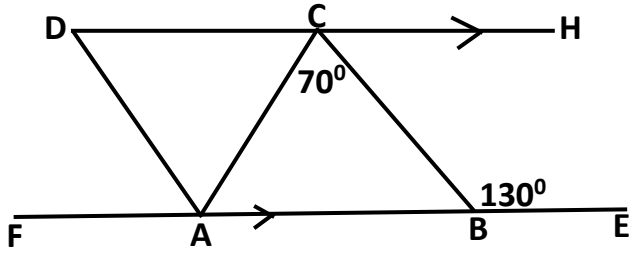
18. Find the value of z in the figure below



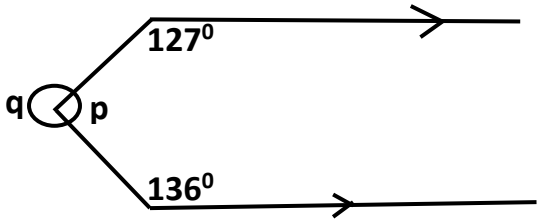
19. Find the size of angles CEX and DCX in the figure below



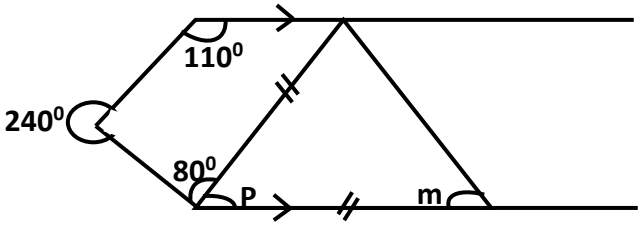
20. In the diagram below, line DH is parallel to line FE. Angle ACB = 70^0 and angle CBE is 130^0. Angle FAD is twice angle DAC. Calculate the size of angle DAC and ADC



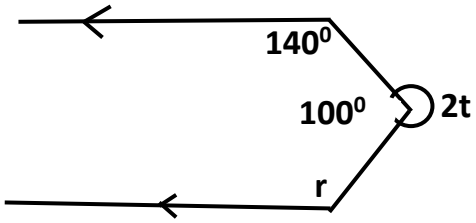
21. Find the value of p and q in the figure below



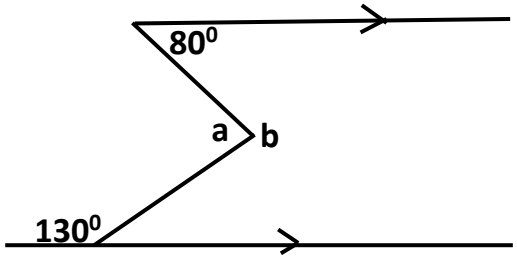
22. Find the value of p and m in the figure below



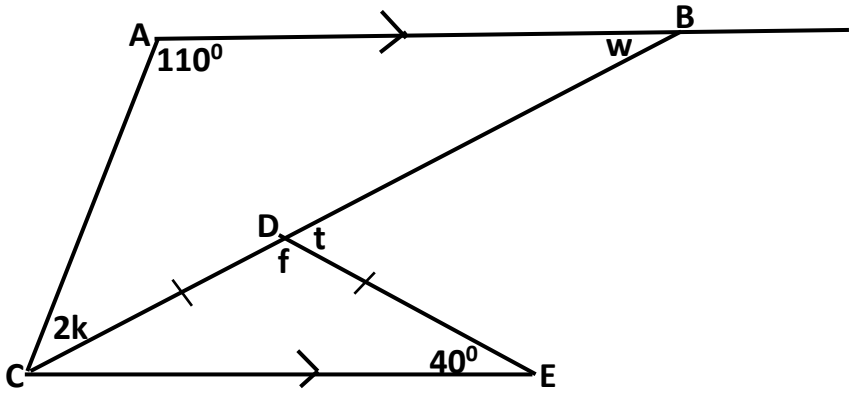
23. Find the value of r and t in the figure below



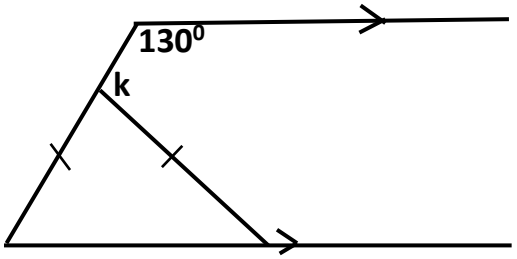
24. Find the value of a and b in the figure below



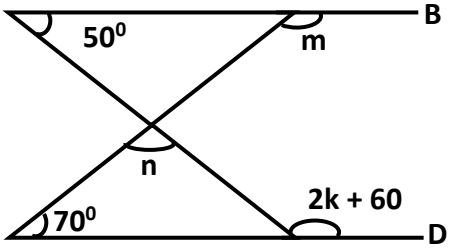
25. The figure below shows the two triangles ABC and CDE and line AB is parallel to line CE. Use it to answer the questions that follow
Find the size of the unknown angles below



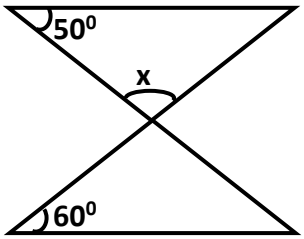
26. Find the value of k in the figure below



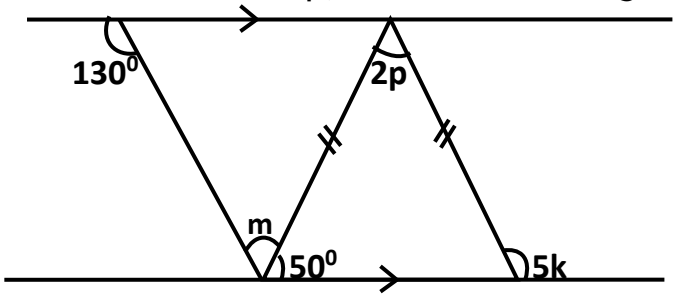
27. Find the value of n, m and k in the figure below



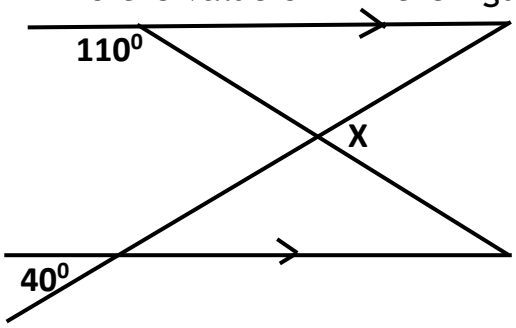
28. Find the value of x in the figure below



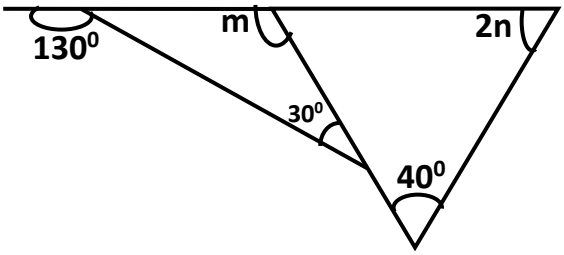
29. Find the value of p, m and k in the figure below



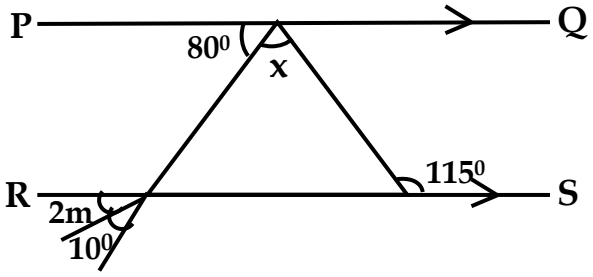
30. Find the value of x in the figure below



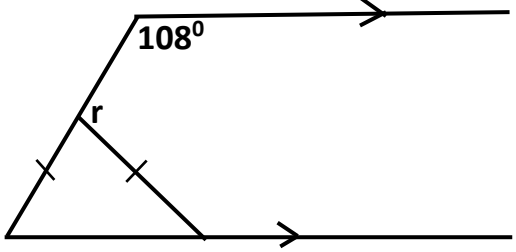
31. Find the value of m and n in the figure below



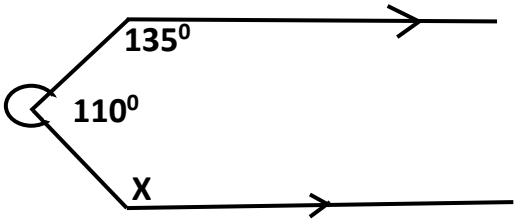
32. In the figure below, line PQ is parallel to line RS. Find the value of m and x



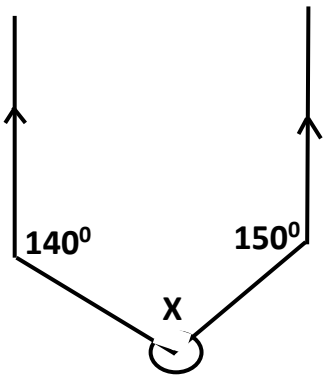
33. Find the value of r in the figure below



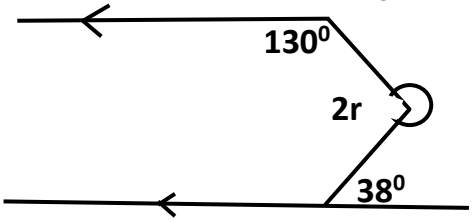
33. Find the value of x in the figure below



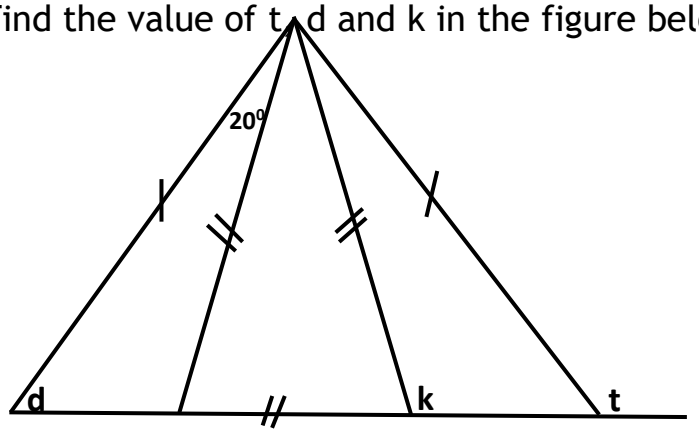
34. Find the value of x in the figure below



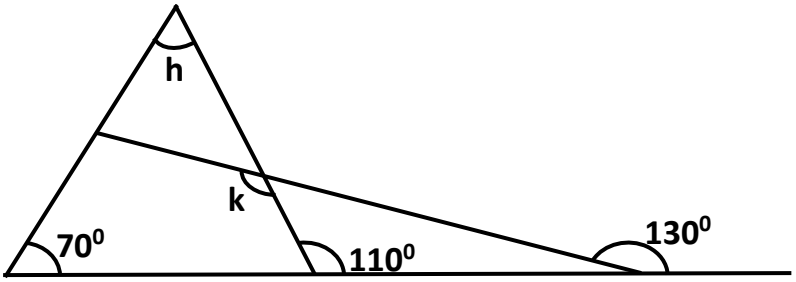
35. Find the value of r in the figure below



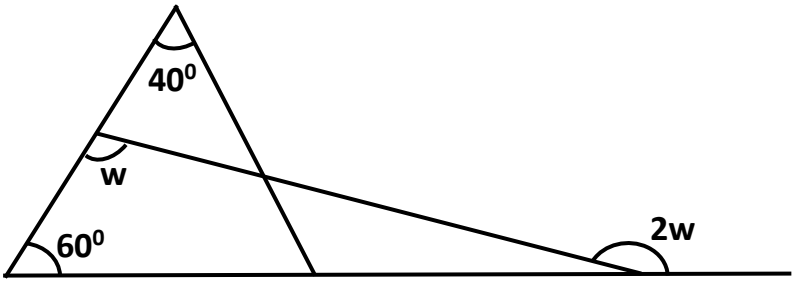
36. Find the value of t, d and k in the figure below



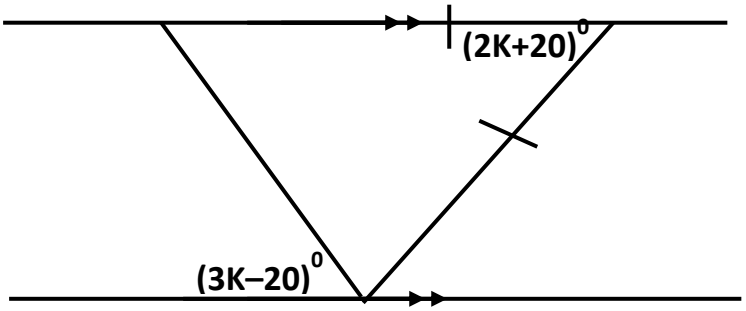
37. Study the figure below carefully and find the size of the marked angles.



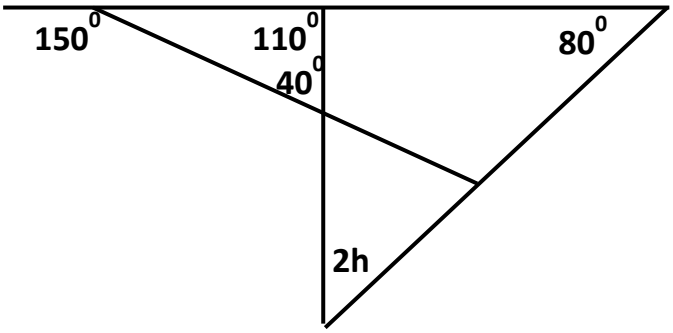
38. Find the value of w in the figure below.



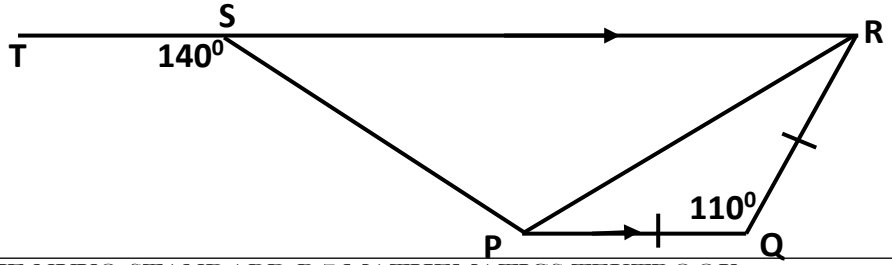
39. Find the value of K in the figure below.



40. Work out the value of h in the figure below.

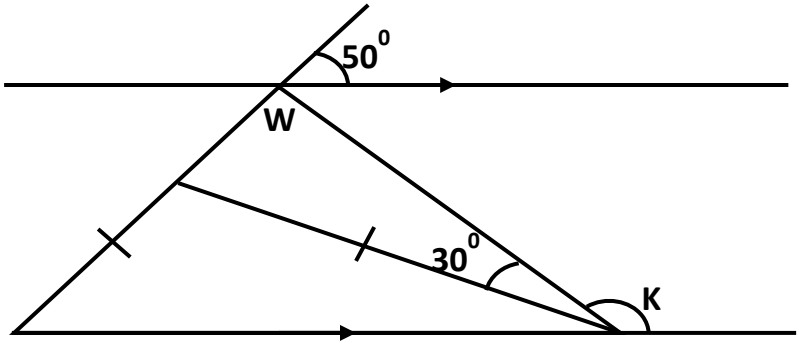


41. In the figure below, TSR is a straight line. PQ is parallel to TR and PQ = QR. Angle PQR = 110^0 and PST = 140^0.



What is the size of angle SPR?

42. Find the values of the unknowns in the figure below.



Other polygons

POLYGON	No of sides
Pentagon	5
Hexagon	6
Septagon	7
Octagon	8
Nonagon	9
Decagon	10
Nuo decagon	11
Duo decagon	12

Finding the size of the exterior angle

Exterior angle = $\frac{\text{Exterior angle sum}}{\text{Number of sides}}$

1. Find the size of each exterior angle of a regular pentagon.

   Exterior angle = $\frac{\text{Exterior angle sum}}{\text{Number of sides}}$

   $= \frac{360}{5}$

   $= 72^0$

2. Work out the size of each centre angle of a regular hexagon.
3. Find the size of each exterior angle of a regular octagon
4. Find the size of each exterior angle of a regular nonagon
5. Find the size of each exterior angle of a regular decagon
6. Find the size of each exterior angle of a regular duo decagon
7. Find the size of each exterior angle of a regular Nuo decagon

Finding number of sides

The number of sides help us to tell the special name given to the polygon.

We use interior angle to get the exterior angle.

1. How many sides has a polygon whose exterior angle is 45^0?

   No. of sides = $\frac{Exterior\ angle\ sum}{Each\ exterior\ angle}$

   = $\frac{360}{45}$

   = 8 sides

2. How many sides has a polygon whose interior angle is 140^0?
3. What special name is given to a polygon whose exterior angle is 72^0?
4. The interior angle of a regular polygon is 100^0 more than its exterior angle. What special name is given to the polygon?
5. The exterior angle is 108^0 less than its interior angle. What special name is given to the polygon?
6. The interior angle of a regular polygon is twice its exterior angle. What special name is given to the polygon?
7. The interior angle and exterior angle of a regular polygon are in the ratio of 1:3 respectively. How many sides does the polygon have?
8. The interior angle and exterior angle of a regular polygon are $3x^0$ and $2x^0$ respectively. How many sides does the polygon have?
9. The exterior angle of a regular polygon is a quarter the size of its interior angle. How many sides does the polygon have?
10. How many sides has a polygon whose exterior angle is 72^0?
11. How many sides has a polygon whose exterior angle is 36^0?
12. How many sides has a polygon whose exterior angle is 60^0?
13. How many sides has a polygon whose exterior angle is 30^0?
14. How many sides has a polygon whose exterior angle is 45^0?
15. How many sides has a polygon whose exterior angle is 40^0?
16. How many sides has a polygon whose interior angle is 108^0?
17. How many sides has a polygon whose interior angle is 135^0?
18. How many sides has a polygon whose interior angle is 144^0?
19. How many sides has a polygon whose interior angle is 120^0?
20. How many sides has a polygon whose interior angle is 140^0?
21. How many sides has a polygon whose interior angle is 150^0?
22. How many sides has a polygon whose interior angle is 90^0 more than its exterior angle?
23. How many sides has a polygon whose interior angle is 36^0 more than its exterior angle?
24. How many sides has a polygon whose interior angle is 60^0 more than its exterior angle?
25. The interior angle of a regular polygon is 36^0 more than the exterior angle. Name the polygon.

ROTATIONS OR REVOLUTIONS OR TURNS

A rotation (complete turn) is a turn from a point and back to the same point.

Forexample a minute hand of a 12-hour clock moving from 12 back to 12 in clock wise way.

A complete revolution is always 360^0

1. How many degrees are in a quarter rotation?

   1 complete rotation = 360^0

   A quarter rotation = $\frac{1}{4} \times 360^0$

   $= 90^0$

2. Find the angle turned through by a minute hand in 15 minutes.
3. Find the angle made in each of the movements below,

   (a) One complete rotation

   (b) $\frac{3}{5}$ rotation

   (c) $\frac{1}{2}$ a turn

   (d) $\frac{1}{20}$ a turn

   (e) $\frac{4}{5}$ rotation

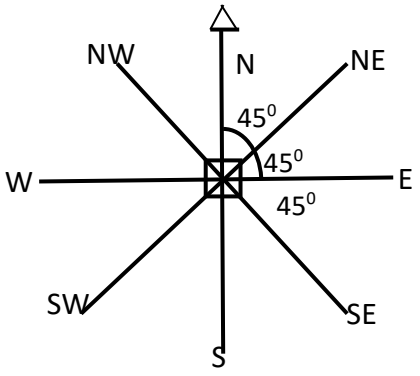
   (f) $\frac{2}{5}$ rotation

4. How many degrees are there in $\frac{1}{3}$ of a rotation.
5. How many degrees will I turn if I make $\frac{3}{4}$ rotations?
6. A tip of a minute hand made $\frac{3}{10}$ of a complete rotation. How many degrees did it turn through?

ANGLE BETWEEN THE COMPASS DIRECTIONS

A compass is an instrument used to show direction. A magnetic compass has 8 main directions. Namely: North (N), North East(NE), East E), South East(SE), South(S), South East(SE), West(W), South West(SW), North(N), North West,(NW)

1. What is the smaller angle between North and South East?

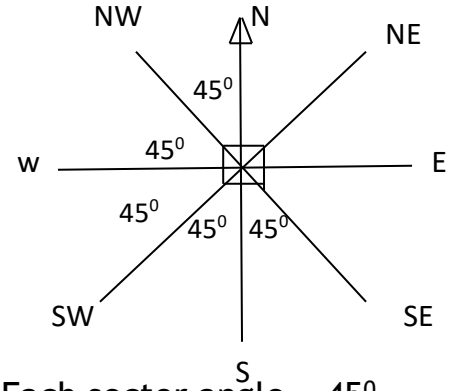


Each sector is 45^0

Smaller angle = $45^0 + 45^0 + 45^0$

= 135^0

2. What is the larger angle between North and South East ?



Each sector angle = 45^0

Larger angle = $45^0 + 45^0 + 45^0 + 45^0 + 45^0$

= 225^0

3. What is the smaller angle between;

(a) North and East? (b) West and South?

(c) West and North? (d) East and South East?

4. What is the size of the clock wise angle between South East and West?

5. What is the larger angle between;

(a) North and North east? (b) North and North west?

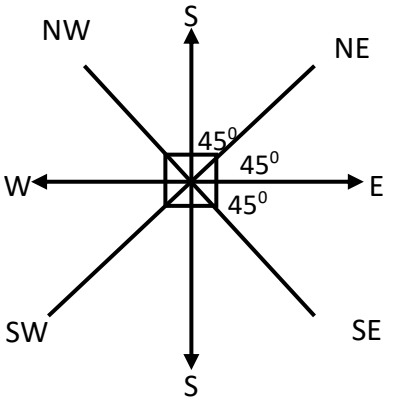
(c) East and South East? (d) West and North?

(e) South and South west? (f) West and South west?

CLOCKWISE AND ANTI-CLOCKWISE DIRECTIONS

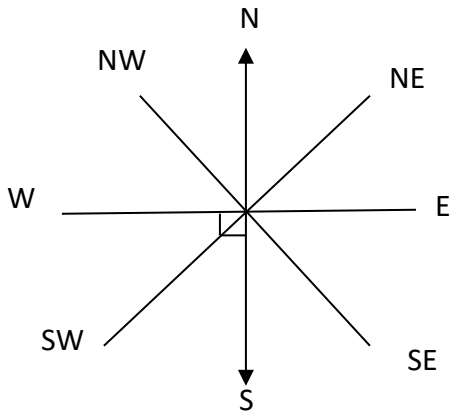
Taking North as the starting direction, the direction in which the hands of a clock turn naturally is clock wise direction and the opposite is anti- clock wise direction

1. In which direction will I face if I turned clockwise through an angle of 135^0 from the North?



You will face the South East direction.

2. In which direction will I face if I turned anti clockwise through an angle of **90^0** from west?



I will face the South direction.

3. What angle will I make if I turned clockwise from;

(a) West to South west? (d) North East to West?

(b) North to South west? (e) North to West?

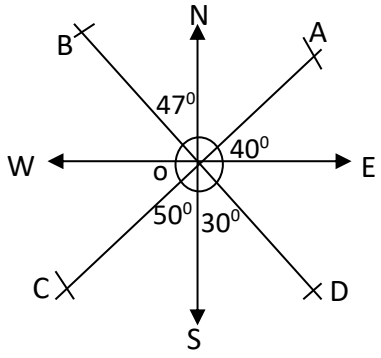
(c) Northwest to South East? (f) North East to West?

2. I am facing North. In which direction shall I be facing if I turn through;
   (a) 45^o clockwise? (b) 135^0 clockwise?

   (c) 135^0 anti – clockwise? (d) 225^0 anti – clockwise?

ORDINARY BEARING

Direction is measured either from North or from South.



On the compass, points: A, B, C and D are shown.

(a) What is the direction of A from O ?

The direction of A from O $(90 - 40)^0$ = N 50^0 E

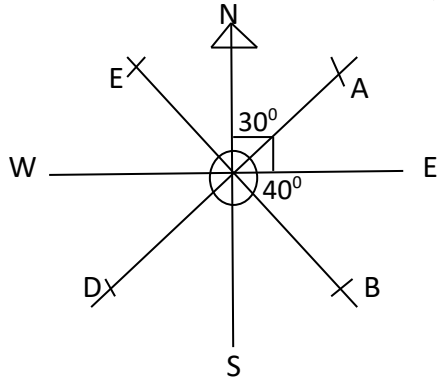
(b) What is the direction of B from O?

The direction of B from O = N 47^0 W

(c) What is the direction of D from O?

The direction of D from O = S 30^0 E

2. What is the direction of;



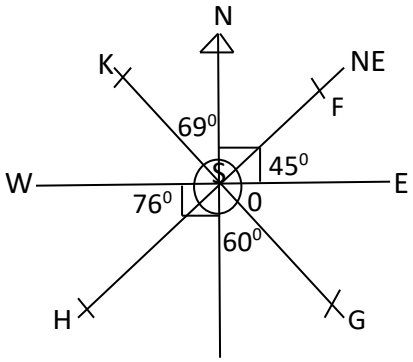
(a) A from O?

(b) B from O?

(c) D from O?

(d) F from O?

3. What is the direction of;



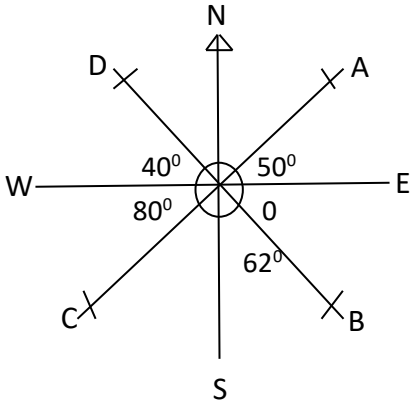
(i) F from O?

(ii) G from O?

(iii) H from O?

(iv) K from O?

4. What is the direction of;



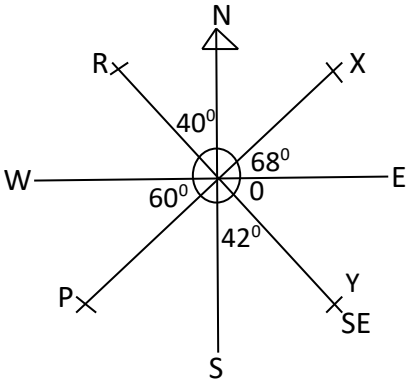
(a) A from O?

(b) B from O?

(c) C from O?

(d) D from O?

5. What is the direction of;



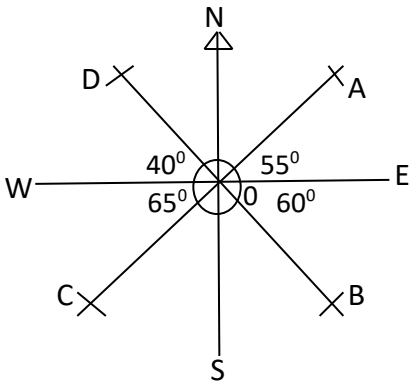
(a) P from O?

(b) Y from O?

(c) R from O?

(d) X from O?

6. What is the direction of;



(a) A from O?

(b) B from O?

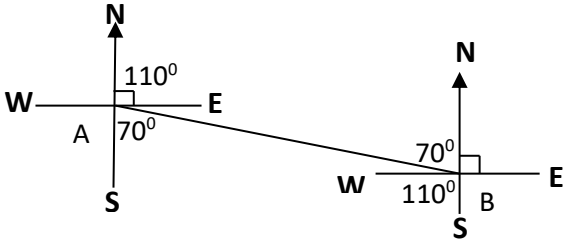
(c) C from O?

(d) D from O?

MORE ON ORDINARY BEARING

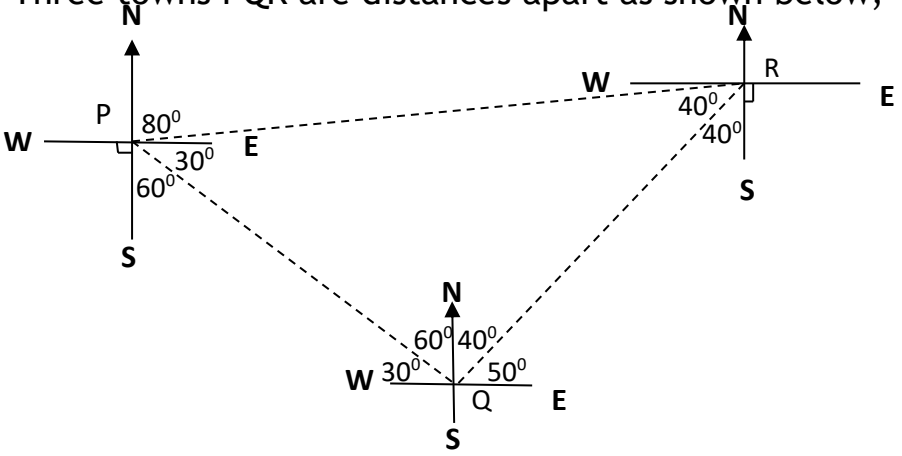
The lines that indicate the North of any two or more places must be parallel.

1. A and B are two towns.



The two co- interior angles between the lines indicating North, add up to 180^0 and alternate angles between the lines are equal (equi-distant).
Therefore; the direction of B from A is S70^0E.
The direction of A from B is N70^0W

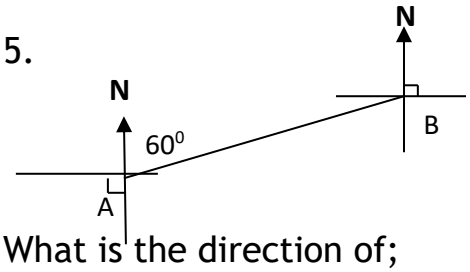
2. Three towns PQR are distances apart as shown below;



(a) What is the direction of P from Q?

(b) What is the direction of R from Q?

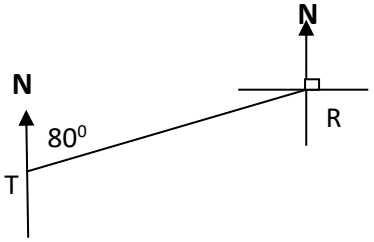
5.



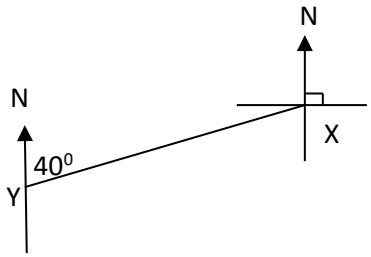
What is the direction of;

(a) B from A? (b) A from B?

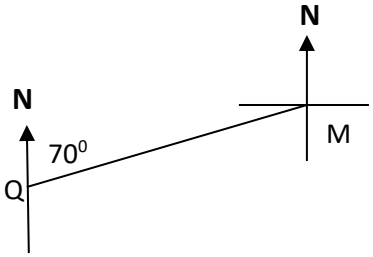
6. (a) What is the direction of T from R?
(b) What is the direction of **R** from **T**?



5. What is the direction of Y from X and X from Y?

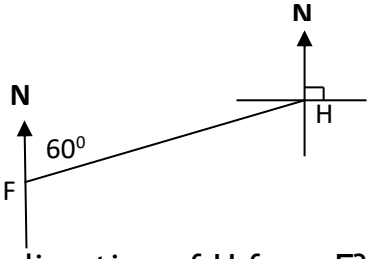


6. (a) What is the direction of Q from M?



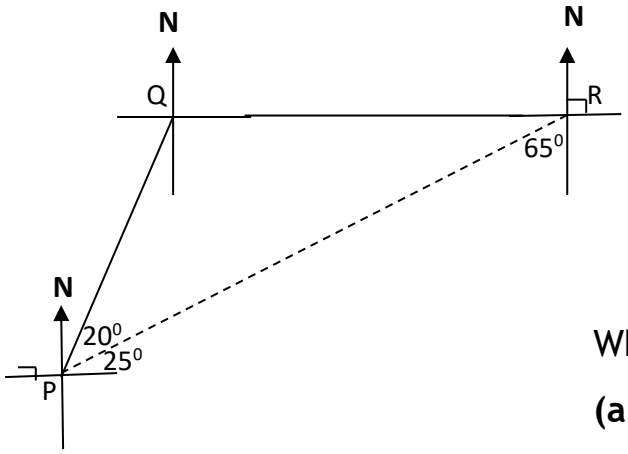
(b) What is the direction of **M** from **Q**?

7. (a) What is the direction of F from H?



(b) What is the direction of H from F?

8.



What is the bearing of;

(a) Q from P?

(b) P from R?

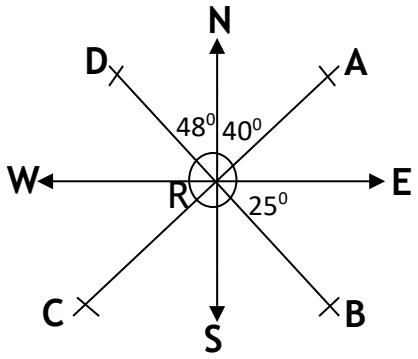
(d) P from **Q**?

(e) R from Q?

.

TRUE BEARING

Unlike ordinary bearing, true bearing is measured from North in a clockwise direction only. Angles less than 100^0 must be written in three digits.



(ii) B from R ?

$(90^0 + 30^0) = 120^0$

Find the bearing of A from R

The bearing of A from R is 067^0

Find the bearing of C from R

= **$180^0 + 40^0$**

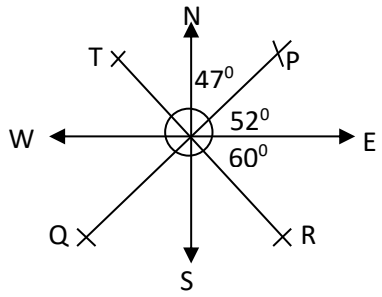
$= 220^0$

Find the bearing of **D** from **R** ?

= **$180^0 + 90^0 + 25^0$**

$= 295^0$

1. What is the bearing of;



(a) P from **O**?

(b) Q from **O**?

(c) T from O?

(c) R from **O**?

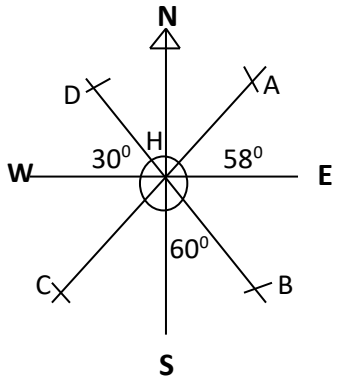
2. What is the bearing of;

(a) A from **H**?

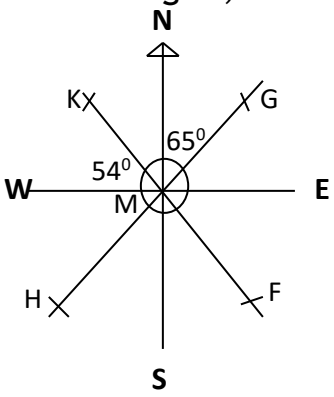
(b) D from **H**?

(c) B from **H**?

(d) C from **H**?



3. What is the bearing of;



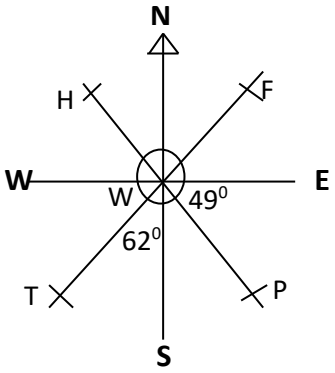
(a) H from **M**?

(b) F from **M**?

(c) K from **M**?

(d) G from **M**?

4. What is the bearing of;



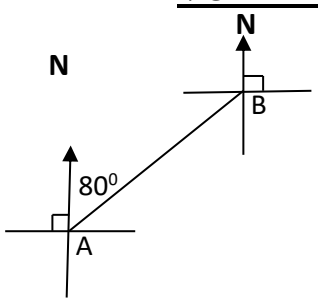
(a) H from **W**?

(b) F from **W**?

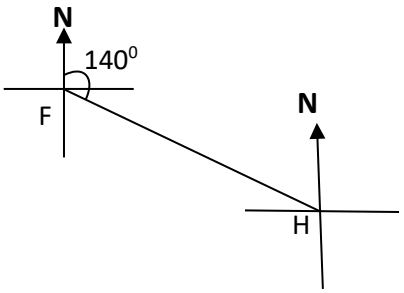
(c) P from **W**?

(d) T from **W**?

MORE ABOUT TRUE BEARING



The bearing of B from A is 080^0

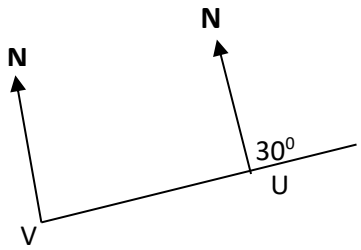


The bearing of F from H is

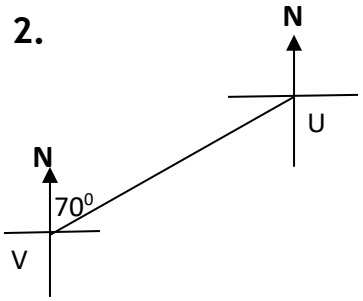
$180^0 + 140^0 = \mathbf{320^0}$

Find the bearing of V from U.

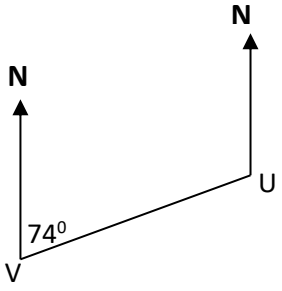
1.



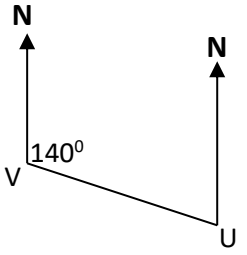
2.



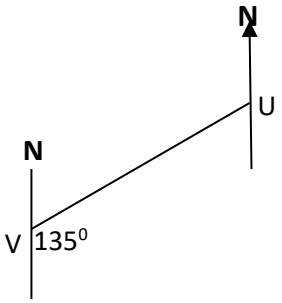
3.



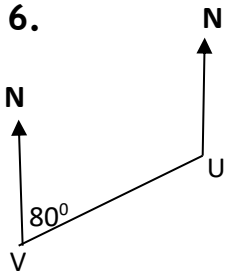
4.



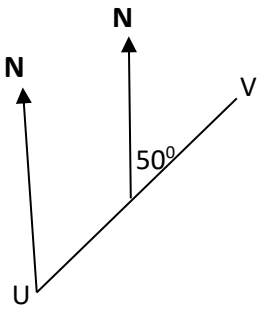
5.



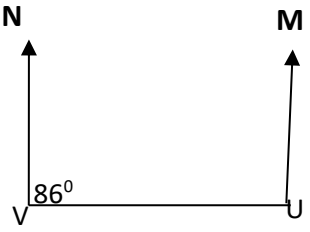
6.



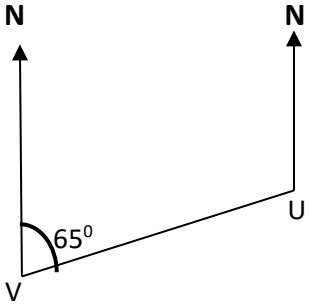
7.



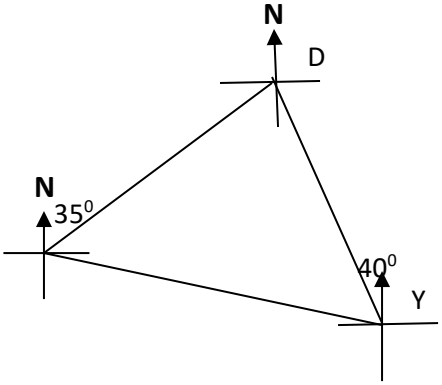
8.



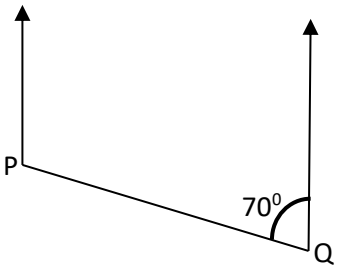
9.



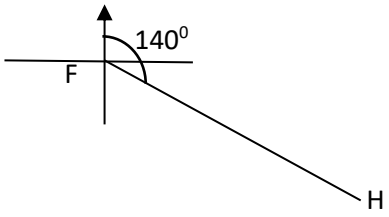
10. Find the bearing of Y from D.



10. The bearing of P from Q is 040^0, what is the bearing of Q from P?
11. The bearing of Mukono from Entebbe is 120^0. What is the bearing of Entebbe from Mukono?
12. Find the bearing of Q from P?



13. What is the bearing of F from H?



14. What is the direction of P from M?
15. What is the bearing of K from T if the bearing of T from K is 140^0?
16. The bearing of L from N is 155^0. What is the bearing of N from L?
17. The bearing of B from A is 088^0. What is the bearing of A from B?

18. Masaka is on a bearing of 150^0 from Mbarara. Find the bearing of Mbarara from Masaka.
19. Town R is on the bearing of 250^0 from town M. What is the bearing of town M from town R?
20. Town R is on a bearing of 210^0 from town M. What is the bearing of town M from town R?

OPPOSITE BEARING

Note: When the bearing is less than 180^o its opposite bearing is 180^0 plus the given bearing

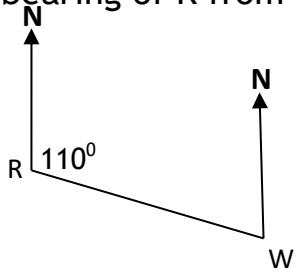
1. The bearing of S from M is 050^0. What is the bearing of M from S?
   Opposite bearing of M from S = $050^0 + 180^0$) = $\underline{230^0}$

2. The bearing of R from V is 310^0. What is the bearing of V from R?

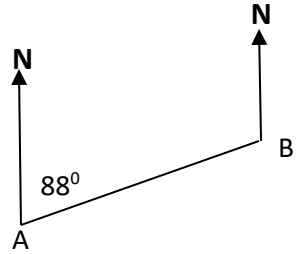
When the bearing is more than 180^0, we subtract 180^0 to get the required bearing. Therefore, the bearing of V from R

= $310^0 - 180^0 = \underline{130^0}$

1. The bearing of P from Q is 040^0. What is the bearing of Q from P?
2. Find the bearing of D from E if the bearing of E from D is 270^0
3. The direction of X from Y is 070^0. What is the bearing of Y from X?
4. Find the bearing of R from W?



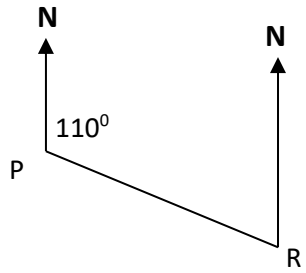
5. Study the diagram below,



What is the bearing of A from B?

5. What is the bearing of K from T if the bearing of T from K is 140^0?

7. What is the bearing of P from R?



8. The bearing of **L** from **N** is **155^0**. What is the bearing of **N** from **L**?

SCALE DRAWING

1. If one centimetre represents 10 km. What will be the actual distance in Km of the following;

(i) 20cm (ii) 3.2cm (iii) 7.8cm (iv) 120cm (v) 2.1cm

Since 1cm represent 10km then,

(i) 20 cm rep (20 x 20) = 400 km

(ii) 3.7cm rep (3.7 x 10) = 37 km

(iii) 7.8cm rep (7.8 x 10) = 78 km

(iv) 120 cm rep (120 x 10) = 12,000 km

(v) 4.1cm rep (4.1 x 10) = 41 km

1 cm represents 10 km, what will be the distance on the map that represents the given actual distance below?

(a) 210 km **(b)** 110 km **(c)** 730 km **(d)** 70 km

2. What will be the actual distance on the ground that will be represented by the following lengths on the map? (Take 1 cm represents 10 km)

(a) 90 cm **(b)** 25 cm **(c)** 22 cm

(d) 5 cm **(e)** 15 cm **(f)** 29 cm

(g) 20cm **(h)** 40 cm **(i)** 50 cm

(j) 43 cm **(k)** 57 cm **(l)** 70 cm

3. What will be the length on the map that represents the given distances below;

if 1cm represents 10km

(a) 180 km **(b)** 250 km **(c)** 70 km

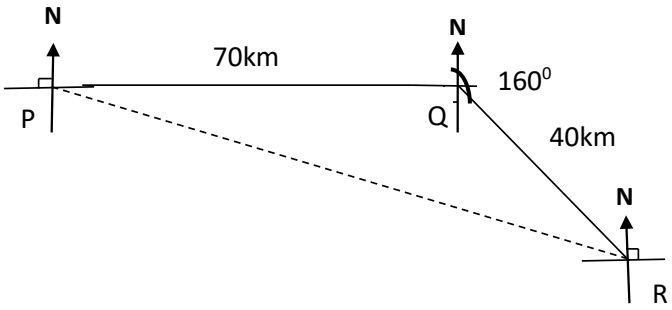
(d) 3.4 km **(e)** 0.08 km **(f)** 357 km

APPLICATION OF BEARING AND SCALE DRAWINGS

1. Town P is 70 km west of town Q and town C is 40 km from Q on a bearing of 160^0

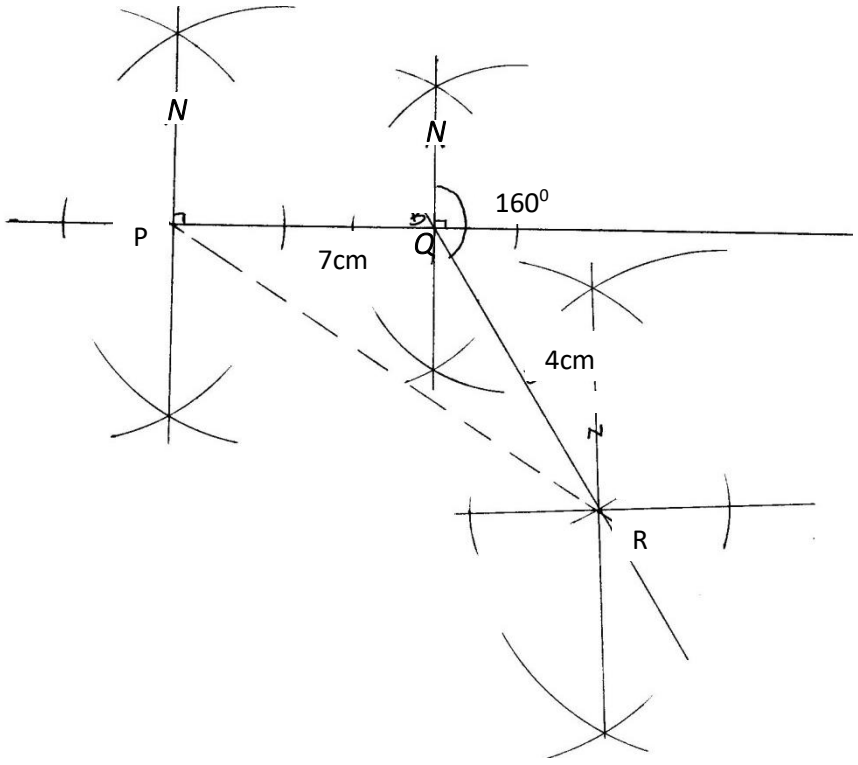
Using a scale 1cm = 10km, what is the distance between town P and town R?

Sketch drawing



Distance	Actual distance	Bearing	Drawing length
From P to Q	70 km	090^0	$\frac{\cancel{70}}{\cancel{10}} = 7$ cm
From R to C	40 km	160^0	$\frac{\cancel{40}}{\cancel{10}} = 4$ cm

Accurate drawing



1. An athlete ran 140km westwards and then turned and ran 110km southwards.
(a) Using the scale 1cm represents 10km, draw an accurate diagram to show the athlete' movements.
(b) Find the shortest distance from the starting point to the ending point.

2. Amon's garage is 80km east of Nathan's garage. Sarah operates 125 km north east from Amon's garage.
(a) Draw a sketch to show this information.
(b) Use the scale 1cm represents 10km and draw an accurate map.

(c) What are the bearings of the following;
(i) Amon's garage from Sarah's garage.
(ii) Nathan's garage from Amon's garage

(d) Measure the drawing length between Nathan's garage and Amon's garage and calculate the actual distance between these two towns.

3. School A is on the bearing of 090^0 from school B, which is 66km away and school C is 88 km on a bearing of 150^0

(a) Show an accurate diagram for the above data. (Take 1cm to represent 10km)

(b) What is the shortest distance between school A and school C?

(c) What are the bearings of the following;

(i) school A from school C?

(ii) school C from school A?

5. Town P is 50 km away from town R on a bearing of 070^0 and town T is 60 km away from town P on a bearing of 150^0
(a) Draw an accurate diagram showing the three towns on the scale 1cm represents 10km.

6. A boat man sailed from island P on a bearing of 300^0 to island Q for a distance of 56km. The boatman then left island Q and sailed on a bearing of 230^0 to island R for a distance of 40km.

(a) Using a scale of 1cm to represent 8km, draw an accurate diagram to show the route of the boatman.

(b) Find the bearing of island R from island P

7. The bearing of town B from town A is 120^0 and town B is 80km from town A. The bearing of town C from town B is 60^0 and town C is 50km from town B

(a) Draw an accurate diagram showing the three towns (Use a scale 1cm:10km)

(b) Find the shortest distance between town A and town C in km

8. A plane flew from airport A to airport T on a bearing of 120^0. The distance between airports A and T is 800km. It then continued to airport R on a bearing of 210^0, and the distance between airports T and R is 650km

(a) Sketch the journey made by the plane.

(b) Using a scale of 1cm to represent 100km, draw an accurate of the journey made by the plane.

(c) Find the bearing of airport R from A.

(d) Calculate the shortest distance from airport A to airport R.

9. Town P is 180km in the East direction of town Q and town R is 120km from town P from town R is 315^0

(a) Use a scale of 1cm:20km to draw an accurate diagram for the above information.

(b) What is the bearing of town R from town Q?

(c) In what direction is town R from town Q?

10. Town B is at the bearing of 090^0 from town A. Town C is at a bearing of 120^0 from town B. Town D is at a bearing of 225^0 from town C. The distance between town A and town B is 40km and that of town B to town C is 80km. It the distance from town A to town D is equal to the distance from town B to town D,

(a) Use a scale of 1cm:10km to represent the above information on an accurate diagram

(b) Calculate the distance from town B to town D in kilometres

11. Town A is 60km due East of town B and town C is 100km due south of town B. Using a scale 1cm:10km

(a) Draw an accurate diagram to show the position of the three towns.

(b) Find the actual distance between town A and town C

12. A ship leaves a port and sails for 120km on a bearing of 062^0. It changes direction on a bearing of 160^0 and sails for 160km to an island. Use 1cm:20km to show the position of the port from the island

13. Town R is 070^0 from Town Q which is 140km away and Town P is 120km from Town R on a bearing of 160^0.

(a) Draw a sketch to show the three towns.

(b) Using a scale of 1cm = 20km;

(i) Draw an accurate diagram showing the three towns.

(ii) What is the bearing of town Q from town P?

14. A boatman sailed from port M on a bearing of 110^0 to port N a distance of 700km bearing of 230^0 through a distance of the 900km.

(a) Draw a sketch diagram of the journey.

(b) Using a scale of 1cm=100km, draw an accurate figure for the whole journey.

15. A ship sailed from port R Eastwards at a speed of 30km/hr for 2 hours to port K. It then turned and sailed Southwards to port P at a speed of 60km/hr for 3 hours.

(a) Using a scale of 1cm represents 20km, draw an accurate diagram to illustrate the journey

(b) calculate the shortest distance between R and P

DISTANCE, TIME AND SPEED.

Converting from 12-hour clock to 24-hour clock.

Morning time (a.m)

All morning time we add 000hrs to change to 24 hour clock except 12:00 am (mid night). For midnight, we subtract 0000hrs.

"a.m" is replaced with hours.

Note: There are no dots in the 24 hour clock system even if some digital watches show it.

Example 1:

Write 12: 30 am to 24 hour clock.

12 30

- 12 00 hrs

00 30 hrs

Note: Midnight

Example.2: Write 8:45 am in the 24 hour clock.

8 : 45

+ 00 00 hrs

08 45 hrs

Example.3

Kiplimo reach Kwen at 2:30am from Olympic games in Tokyo.

Write this time to 24 hour clock.

2 30

+ 00 00 hrs

02 30 hrs

Converting 12 hour clock to 24 hour clock.

Afternoon time (P.m)

We add 1200hrs to all afternoon time except midday where we add 0000hrs.

Example.1

Write 12 55pm to 24 hour clock.

12 55

00 00 hrs

12 55 hrs

Example.2

Write 9: 30pm to 24 hour clock.

9 30

+ 12 00 hrs

21 30 hrs.

Converting 24 hour clock time to 12 hour.

All the time more than 12 hours we subtract 1200hrs while all the time less than or equal to 1200hrs we subtract 0000hrs.

Note: When you subtract 1200hrs you change hours to am except midday (1200hrs) hours change to pm.

Example.1

Write 1215 hours to 12 hour clock.

12 15
- 00 00
12:15pm

Example.2

Write 15 40hrs to 12 hour clock.

15 40
-12 00
3: 40 pm

Example. 3

Write 0750hrs to 12 hour clock.

07 50
-00 00
7: 50 am

EXERCISE.

1. Write 10 minutes past mid night to 24 hour clock.
2. Write 3:25 am to 24 hour clock.
3. Write 4:30pm to 24 hour clock.
4. Express 12: 48pm to 24 hour clock.
5. Write 0015hrs to 12 hour clock.
6. Express 09 20 hrs to 12 hour clock.

Finding ending time.

Example. 1

A party started at 2: 30 pm and lasted for $3\frac{3}{4}$ hours. At what time did it end?

E.T = S.T + D

= 2 : 30 pm

3: 45

6: 15 pm

$\frac{75}{60}$ = 1r15

$\frac{1}{4}$ hr = 15min	$\frac{2}{3}$ = 40 minutes.
$\frac{1}{2}$ hr = 30 min	
$\frac{3}{4}$ = 45min	
$\frac{1}{3}$ = 20 min	

Example. 2

Sky Net news started at 11: 30pm and lasted for 1 hour and 40 minutes. At what time did the news end?

11: 30pm

\+ 1 40

13 10 $\frac{70}{60}$ = 1r10

13 10

\- 12 00

1 :10 a.m

Finding starting time.

S.T = E.T – D

Example. 1

It stopped raining at 1:25pm. If it rained for 3 hours and 30 minutes, find the time it started raining.

1: 25

12 00

13 25hrs

S.T = E.T - D

13 25

- 3 30

9: 55a.m

Example.3

A football match which lasted for $1\frac{1}{2}$ hours ended at 12: 10 am. At what time did the match start?

S.T = E.T – S.T

= 12 : 10

- 1 30

10 : 40p.m

Finding duration.

D = E.T – S.T

Example. 1

A cyclist left town A at 7:30 a.m and cycled to town B and reached at 9: 00am. How long did the cyclist take?

Note: if the units are the same, subtract but if they are different then change everything to the 24 hour clock.

D = E.T -S.T

9 : 00

- 7 30

1 30

∴**He took I hr and 30 minutes.**

Example 2

A concert started at 9: 45 am and ended at 1: 25 pm. For how long did the concert last?

Different units convert to 24 hour clock.

S.T	E.T
9 45	1 25
+00 00	- 12 00
09 45hrs	13 25hrs

D = E.T -S.T

12 60

= ~~13~~ 25

09 45

3 40

8 5
- 45
40

The concert lasted for 3 hours and 40 minutes.

Example 3

A train left Nairobi at 7: 30p.m and arrived at Tororo at 2: 00a.m. How long did the train take?

Get time remaining to end of 1st day

11 60

12 00

- 7 30

4 30

Add the answer to 2:00a.m.

4 30

+ 2 00

6 30

∴ The train took 6 hours and 30 minutes.

EXERCISE.

1. The first half of a football match started at 4:30p.m. At what time did it end?
2. A fifty minute debate started at 1:30 pm, at what time did it end?
3. A concert which lasted for $3\frac{1}{2}$ hours ended at 2: 00pm. At what did it last?
4. A motorist left Mbale and drove for 3 hours 40 minutes to Mukono. If the motorist reached Mukono at 3:00pm, find the time at which it left Mbale.
5. A movie which lasted for $2\frac{1}{2}$ hours ended at 12:10 a.m. At what time did the movie start.
6. A bus left Kisoro at 7:40a.m and reached Kampala at 4:30pm. How lond did the journey take?
7. A train left Tororo at 10:30pm. How long did the train take to reach Kampala?

TIME TABLES.

Travel time tables.

Example. 1

The table below shows the arrival and departure time for a bus from Kampala to Hoima.

Town	Arrival time	Departure time
Kampala		*7:30a.m*
Busunju	*8:10a.m*	*8:30a.m*
Bukomero	*9:30a.m*	*9:45a.m*
Kiboga	*10:15a.m*	*10:40a.m*
Hoima	*11:40a.m*	

(a) At what time did the bus leave Kampala?
7:30a.m

(b) At what did the bus reach Busunju?
8:10a.m

(c) How long did the bus stay at Busunju?

8: 30
- 8 10
20 minutes.

(d) At what time did the bus leave Busunju?
At 8:30a.m

(e) At what time did the bus reach Bukomero?
At 9:30a.m

(f) How long did the bus stay at Bukomero?
9: 45a.m
- 9 30a.m
15 minutes.

(g) At what time did the bus leave Bukomero?
At 9: 45a.m

(h) At what time did the bus reach Kiboga?
At 10: 15a.m

(i) How long did the bus stay at Kiboga?
10 : 40 a.m.
- 10 : 15 a.m.
25 minutes.

(j) At what time did the bus leave Kiboga?
At 10:40a.m

(k) At what time did the bus reach Hoima?
11: 40 a.m.

(l) How long did the bus take travelling from Kampala to Hoima?
11: 40a.m.
- 7 30a.m.
4 10a.m.

It took 4 hours and 10 minutes.

(m) At what time did the bus leave Busunju in the 24 hour clock?
8 30
+ 00 00hrs
08 30hrs

(n) How long did the bus spend on stoppages (testing on the way)
At Busunju ___ 20 minutes
At Bukomero ___ 15 minutes
At Kiboga ___ 25 minutes
Total time spent on stoppages
= (20 + 15 + 25) minutes
= 60 minutes
= 1 hour.

(o) How long does the bus take from Busunju to Kiboga?

Busunju	Kiboga
Left at 8:30a.m.	reached at 10:15a.m.
10 15	7 5
- 8 30	- 3 0
1 45	45

It took 1 hour and 45 minutes.

EXERCISE.

The time table below shows how Magaya spent his time one Saturday.

Time	Activity
8:00am – 10:30am	Washing
10:40a.m – 12:30pm	Cooking
3: 15pm – 4: 50pm	Lunch
5:00 pm – 8: 30 pm	Reading

(a) Write the time lunch ended to 24 hour clock.
(b) How long did he take reading?
(c) What activity was Magaya doing by 12:00 noon?
(d) If Mayaga washed 4 clothes in every 30 minutes, find the total number of clothes he washed from 8:00am to 9:30 am

2. The table below shows the arrival and departure time for a bus from Mbale to Kampala.

Town	Arrival	Departure
Mbale		9:00am
Iganga	10:30am	10:40am
Jinja	11:20am	11:30am
Lugazi	12:50am	1:00pm
Mukono	1:40pm	2:00pm
Kampala	3:00pm	

(a) At what time did the bus arrive at Jinja?
(b) How long did the bus stay at Lugazi?
(c) How long did the bus spend on stoppages?
(d) Write the time the bus left Mbale in the 24 hour clock.
(e) How long did the bus take travelling from Mbale to Kampala?
(f) How long did the bus take to travel from Jinja?

3. The table below shows how a motorist travelled from town A through towns.

Town	Arrival	Departure
A		10: 00am
B	10: 30 am	10: 45am
C	11: 30 am	12: 15pm
D	2: 30 pm	

(a) At what time did the motorist leave town A?

(b) Write the time the motorist left town C in the 24-hour clock.

(c) How long did the motorist take to travel from town A to town D?

(d) How long did the motorist stay at town C.

3. The table below shows the bus timetable from Mbarara to Kampala. Use it to answer the questions that follow

Time	Arrival time	Departure time
Mbarara		08 45 hr
Lyantonde	09 30 hr	09 35 hr
Masaka	10 00 hr	10 15 hr
Lukaya	10 45 hr	11 35 hr
Kampala	12 15 hr	

(a) At what time did the bus depart from Mbarara?

(b) How long did the bus take to travel from Mbarara to Kampala?

(c) If the distance between Mbarara and Kampala is 252km. Calculate the average speed of the bus for the whole journey in metres per second

4. The table below describes the flights of Kenya Airways plane from Entebbe airport. Study it carefully and use it to answer the questions that follow

Airport	Departure time	Arrival time
Entebbe to London	04 20 hr	05 30 hr
Nairobi to Bujumbura	06 30 hr	07 30 hr
Bujumbura to Kigali	08 40 hr	09 10 hr
Kigali to Johannesburg	09 50 hr	15 30 hr
Johannesburg to London	16 30 hr	02 00 hr
London to Entebbe	06 00 hr	16 00 hr

(a) Change the time the aircraft left Entebbe for Nairobi to 12-hour clock

(b) How long was the stopover in Nairobi?

(c) How long was the flight from Bujumbura to Kigali?

(d) How long did it take the plane to fly from London to Entebbe?

(e) Change the time the plane left Johannesburg for London to 12-hour clock.

(f) How long was the flight between Johannesburg and London?

(g) Calculate the time spent on stopover at Entebbe.

(h) Calculate the average speed of the plane from London back to Entebbe in m/s if it travelled a distance of 720km

5. The table below shows the journey for a bus. Use it carefully to answer the questions that follow.

Town	Arrival time	Departure time
Kampala		**7:00am**
Bujuko	**7:45am**	**7:55am**
Mityana	**8:30am**	**8:40am**
Myanzi	**9:15am.**	**10:10am**
Kiganda	**11:00am**	**11:20am**
Mubende	**12:00pm**	

(a) Convert the arrival time at Myanzi to **24 hour clock** system.

(b) How long did the bus take from Bujuko to Myanzi?

(c) Calculate the total stop overs for the whole journey.

(d) If the distance from Kampala to Mubende is **360km**, find the average speed of the bus for the whole journey.

6. Study Mr. Akimu's time table and use it answer the questions that follow.

Time	**6:30am** **7:10am**	**7:10am** **8:00am**
Activity	**Morning Tea**	**First lesson**
Time	**8:00am** **8:45am**	**8:45am** **9:50am**
Activity	**Marking books**	**Second lesson**
Time	**9:50am** **12:00noon**	**12:00noon** **2:00pm**
Activity	**Marking books and homework**	**Lunch and Resting**
Time	**2:00pm** **4:00pm**	**4:00pm** **5:30pm**
Activity	**Third lesson**	**Departure**

(a) How long does he take in the third lesson?

(b) Write the starting time for the second lesson in **24** hour clock system.

(c) How long does Mr. Akimu stay working at school?

9. The time table below is for the flight of Bombadier Uganda airlines. Study it carefully and answer the questions that follow

Town / Airport	**Arrival time**	**Departure time**
Entebbe		06 00hr
Cairo	09 40hr	10 15hr
Accra	11 00hr	11 30hr
London	13 45hr	14 00hr
Kigali	16 00hr	

(a) Express the arrival time of the plane in Accra in a 12 hour clock system

(b) For how long did the plane take to reach Kigali from Accra?

(c) For how long did the plane rest at London?

(d) Calculate the total stoppages of the plane for the whole journey.

(e) If the plane covered a distance of 2400km from Entebbe to Kigali, calculate its mean speed for the whole journey.

10. The timetable below shows the arrival time and the departure time of a bus travelling between Kampala and Mubende. Study it carefully and use it to answer the questions that follow

STAGES	ARRIVAL TIME	DEPARTURE TIME
A		08 45hr
B	09 00hr	09 07hr
C	09 22hr	09 30hr
D	09 34hr	09 39hr
E	09 54hr	10 00hr
F	10 15hr	

(a) How long did the bus take to travel from Kampala to C?

(b) At what time did the bus leave E?

(c) For how long did the bus stay in D?

(d) Calculate the average speed of the bus for the whole journey if the distance between A and F is 360km

11. The table below shows the journey for horizon bus. Use it to answer the questions that follow.

Distance	Station	Arrival	Departure
-	Kabale	-	07 00 hr
80 km	Ntungamo	09 00 hr	09 15 hr
60 km	Mbarara	10 15 hr	10 25 hr
30 km	Lyantonde	11 20 hr	11 35 hr
50 km	Masaka	12 40 hr	12 45 hr
60 km	Mpigi	13 50 hr	13 55 hr
20 km	Kampala	14 30 hr	-

(a) What is the distance between Ntungamo and Masaka?
(b) How long does the bus take resting at Mpigi?
(c) Find the average speed of the bus.

12. The time table below shows how a P.7 pupil spent his time one Monday during the lock down. Use it to answer the questions that follow.

Time	**Activity**
7:00 a.m. – 10:30 a.m.	Reading
10:45 a.m. – 12:45 p.m.	Washing
1:00 p.m. – 2:45 p.m.	Lunch and resting
3:00 p.m. – 4:30 p.m.	Playing video games
5:00 p.m. – 7:30 p.m.	Ironing clothes

(a) How long did he take washing?

(b) If he read at a rate 17 pages in every 30 minutes, find the number of pages he read that day.

(c) Change the time she stops playing video games into 24 hour clock system.

13. The time table below shows the Kalita bus that travels from Kampala to Fort Portal. Study it carefully and use it to answer the questions that follow.

Town	**Arrival**	**Departure**	**Fare**
Kampala		09 00 hr	
Mityana	09 45 hr	10 00 hr	Sh 7000
Mubende	11 45 hr	12 00 hr	Sh 5000
Kyenjojo	13 00 hr	13 20 hr	Sh 6000
Fort Portal	14 30 hr		Sh 4000

(a) How long does the bus take to travel from Kampala to Fort Portal?

(b) Find the total time the bus stopped along the way.

(c) If the bus travels at an average speed of 52 km/hr, calculate the distance from Kampala to Fort Portal.

(d) What is the fare paid from Mityana to Kyenjojo?

(e) Havard travelled from Kampala to Fort Portal. What was his total transport for the whole journey?

(f) Change the departure time of the bus at Kyenjojo into 12 hour clock system.

14. The table below shows the taxi travelling from Kilema town to Butiba town. Use it to answer the questions that follow

Town	Distance	Arrival time	Departure time
P			06 00 hours
Q	35km	06 45 hours	07 00 hours
R	100km	08 00 hours	08 30 hours
T	161km	09 45 hours	10 15 hours
V	215km	11 00 hours	

(a) For how long does the taxi stop on the way?
(b) Express the arrival time at Koko in 12 hour clock system
(c) For how long does the taxi take to travel from Q to T?
(d) How long does the taxi take to travel from R to V?
(e) Calculate the mean speed for the whole journey

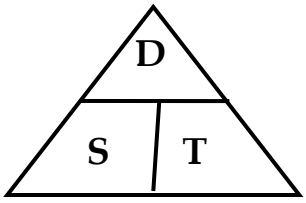
CALCULATING SPEED.

Speed is the distance covered in a unit time.

When speed increases, the time increases Distance remains constant no matter whether speed increases or decreases.

Speed (s) = Distance (D)
Time (T)

$S = \frac{D}{T}$



Speed is measured in m/s or km/hr.

Conversion of speed from km/hr to m/s. Convert 54km/hr to m/s

Method. 1

D = 54km/hr to m/s
1km = 1000m
54km = 54 x 1000m
D= 54000m
T= Ihr
1hr = (60 x 60) sec
T = 3600 sec

$S = \frac{D}{T}$

$= \frac{\cancel{540\,00}^{15}\ m}{\cancel{36\,00}_{4}\ s}$

$= 15m/s$

Method. 11

1km/hr
D = 1km
1km = 1000m
D = 1000m

$1km/hr = \frac{\cancel{1000}^{5}\ m}{\cancel{3600}_{18}\ s}$

$1km/hr = \frac{5}{18}\ m/s$

$54km/hr = \cancel{54}^{3} \times \frac{5}{\cancel{18}_{1}}$

3x 5 m/s

$= 15m/s$

Example2.

A motorist covered a certain distance at a constant speed of 144km/hr. What was the speed in m/s

$$1\text{km} = \frac{1000\ \text{m}}{36000\ \text{sec}}$$

$$144\text{km/hr} = \overset{4}{\cancel{144}} \times \frac{\cancel{1000}\ \text{m}}{\cancel{3600}\ \text{sec}_{1}}$$

= 4 x 10 m/s

40m/s

Method.2

K	H	D	M	d	c	m
144	0	0	0			

144km = 144000m

1hr = (60 x 60) s

= 3600s

$S = \frac{D}{T}$

$$= \frac{\overset{40}{\cancel{14400}}\ \text{m}}{\cancel{3600}\ \text{s}_{1}}$$

= 40 m/s

Example.3

A cyclist covered a distance of 72km in 2 hours. Calculate the cyclist's speed in m/s.

K	H	D	M	d	c	m
72	0	0	0			

72km = 72000m

1 hr = (60x60) sec

2hrs = 2x36000 sec

= 72000 sec

$S = \frac{D}{T}$

$$= \frac{\overset{10}{\cancel{72000}}\ \text{m}}{\cancel{7200}\ \text{s}_{1}}$$ ***= 10m/s***

Converting speed from m/s to km/hr.

Example.1

K	H	D	M	d	c	m
0	0	2	0			

$20m = \frac{20}{1000}$ km

1 sec = $\frac{1}{3600}$ hr

S = D÷ T

= $\frac{20}{1000}$ km ÷ $\frac{1}{3600}$ hr

$\frac{20}{1000}$ km ÷ $\frac{1}{3600}$ hr

$\frac{20}{1000}$ km x $\frac{3600}{1}$ hr

2km x 36 hr.

= 72 km/hr

Example.2

A man drove a car at a steady speed of 35m/s. Change his speed into km/hr.

K	H	D	M	d	c	m
0	0	3	5			

$35m = \frac{35}{100}$ km

1 sec = $\frac{1}{3600}$ hr

S = D ÷ T

= $\frac{35}{100}$ km ÷ $\frac{1}{3600}$

= $\frac{\cancel{35}^{7}}{\cancel{100}_{\cancel{2}}}$ km x $\frac{\cancel{3600}^{18}}{\cancel{1}_{1}}$

7km x 18hr

= 126km/hr.

Example 3

An athlete covered a distance of 400m in 40 seconds. What was the speed of the athlete in km/hr?

K	H	D	M	d	C	m
0	4	0	0			

400m = $\frac{400}{1000}$ km

1 sec = $\frac{1}{3600}$ hr

40 sec = $\frac{1}{3600}$ x 40

= $\frac{40}{3600}$ hr

S = D ÷ T

= $\frac{400}{1000}$ km ÷ $\frac{40}{3600}$

= $\frac{\cancel{400}}{\cancel{1000}}$ km x $\frac{\cancel{3600}}{\cancel{40}}$

1km x 36hr

= 36km/hr.

Exercise.

1. Write the following speed in m/s
   (a) 36km/hr (b) 72km/hr
   (c) 90km/hr (d) 108km/hr
   (e) 126km/hr (f) 162km/hr
2. Change the following speed in km/hr.
   (a) 10m/s (b) 5m/s
   (c) 25m/s (d) 45m/s
   (e) 60m/s (f) 90m/s
3. A tourist covered a distance of 180km in 5 hours. Calculate the speed of the motorist in m/s.

4. A bus covered a distance of 216km in 3 hours. What was the speed of the

bus in m/s.

5. A n athlete covered a distance of 720km in 20 seconds. Express the speed of the athlete in km/hr.
6. A cyclist covered a distance of 600 metres in 40 seconds. Calculate the cyclist's speed in km/hr.

Calculating speed.

A taxi covered a distance of 120km in 3 hours. Calculate the speed at which the taxi was travelling.

$S = \frac{D}{T}$

$= \frac{120km}{3hr}$

$= 40km/hr$

Example .2

A bus covered a distance of 280km in 3 hours and 30 minutes. What was its speed?

$S = D \div T$

$= 150 \text{ km} \div \frac{1}{4} \text{ hr}$

$= 150km \times \frac{4}{1} hr$

$= 600 \text{ km/hr.}$

Example.5

Adonyo left home at 7:45am for town a distance of 120km and reached at 9:45am. Calculate her speed.

$S = \frac{D}{T}$

$= \frac{120km}{2}$

$T = 9:45am - 7:45am = 2:00$ T= 2hrs.

= 60km/hr

Example 6.

A bus left town A at 11:30am for town B which is 120km away and reached town B at 1:30pm. Calculate the speed of the motorist.

S.T	E.T	T = 13 30
11:30	1 :30	-11 30
+ 00 00	+ 12:00	2 00
11: 30hr	13: 30hrs	T = 2hrs

$$S = \frac{D}{T}$$

$$= \frac{\overset{60}{\cancel{120}}km}{\cancel{2}hr_{\ 1}}$$

= 60km/hr.

Exercise.

1. A motorist covered a distance of 150km in 3 hours. Calculate the speed of the motorist.
2. A cyclist covered a distance of 54km in 1 hour and 30 minutes. What was the speed of the cyclist?
3. A bus covered a distance of 90km in 30 minutes. Find the speed of the bus.
4. A jet covered a distance of 120km in $\frac{1}{3}$ an hour. Calculate the speed of the jet.
5. Otukol left town at 4: 30pm and covered a distance of 48km back home and reached at 6:00pm. Calculate his speed.
6. A KK travellers bus left Arua at 7:30am for Kampala a distance of 600km and reached Kampala at 3:00pm. Calculate the speed of the bus.
7. A driver started at 8:00am driving his car from Kampala to Nakasongola for a distance of 230km at a steady speed of 80km/hr. After driving for 1 hour and 30 minutes, his car got a puncture and was repaired for half an hour. At what speed must he have driven in order to complete his journey by noon?

Calculating average speed.

Example.1

Muntale covered a distance of 90km at a speed of 60km/hr. He then covered 130km at a speed of 104km/hr. Calculate his average speed for the whole journey.

Average = $\frac{\text{total distance}}{\text{total time}}$

$T_1 = \frac{D}{S}$

$\frac{90\text{ km}}{60\frac{\text{km}}{\text{hr}}}$

$= 1\frac{1}{2}$ hr

$T_2 = \frac{D}{S}$

$\frac{130\text{ km}}{104\frac{\text{km}}{\text{hr}}}$

$= 1\frac{31}{52}$

$= 1\frac{1}{4}$ hrs

Total time = $T_1 + T_2$

$1\frac{1}{2}$ hr + $1\frac{1}{4}$ hr

$= (1+1) + \frac{1}{2} + \frac{1}{4})$ hr

$= 2 + \frac{2+1}{4}$

$= 2 + \frac{3}{4}$ hr

$= 2\frac{3}{4}$ hrs

Total distance = $D_1 + D_2$

= 90km + 130km

= 220km.

$A.S = \frac{T.D}{T.T}$

$= 220\text{km} \div 2\frac{3}{4}\text{ hr}$

$= 220\text{km} \div \frac{11}{4}$

$= 220\text{ km} \times \frac{4}{11}$

= 20km x 4hr

= 80 km/hr

Example. 2

A motorist moving at a speed of 60km/hr took 3 hours to cover part of its journey. He then continued at a speed of 80km/hr for two hours to cover the remaining journey. Calculate the average speed for the whole journey.

$D_1 = S \times T$

$= \frac{60km}{1hr} \times 3hr$

$= 180km$

D_2

$= \frac{80\ km}{1\ hr} \times 2hr$

$160km$

Total distance $= D_1 + D_2$

$= 180km + 160km$

$= 340km$

Total time $= T1 + T2$

$= 3hrs + 2hrs$

$= 5hrs$

$A.S = \frac{T.D}{T.T}$

$= \frac{340\ km}{25\ hr}$

= 68km/hr.

Example. 3

A motorist drove for $3\frac{1}{2}$ hours at a speed of 80km/hr and another distance of 144km at a speed of 72km/hr. Calculate the average speed of the motorist.

$D_1 = S \times T$

$= \frac{80km}{1hr} \times \frac{7hr}{2}$

$= 40km \times 7$

$= 280km.$

$= T.D = D_1 + D_2$

$= 280km + 144km$

$= 424km$

$T_2 = \frac{D}{S}$

$= \frac{144km}{72km/hr}$

$T.T = T_1 + T_2$

$= 3\frac{1}{2}\ hr + 2hr$

$= 5\frac{1}{2}\ hr$

$A.S = T.D \div T.T$

$= 424km \div 1\frac{1}{2}\ hr$

$= 424km \times \frac{2}{11} hr$

$= \frac{848km/hr}{11}$

$= 77\frac{1}{11} km/hr$

Example. 4

Opus rode a bicycle for $2^1/_2$ hours at a speed of 15km/hr. He rested for 45 minutes and rode for another one hour at the same speed. What was the average speed for the whole journey?

$D_1 = S \times T$

$= \frac{\cancel{15}^{5}\text{km}}{1\cancel{\text{hr}}} \times \frac{7\cancel{\text{hr}}}{\cancel{3}}$

$= 5\text{km} \times 7$

$= 35\text{km}$

$= T.D = D_1 + D_2$

$= 35\text{km} + 15\text{km}$

$\mathbf{= 60km}$

A.S $= T.D \div T.T$

$= 60\text{km} \div {}^{49}/_{12}$ **hr**

$= 60\text{km} \times {}^{12}/_{49}$ **hr**

$= \frac{\cancel{720}\text{km/hr}}{\cancel{49}}$ $= \mathbf{13\ {}^{34}/_{49}\ km/hr}$

$D_2 = S \times T$

$= \frac{\cancel{15}\text{km}}{\cancel{1\text{hr}}} \times 1\text{hr}$

$= 15\text{km}$

$T.T = T_1 + \text{resting time} + T_2$

$=(2^1/_3 + {}^{45}/_{30} + 1)$ hr

$= 2^1/_3 + {}^3/_4 + 1)$ hr

= (2 + 1) + ($^1/_3 + {}^3/_4$**) hr**

$\frac{\mathbf{= 4 + 9}}{\mathbf{12}}$ $3 + {}^{13}/_{12}$

$3 + 1\ {}^1/_{12}$

$= \mathbf{4}\ {}^1/_{12}$ hr

1. Achopa drove froms town at an average speed of 50km/hr for $2^1/_2$ hrs. He rested for an hour in town and drove back home taking a total of 5 hours for journey for the whole journey. Calculate his speed on his return journey.
2. A motorist left Busia and moved at a speed of 80km/hr for $1\frac{1}{2}$ hours to Jinja. He rested for 30 minutes at Jinja and returned to Busia at a speed of 60km/hr. Calculate the average speed for the whole journey.
3. YY coach left Soroti at 8:30am and moved at a speed of 90km/hr reaching at 9:10am. It got a puncture and repairs took 40 minutes and then continued its journey at a speed of 75km/hr for 2 hours. Calculate the average speed of the bus for the whole journey.
4. Obote covered a distance of 120km in 4 hours. He then covered another 210km in 6 hours. Calculate the average speed for the whole journey.
5. Nkote covered a distance of 100km at a speed of 40km/hr. He then continued and covered another 90km at a speed of 60km/hr. Calculate the average speed for the whole journey.

6. A motorist moving at a speed of 70km/hr for 3 hours to travel from town A to B. He then continued to town C at a speed of 50km/hr for 2 hours. Calculate the average speed of the motorist for the whole journey.

7. A motorist drove for $3\frac{1}{2}$ hours at a speed of 60km/hr and another distance of 120km at a speed of 80km/hr. Find the motorist average speed for the whole journey.

8. Nakato cycled for $2\frac{1}{2}$ hours at a speed of 40km/hr. She rested for 30 minutes and cycled for another 1 hour at the same speed. What was her average speed for the whole journey?

9. A motorist left Mbale and moved at a speed of 120km/hr for 3 hours to Kampala. He rested for an hour and drove back at a speed of 90km/hr. Calculate the average speed for the whole journey.

10. A car left Kampala at a speed of 60km/hr and reached Mbale fter 4 hours. It left Mbale at 3:00pm and drove back to Kampala at a speed of 80km/hr after resting for an hour.

(a) At what time did the car arrive Kampala?

(b) Calculate the average speed for the whole journey

11. Town A and town C via town B are 408 km apart. A taxi left town A at 8:30 a.m. travelling at 64 km/hr for 3 hours. It rested for 2 hours at town B and continued on its journey to town C. At what speed in metres per second must the taxi travel in order to complete its journey at 4:30 p.m.?

12. A motorist travelled at a speed of 80km/hr for 3 hours from town P to town Q. He rested for an hour at town Q repairing a punctuare. He then left town Q tot own R from 9:00am to 11:30am moving at a speed of 60km/hr. Calculate the mean speed for the whole journey

CALCULATING DISTANCE

Exercise

1. A motorist moving at a speed of 70km/hr took $2\frac{1}{2}$ hours to complete the journey. How long was the journey?

   D = S x T

   = $\frac{70km}{hr}$ x $\frac{5}{2}$ hr

   = 35km x 5

   = 175km

2. Mutaka takes 1 hour and 20 minutes to cycle for home to school at a speed of 18km/hr. How far is his school from home?

3. A motorist drove from town Y to town Z at an average speed of 75km/hr. On his return journey, he drove at an average of 60km/hr. If the total time taken was $1\frac{1}{2}$ hours, how far is town Z from town Y?
4. A bus was moving at a speed of 80km/hr to travel from town P to town Q. On its return journey, it moved at speed of 70km/hr. If the total journey took 15 hours, find the distance between the two towns.
5. A cyclist moving at a speed of 50km/hr took $2\frac{1}{2}$ hours to cover a journey. How long was the journey?
6. A motorist was moving at speed of 40km/hr from town A to town B. On its return journey, it moved at a speed of 60km/hr. If the total journey took 5 hours, find the distance between town A and town B.
7. A motorist drove from town P to town Q at an average speed of 120km/hr. On his return journey, he drove at an average speed of 60km/hr. If the total time taken was $4\frac{1}{2}$ hours, how far is town P from town Q?

Calculating time

1. A bus left town A at 11:30 am moving at a speed of 60km/hr to town B which is 150km from town A. At what time did the bus reach town B?

$$T = \frac{D}{S}$$
$$= \frac{150km}{60km/hr}$$
$$= 2\frac{1}{2} \text{ hr}$$

Arrival time = Departure + Duration

Hr	Min
11	30
+ 2	30
14	00 hr

14	00
- 12	00
2	00

It reached at 2:00 pm

2. A motorist that left town P at 10:30am moving at a speed of 80km/hr reached town Q at 1:30pm. The motorist stayed at town Q for 30 minutes. It then continued to town R and covered a distance of 90km at a speed of 60km/hr. At what time did the motorist reach town R?

3. An athlete ran a distance of 6km at a speed of 2m/s. At what time did he finish the race if he started at a 7:15am?
4. A car takes 12 minutes to cover a distance of 90km. How long does it take to cover 5km?
5. A cyclist covers 70km in $2\frac{1}{2}$hours. How long will he take to cover 21km at the same speed?
6. A watch loses 5 seconds in every one hour. How many minutes will it lose in 3 days?
7. A watch loses 5 seconds after every 2 hours. If it was corrected on Monday at 4:00pm, what time will it show the following Monday at 4:00am?
8. A motorist left home at 11:50am moving at a speed of 72km/hr to town which is 360km away. At what time did the motorist reach town?
9. An athlete ran a distance of 36km at a speed of 5m/s. At what time did the athlete finish if he started at 8:45am?
10. A motorist takes 3 hours to cover a distance of 150km. How long would the motorist take to cover a distance of 375km at the same speed?
11. A car takes 36 minutes to cover a distance of 80km. How long would the car take to cover a distance of 120km at the same speed?
12. A watch loses 5 seconds every 4 hours. How many minutes will it lose in 2 days?
13. A watch loses 4 seconds every 2 hours. If it was completely corrected on Friday at 7:00pm, what time will it show on Friday at 7:00am?

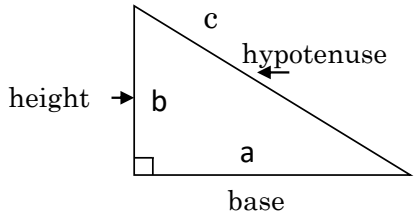
TOPIC: LENGTH, MASS AND CAPACITY

AREAS AND TOTAL DISTANCES ROUND FIGURES:

TRIANGLES AND PYTHAGOREAN THEOREM:

Note : Pythagorean theorem is useful in finding unknown sides in a right-angled triangle.

Take :



The hypotenuse^2 = base^2 + height^2

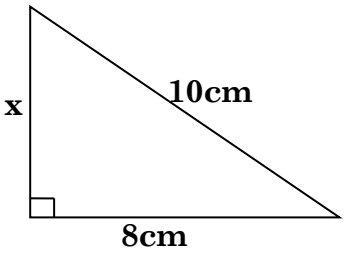
$hyp^2 = b^2 + h^2$

Therefore $c^2 = a^2 + b^2$, where a and b are the 2 short sides while c is the longest side.

The two short sides in a right angled triangle are the ones that meet in a right angle.

EXAMPLE I

Find the value of x and the area of the triangle.



Value of x

$8^2 + x^2 = 10^2$

$(8 \times 8) + x^2 = (10 \times 10)$

$64 + x^2 = 100$

$64 - 64 + x^2 = 100 - 64$

$x^2 = 36$

$\sqrt{x^2} = \sqrt{36 cm^2}$

$x = 6$ cm

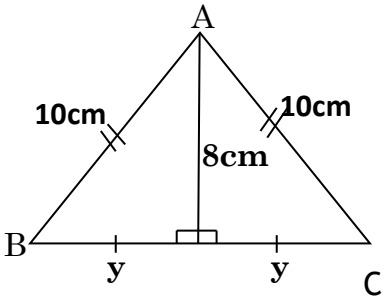
Area $= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 8 \times 6\ cm^2$

$= 24\ cm^2$

EXAMPLE II

Find the value of y and the area of the figure.



Value of y

$a^2 + b^2 = c^2$

$y^2 + 8^2 = 10^2$

$y^2 + (8 \times 8) = (10 \times 10)$

$y^2 + 64 = 100$

$y^2 + 64 - 64 = 100 - 64$

$\sqrt{y^2} = \sqrt{36}$

$y = 6$ cm

Area of the figure

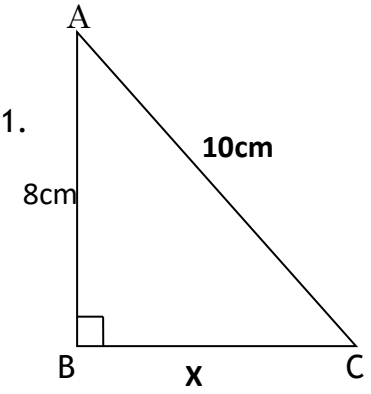
$A = \frac{1}{2} \times b \times h$ $= \frac{1}{2} \times (6 + 6) \times 8$

$= \frac{1}{2} \times 12 \times 8\ cm^2$

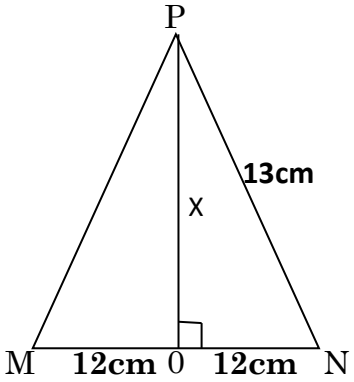
$= 48\ cm^2$

Find the area of the figures below

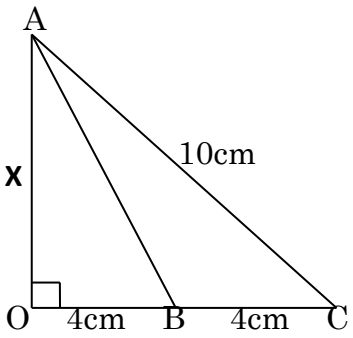
1.



2.



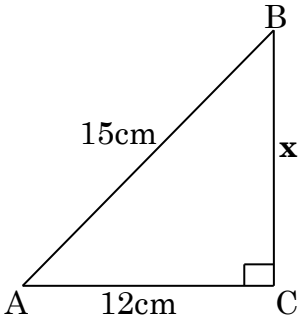
3.



Find : (i) x

(ii) Area of AOC

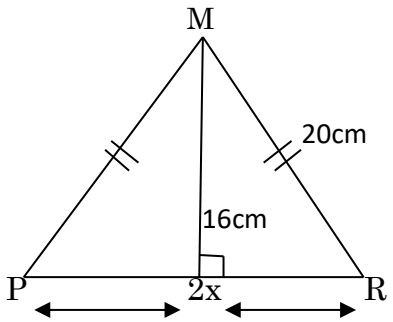
4.



Find : (i) x

(ii) Area of ABC

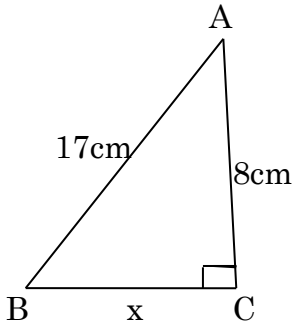
5.



Find : (i) the value of x

(ii) the area of MPR

6.

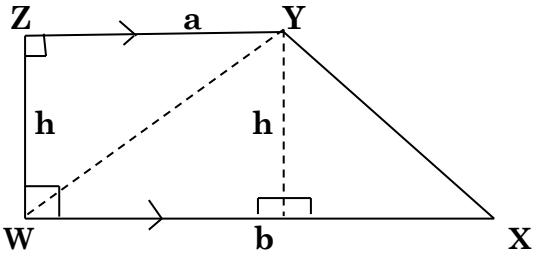


Find : (i)

TRAPEZIUM AND PYTHAGORUS THEOREM

Note : How to find area of a trapezium:

Take trapezium WXYZ,



- the parallel sides are a and b.
- the perpendicular side that cuts a and b is h

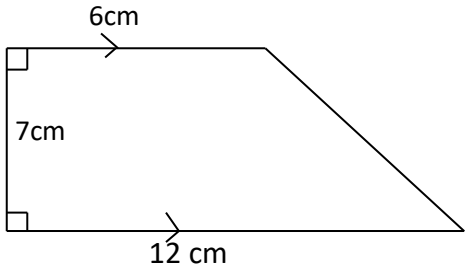
Area of the trapezium = $\left[\frac{1}{2} \times h \times a\right] + \left[\frac{1}{2} \times b \times h\right]$

(Area of WYZ) + (Area of WXY)

$= \frac{1h}{2}$ (a + b) by factorization

∴ Area of a trapezium = $\frac{1h}{2}$ (a + b) where a and b are the parallel sides and h the perpendicular that cuts a and b.

Find the area of the trapezium below;



$A = \frac{1}{2} h (a + b)$

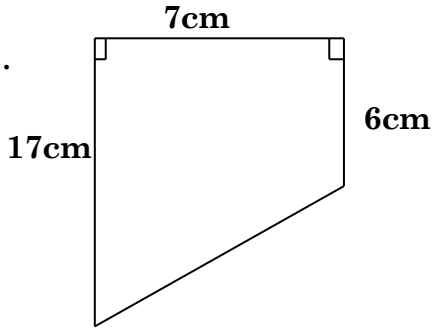
$= \frac{1}{2} \times 7 (6 + 12) \text{ cm}^2$

$= \frac{1}{2} \times 7 \times 18 \text{ cm}^2$

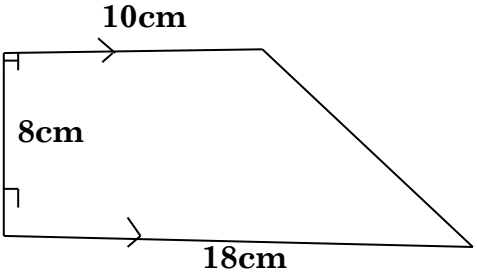
$= 63 \text{ cm}^2$

Find the area of the following;

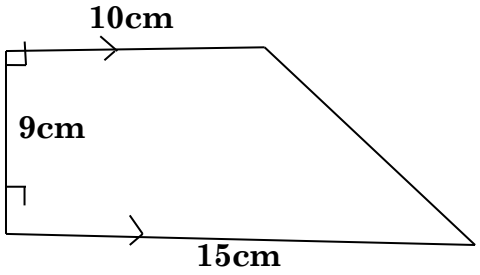
1.



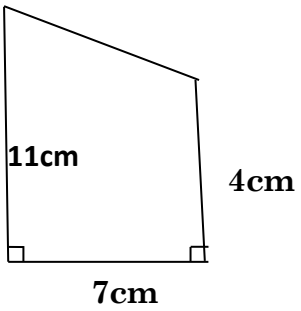
2.



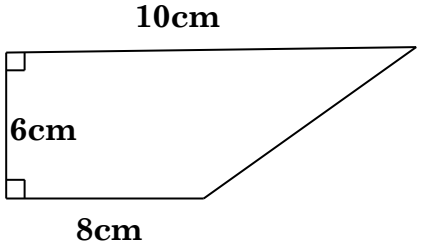
3.



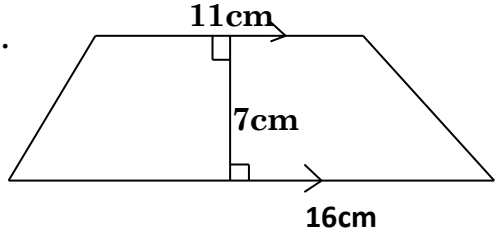
4.



5.

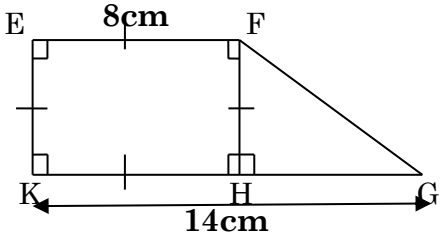


6.



7. Calculate the area of a trapezium whose two parallel sides are *8cm* and *15cm* with height *8cm*.

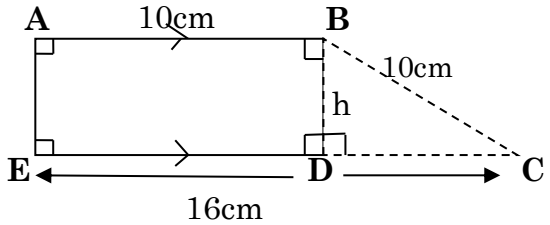
8. Study the given figure carefully;



(a) Find the length FG

(b) Calculate the area of the figure.

(c) Find the perimeter of the figure



(a) Calculate the length of h

$a^2 + b^2 = c^2$ (where $\overline{DC}$ = (16 - 10) cm

$6^2 + h^2 = 10^2$ = 6cm

$36 + h^2 = 100$

$36 - 36 + h^2 = 100 - 36$

$0 + h^2 = 64$

$\sqrt{h^2} = \sqrt{64}$

$\underline{h = 8 \text{ cm}}$

(b) Find its perimeter.

P = S + S + S + S

= (16 + 10 + 10 + 8) cm

<u>= 44cm</u>

(c) Find its area

$A = \frac{1}{2} h (a + b)$

$= \frac{1}{2} \times 8 (16 + 10) \text{ cm}^2$

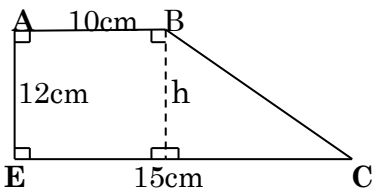
$= \frac{1}{2} \times 8 \times 26 \text{ cm}^2$

$= 4 \times 26 \text{ cm}^2$

$\underline{= 104 \text{ cm}^2}$

Calculate:

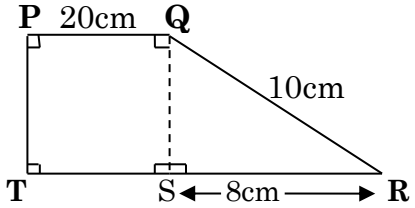
1.



(i) Perimeter

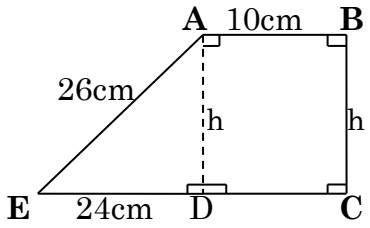
(ii) Area

2.



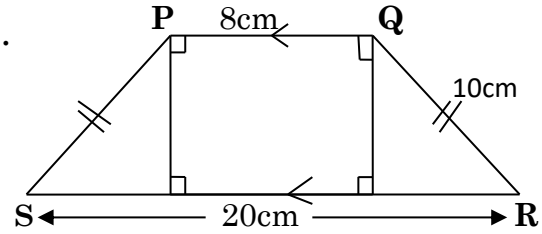
(i) Perimeter

(ii) Area

3. 

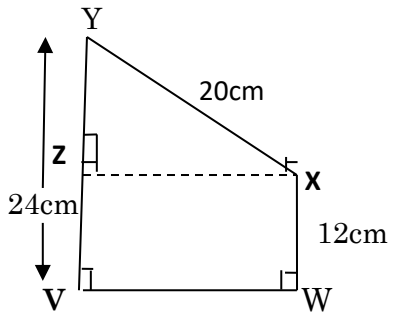
(i) Perimeter

(ii) Area

4. 

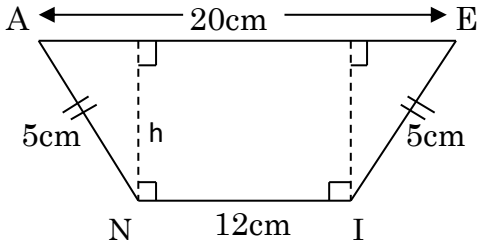
(i) Perimeter

(ii) Area

5. 

(i) Perimeter

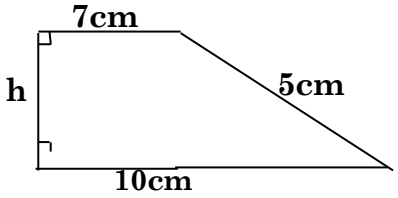
(ii) Area

6. 

(i) perimeter

(ii) Area

7. A trapezium has its two parallel sides measuring 7cm and 10cm with its slanting side measuring 5cm. Find its height, perimeter and area.



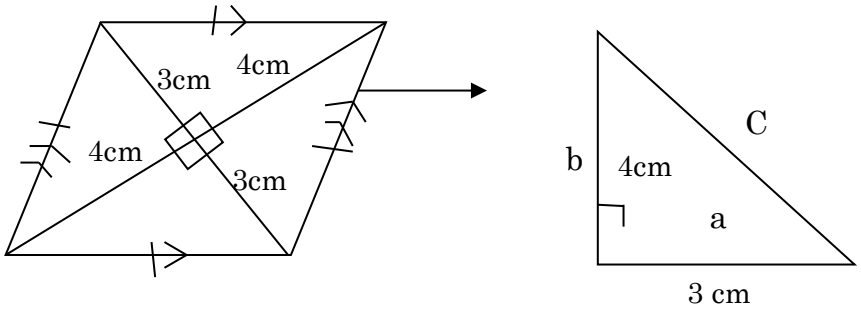
8. A garden with the shape of a trapezium measures 110m and 170m along the two parallel sides. If the perpendicular side to the two parallel sides is 80m, calculate the perimeter of the garden.

RHOMBUSES AND PYTHAGORUS THEOREM:

Note : A rhombus is a quadrilateral with all sides equal and opposite angles equal. The diagonals bisect each other at 90^0 and form 4 congruent triangles. The opposite sides are parallel. Congruent triangles have the same shape, size and area.

EXAMPLE I

Calculate the length of each side of a rhombus whose diagonals are 8cm and 6cm.



Length of each side is the hypotenuse (c)

$a^2 + b^2 = c^2$

$3^2 + 4^2 = c^2$

$9 + 16 = c^2$

$\sqrt{25} = \sqrt{c^2}$

$5m = c$

Therefore each side is 5cm

(b) Find the perimeter of the rhombus.

P = S + S + S + S

= (5 + 5 + 5 + 5) cm

= 20 cm

OR P = 4 x side given

= 4 x 5 cm

= 20 cm

(c) Find the area of a rhombus

$A = \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 8 \times 6\ cm^2$

$= 4 \times 6\ cm^2$

$= 24\ cm^2$

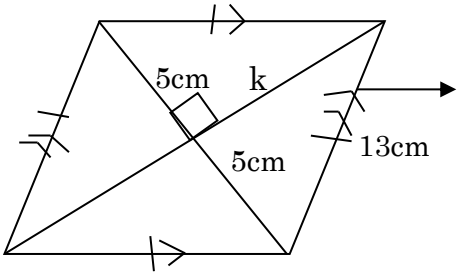
OR $A = 4\ \frac{1}{2} \times 4 \times 3\ cm^2$

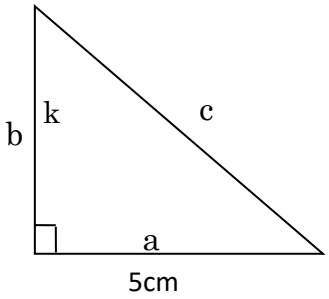
$= 4 \times 6\ cm^2$

$= 24\ cm^2$

EXAMPLE II

The side of a rhombus is 13cm and one of its diagonals is 10cm. Find the length of the second diagonal.





$a^2 + b^2 = c^2$

$5^2 + k^2 = 13^2$

$25 + k^2 = 169$

$25 - 25 + k^2 = 169 - 25$

$0 + k^2 = 144$

$\sqrt{k^2} = \sqrt{144}$

$k = 12$ cm

Length of second diagonal = 12cm + 12cm

(k + k) = 24 cm

(b) Find the perimeter of the rhombus

P = S + S + S + S

= (13 + 13 + 13 + 13) cm

= 52 cm

OR: P = 45

= 4 x 13cm

= 52 cm

(c) Find the area of the rhombus

$A = \left[\frac{1}{2} \times b \times h\right] \times 4$ triangles

$= \frac{1}{2} \times 5 \times 12 \times 4$ cm^2

$= 5 \times 6 \times 4$ cm^2

= 120 cm^2

OR: Area $= \frac{1}{2} \times d_1 \times d_2$

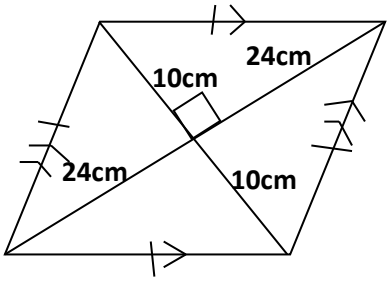
$= \frac{10}{2} \times 24$ cm^2

= 120 cm^2

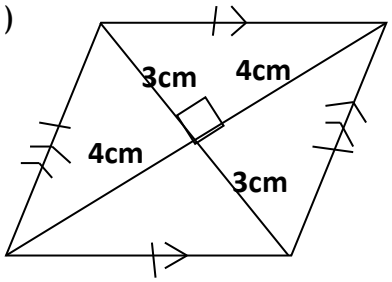
Exercise

1. Find the sides, the perimeter and area of the rhombuses below;

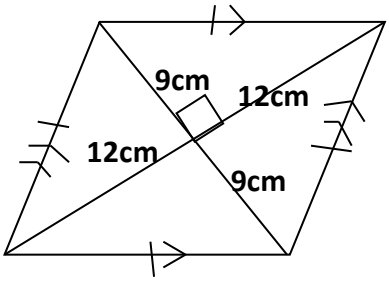
(a)



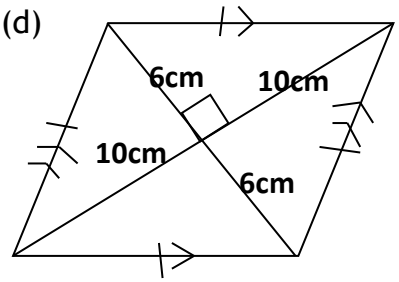
(b)



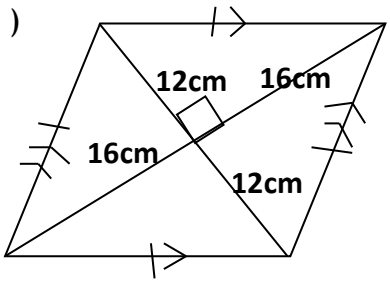
(c)



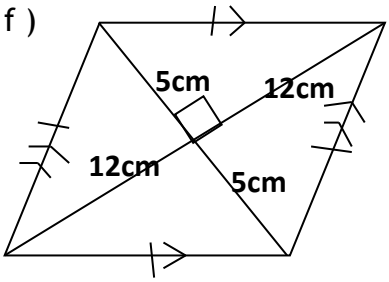
(d)



(e)



(f)

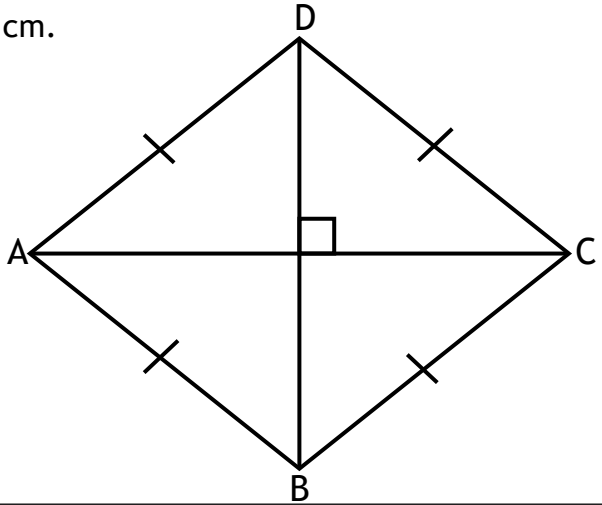


2. The side of a rhombus is 10cm and the shorter diagonal is 12 cm.

(i) Find the longer diagonal.

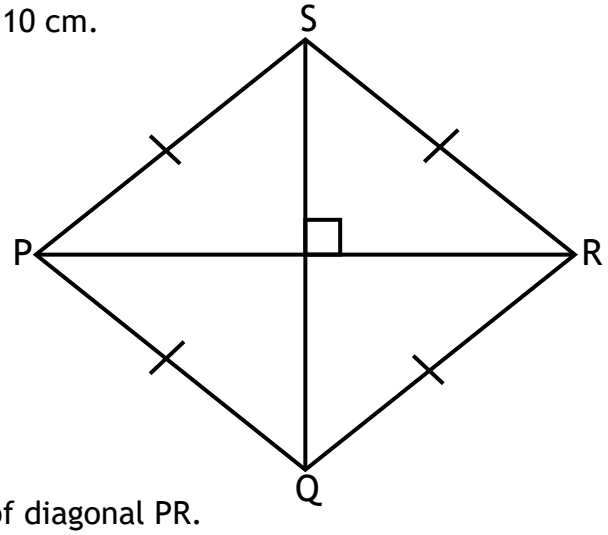
(ii) Find the area of the rhombus.

2. The perimeter of the rhombus below is 80 cm and the length of the longer diagonal AC is 32 cm.



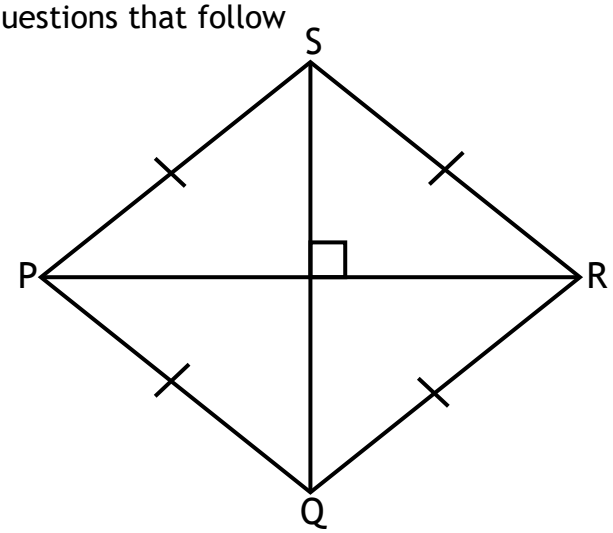
(g) Find the length of diagonal BD
(h) Calculate the area of the rhombus

3. The perimeter of the rhombus below is 52 cm and the length of the shorter diagonal SQ is 10 cm.



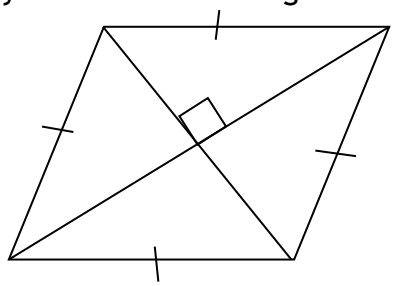
(a) Find the length of diagonal PR.
(b) Calculate the area of the rhombus.

4. The perimeter of the Rhombus below is 40m. Study it carefully and use it to answer the questions that follow



(a) If QS = 16cm, find the length of each side of the Rhombus.
(b) Calculate its area

5. The diagonals of the rhombus drawn in the diagram below are in the ratio of 3:4 respectively. If the shorter diagonal is 12 m,

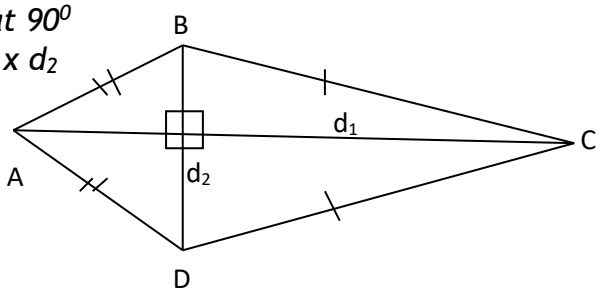


(a) Find the longer diagonal.
(b) Calculate the area of the rhombus.

KITES AND PYTHAGOREAN THEOREM:

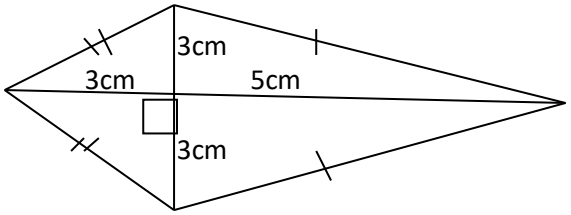
Note : ABCD is a kite. Triangle ABC = Triangle ACD

- *A kite is a quadrilateral with 2 pairs of adjacent sides equal.*
- *A kite has 1 line of folding symmetry. It is the longest diagonal, which is the only line of folding symmetry.*
- *Diagonals intersect at 90^0*
- *We use area = $\frac{1}{2} \times d_1 \times d_2$*



EXAMPLE I

Find the area of the kite.



Using diagonals

Area = $\frac{1}{2} \times d_1 \times d_2$

= $\frac{1}{2} \times 6 \times 8\ cm^2$

= $3 \times 8\ cm^2$

= $24\ cm^2$

Using triangles

Area = $\frac{1}{2} \times b \times h + \frac{1}{2} \times b \times h$

= $\frac{1}{2} \times 6 \times 3 + \frac{1}{2} \times 6 \times 5$

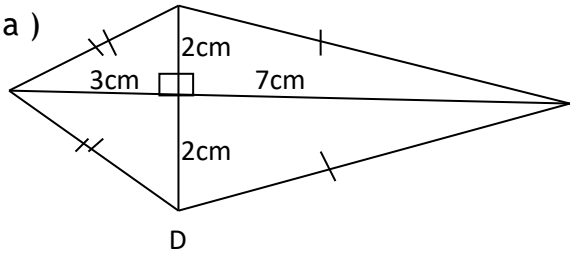
= (3 x 3) + (3 x 5)

= $24\ cm^2$

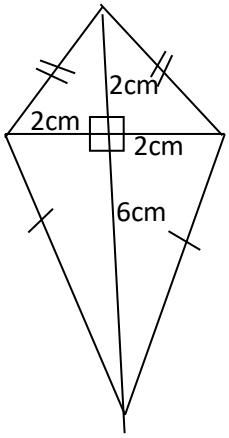
Exercise:

1. Find the area of the figures below,

(a)



(b)

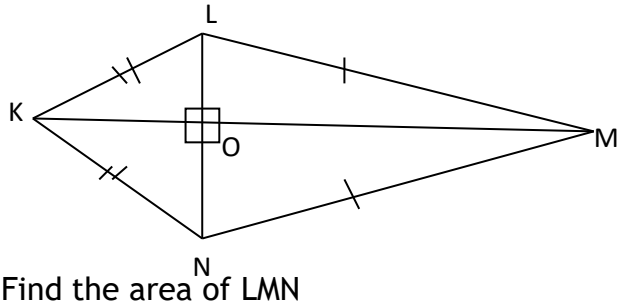


2. Find the area of the kite whose diagonals measure 16cm and 28cm.

3. Calculate the area of the kite whose diagonals are 20cm and 10cm.

4. The two diagonals of a kite are *18cm* by *11cm* respectively. Calculate its area.

5. The diagonals of a kite measure 14cm and 22cm. If $\overline{KO}$ = *8cm*.



(a) Find the length of $\overline{OM}$ and $\overline{LO}$

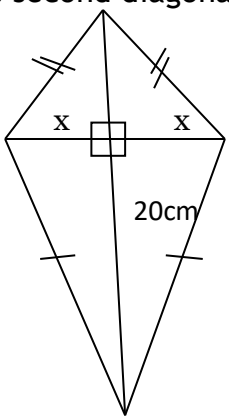
(b) Find the area of LMN

(c) Find the area of the kite

MORE KITES AND PYTHAGOREAN THEOREM:

EXAMPLE I

The area of a kite below is 80cm^2. One of the diagonals is 20cm. Find the length of the second diagonal.



$\frac{1}{2} \times d_1 \times d_2$ = Area

$\frac{1}{2} \times 20 \times d_2 = 80$

$\frac{10d_2}{10} = \frac{80}{10}$

d_2 = 8 cm

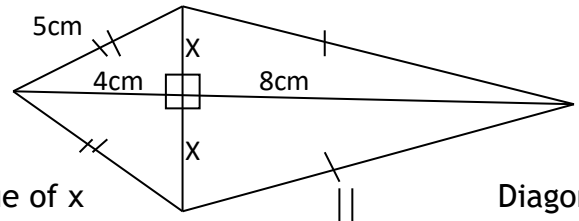
(b) Find the value of x

$x = \frac{\text{diagonal}}{2}$

$= \frac{8}{2}$ cm

= 4 cm

The diagram below is a kite. Find the area of the kite.



Value of x

$a^2 + b^2 = c^2$

$4^2 + x^2 = 5^2$

$16 + x^2 = 25$

$16 - 16 + x^2 = 25 - 16$

$0 + x^2 = 9$

$\sqrt{x^2} = \sqrt{9}$

$x = 3cm$

Diagonals

$d_1 = x + x$

$= (3 + 3) = 6$ cm

$d_2 = (4 + 8)$ cm

$= 12$ cm

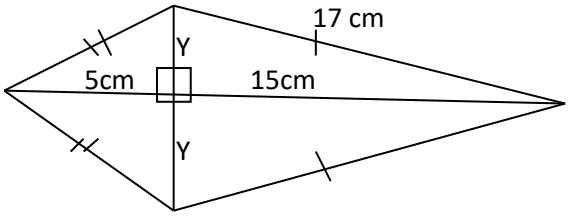
Area $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 6 \times 12$ cm^2

$= 36$ cm^2

Exercise:

1. A kite has an area of 72 cm^2. One of its two diagonals is 8 cm. Find the length of the second diagonal.
2. The area of the kite is 120 cm^2. If one of its diagonals is 8cm. Find the length of the second diagonal.
3. Study the kite below and find the following;

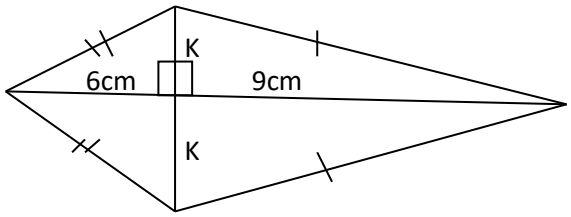


(a) Find the value of y

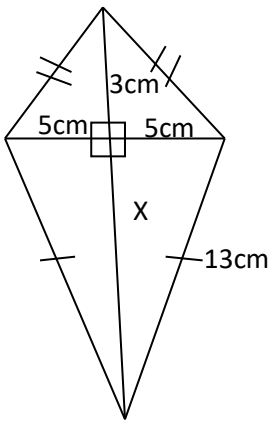
(b) Find the length of the diagonals

(c) Find its area

4. The given figure has an area of 45 cm^2. Find the length of the unknown diagonal.



5. Study the kite below and find the following:

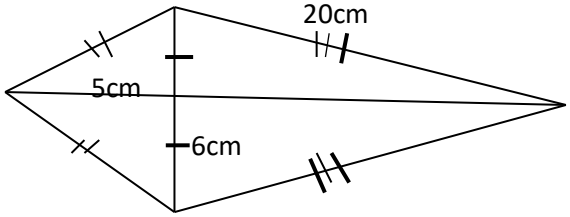


(a) the value of x

(b) the diagonals

(c) its area

6. Study the kite below and answer the following questions.



Circles

Radius is the line drawn from the centre to the circumference.
Diameter is a line passing through the centre from circumference to circumference.
Arc is part of the circle.
Circumference is the distance round the circle.
Chord is the line joining circumference to circumference without passing through the centre.
Sector is an area of the circle bounded by two radii and arc.
Semi-circle is half a circle.
Quadrant is quarter circle.

Relationship between radius and diameter.

1. Find the diameter of a circle whose radius is 14cm.
   D = 2R
   = 2 x 14 cm
   = 28cm

2. Find the radius of the circle whose diameter is 40m.
   R = D ÷ 2
   = 40m ÷ 2
   = 20m

3. Find the diameter of the circle whose radius is;

(a) 10cm	(b) 5cm	(c) 7cm
(d) 28cm	(e) 20m	(f) 50cm
(g) $12\frac{1}{2}$ m	(h) $4\frac{1}{4}$ cm	(i) 0.5m
(j) 0.5cm	(k) 2.6cm	(l) 17cm

4. Find the radius of the circle whose dimeter is;

(a) 30cm	(b) 25cm	(c) 42cm
(d) 56cm	(e) 100m	(f) 63m
(g) $4\frac{1}{2}$ m	(h) 3.6m	(i) 4.8m

5. A circular flower garden has a diameter of 4.2 metres. Find its diameter

6. A circular plate has a diameter of 15cm. Find its radius.

CIRCUMFERENCE OF A CIRCLE

Examples

1. Find the circumference of a circle whose radius is 21cm.

   $C = 2\pi R$

   $= 2 \times \frac{22}{7} 21$ cm

   $= 2 \times 22 \times 3$ cm

   $= 132$cm

2. Work out the circumference of a circle whose diameter is 40m.

   $C = \pi D$

   $= 3.14 \times 40$m

   $= \frac{314}{100} \times 40$m

   $= \frac{314 \, x \, 4}{10}$ m

   $= \frac{1256}{10}$ m

   $= 125.6$m

3. Find the circumference of a circle whose radius is;

(a) 7cm	(b) 5cm	(c) 28cm
(d) 20cm	(e) 30cm	(f) 40cm
(g) 50cm	(h) 63cm	(i) 84cm
(j) $10\frac{1}{2}$ cm		

4. Find the circumference of a circle whose diameter is;

5. A goat is tied on a peg using a 14m rope. Calculate the distance all round that a goat can graze.

FINDING RADIUS AND CIRCUMFERENCE WHEN GIVEN CIRCUMFERENCE

1. The circumference of a circle is 88cm. Find its radius. (Use Π = $\frac{22}{7}$)

   $2\pi R = C$

   $2 \times \frac{22}{7} \times R = 88$

   $\frac{2 \times 22 \times R}{7} = 88$

   $\frac{44R}{7} = 88$

   $R = 88 \times \frac{7}{44}$

   $= 2 \times 7$ cm

   = 14cm

2. Calculate the diameter of a circle whose circumference is 132cm.
3. Calculate the radius of a circle whose circumference is;
   (a) 22cm (b) 44cm (c) 176cm
   (d) 264cm (e) 352cm (f) 440cm
   (g) 536cm (h) 11cm

4. Calculate the diameter of a circle whose circumference is;
   (a) 31.4cm (b) 125.6cm (c) 502.4cm
   (d) 15.7cm (e) 28.26cm (f) 113.04cm
   (g) 226.08cm (h) 94.2cm (i) 314cm
   (j) 628cm

FINDING NUMBER OF POLES AND SPACE

1. How many posts of 1.5m apart are needed to erect a circular hut of diameter 21m. (Use Π as $\frac{22}{7}$)

   $C = \pi D$

   $= \frac{22}{7} \times 21$m

   $= 22 \times 3$m

   = 66m

   Number of poles = $\frac{C}{D.A}$

   $= 66 \div \frac{15}{10}$

   $= 66 \times \frac{10}{15}$

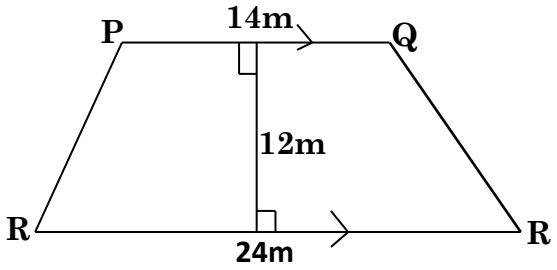
   = 44 posts

2. 11 posts were fixed a distance of 4m apart to make a circular fence
   (a) Calculate the total distance around the fence.
   Total distance = 11 x 4m
   = 44m

   (b) Calculate the radius of the fence.
   $2\pi R = C$
   $2 \times \frac{22}{7} \times R = 44$
   $\frac{44R}{7} = 44$
   $R = 44 \times \frac{7}{44}$
   $= 7cm$

3. How many posts of 2.5m apart are needed to erect a circular hut of diameter 280cm?
4. Rose used 99 pegs to fence around a circular garden. The interval between the pegs was 2m.
   (a) What was the circumference of the garden?
   (b) Find the diameter of the garden.
   (c) Find the radius of the garden.
5. Christianah used 176 pegs to fence round her circular garden. The interval between the pegs was 3m. What was the radius of the circular garden?
6. How many posts of 0.5m apart are needed to erect a circular hut of radius 21m?
7. How many posts of 500cm apart are needed to erect a circular hut of radius 21cm?
8. A circular garden has a radius of 28m. How many posts 2m apart can be put round the garden?
9. Badru wants to construct a circular hut of diameter 14m using poles placed 40cm apart.
   (a) How many poles does he need to construct the above hut?
   (b) If each pole cost sh.2600, how much money does Badru require to buy the poles needed to construct the above hut?
10. Jane wants to fence a circular tomato garden of diameter 7m using poles places at intervals of 44cm. If each pole costs sh.2300, how much will she spend on all the poles needed?

11. The figure below shows a school garden PQRS. Use it to answer the questions that follow



(a) If the garden was fenced using wooden poles planted 4m apart, how many poles were used to complete the fence?

(b) Calculate the amount of money spent on buying the poles used to fence the garden if each pole costs sh.2500.

12. A man constructed a hut of diameter 35m. He used wooden poles to put up the walls, poles placed $\frac{2}{3}$m apart.

(a) How many poles did he use to put up the hut?

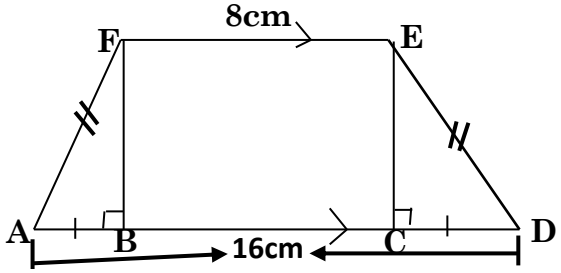
(b) If each pole costs sh. 2000, how much did he spend on all the poles?

13. A rectangular piece of land measuring 140 cm by 60 cm is to be enclosed by a fence made up of fencing poles and wires. If the interval between the poles is 8 m.

(a) How many poles are needed altogether?

(b) If the wire is fixed in four strands at different heights, what is the total length of the wire?

14. Study the figure below and use it to answer the questions that follow

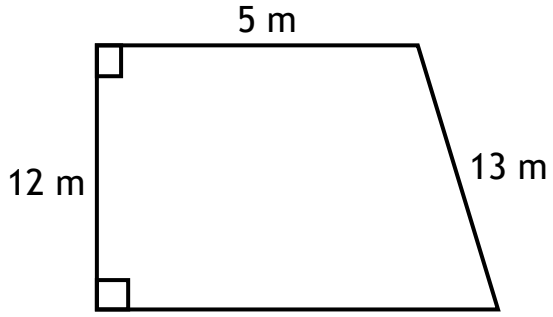


(a) Find the length of BF.

(b) If each plot of land was cleared for sh.600, how much money was spent on clearing the whole land?

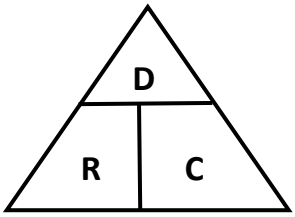
15. The shape below shows a flower garden which was fenced using poles at intervals of 3m apart, how many poles were used to complete the fence.

s



REVOLUTIONS

When a wheel goes around once, it covers a distance equal to its circumference. The distance is referred to as a revolution
One revolution is equal to circumference



Distance/ length = R x C

Revolutions = $\frac{Distance}{Circumference}$

Circumference = $\frac{Distance}{Revolutions}$

1. A wheel of diameter 35cm makes 50 revolutions. What distance does it cover? (Take Π = $\frac{22}{7}$)

   C = πD

   = $\frac{22}{7}$ X 35cm

   = 22 x 5cm

   = 110cm

   Distance = R x C

   = 50 x 110cm

   = 5500cm

2. A bicycle wheel covered a distance of 2640cm after making 20 revolutions. What was the radius of the bicycle wheel?

   Circumference = $\frac{Distance}{Revolution}$

   = $\frac{2640}{20}$

   = 132cm

   2πR = C

   2 x $\frac{22}{7}$ x R = 132cm

   $\frac{44R}{7}$ = 132cm

   R = 132cm x $\frac{7}{44}$

   $R = 3cm\ x\ 7$

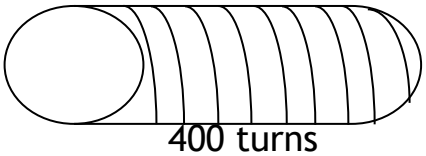
   R = 21cm

3. A wheel made 1000 revolutions and covered a distance of 660m. What was the diameter of the wheel in cm?
4. A tyre has a diameter of 70cm. How many revolutions will it make to cover a distance of 22km?
5. Work out the number of complete revolutions a wheel of a bicycle whose radius is 35cm can make to cover a distance of 88 metres. (Take Π = $\frac{22}{7}$)
6. A wheel covered a distance of 26.4m if its diameter was 42cm, how many revolutions did it make?
7. A boy rolled a wheel to another boy. The wheel had a diameter of 49cm. If the wheel made 200 revolutions, how far where the two boys? (Take pi as $\frac{22}{7}$)
8. A wheel has a radius of 21cm. If it makes 200 revolutions, what distance does it cover in metres?
9. A wheel has a radius of 28cm. What distance in km does it cover in 500 revolutions?
10. A wheel covers a distance of 66m after making 10 revolutions. What is the radius of the wheel?
11. The wheel of a lorry has a radius of 63cm. What distance in km does the wheel cover when it makes 2000 revolutions?
12. How many complete revolutions can a wheel of diameter 70cm make to cover a distance of 176 meters?
13. A wire of length 176m is wound round a tin 800 turns.
    (a) Workout the diameter of the tin.
    (b) Calculate the area of the circular parts of the tin.

14. A wheel of diameter 140cm made 1000 revolutions in 40 minutes. What was the speed of the wheel in km/hr?

MORE ABOUT CIRCUMFERENCE(REVOLUTIONS)

1. A wire of length 352 m is wound round a tin 400 times. Find the diameter of the tin.



1m = 100 cm

352m = (352 x 100) cm
= 35,200 cm

1 revolution = $\frac{35200}{400}$

= 88 cm

Circumference = Distance in 1 revolution

$\pi d = C$

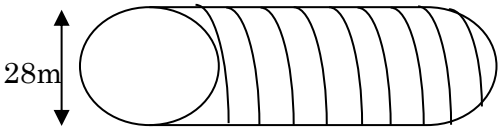
$\frac{22}{7}d = 88cm$

$d = 88 \times \frac{7}{22}$ cm

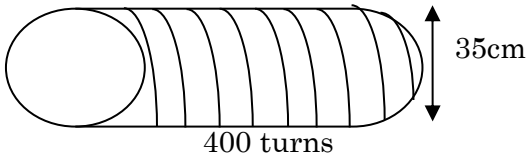
$\therefore$ d = 28cm

2. A bicycle wheel has a radius of 14 dm.
(a) What distance can it cover in one complete revolution?
(b) What distance can it cover in 10 revolutions?

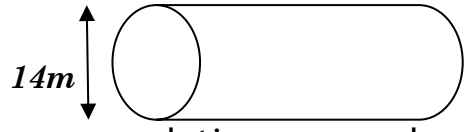
3. The distance from town M to town N can be covered by a wheel of diameter 35cm in 100 revolutions. What is the distance between M and N?
4. Find the length of the wires wound round the cylinders shown in the diagrams below



300 turns



5. A thread is wound round a cylindrical tin 20 times. Calculate the length of the thread used if the radius of the tin is 7dm.
6. A wire has a length of 176m. Find the number of turns it can be wound round the tin below

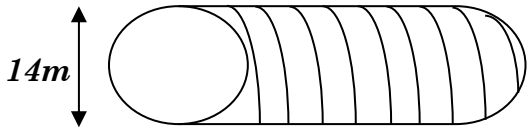


7. How many revolutions can a wheel of 70 cm diameter make if it covers a distance of 88 km?

8. The length of a wire wound round a tin is 88 cm. Find the diameter of the tin. Use $\pi = \frac{22}{7}$

20 turns

9. Find the length of a wire wound round the cylinder in the diagram.

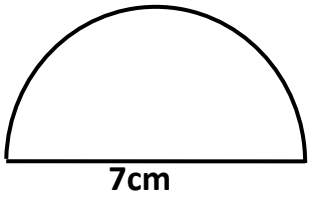


800 turns

FINDING PERIMETER OF PARTS OF A CIRCLE

Perimeter is the total distance around the figure

1. Find the perimeter of the figure below



Fraction = $\frac{\theta}{360} = \frac{180}{360} = \frac{1}{2}$

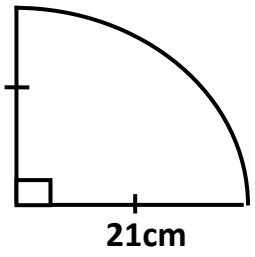
$P = \frac{1}{2} \times \pi D + D$

$= \frac{1}{2} \times \frac{22}{7} \times 7cm + 7cm$

$= 11cm + 7cm$

$= 18cm$

2. Find the perimeter of the figure below



Fraction = $\frac{\theta}{360} = \frac{90}{360} = \frac{1}{4}$

$C = \frac{1}{4} \times 2\pi R$

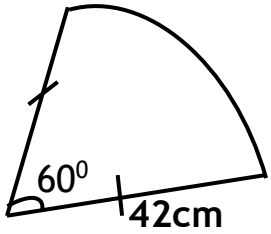
$= \frac{1}{4} \times 2 \times \frac{22}{7} \times 21cm$

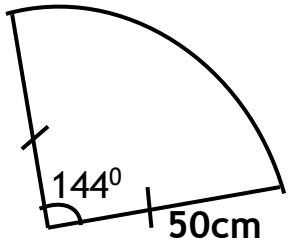
$= 33cm$

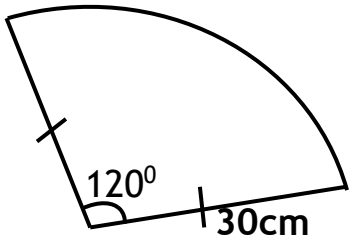
P = C + R + R

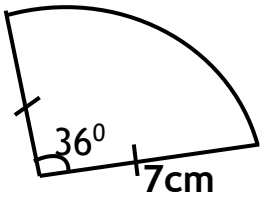
= 33cm + 21cm + 21cm

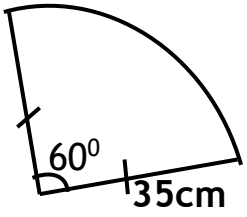
3. Find the perimeter of the following figures

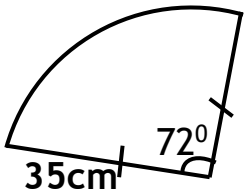


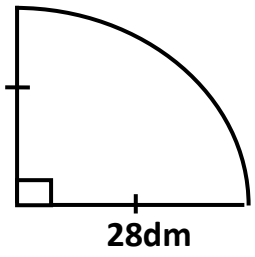


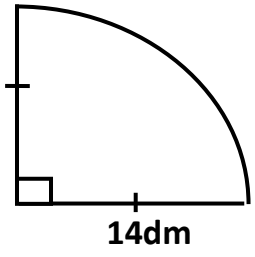


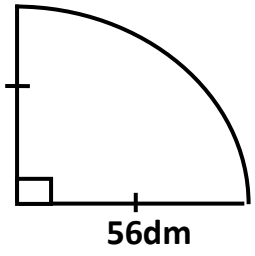


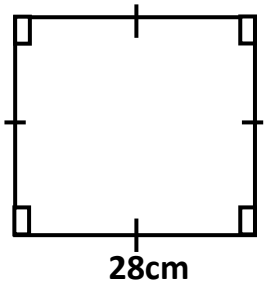


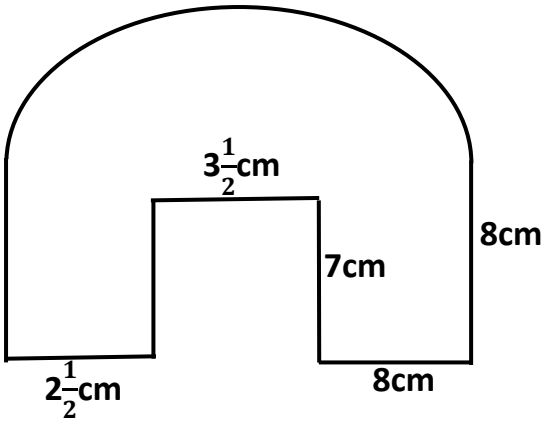


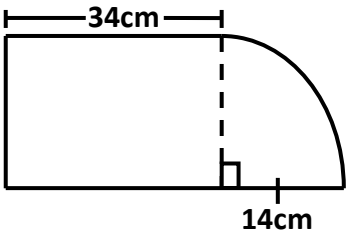


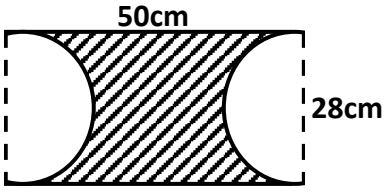


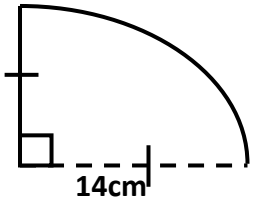


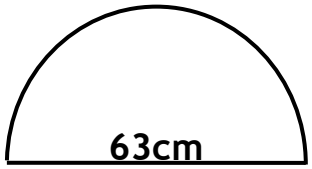


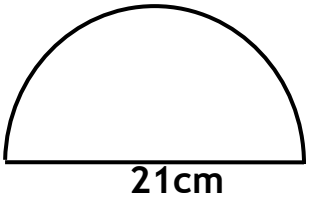






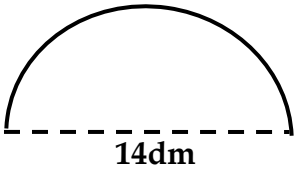




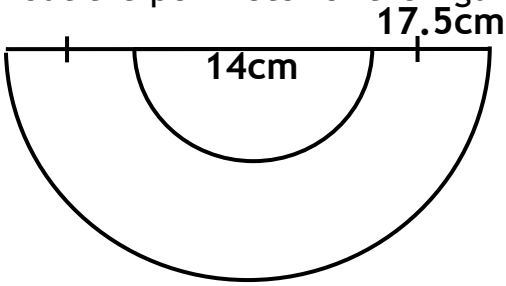


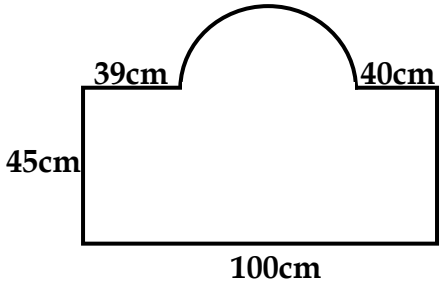
Below is an athletic track. If Kato ran round the track $7\frac{1}{2}$ times. What distance in metres did he cover

7. Work out the circumference of the figure below.



Work out the perimeter of the figures below





AREA OF CIRCLES

Area of the circle = πr^2

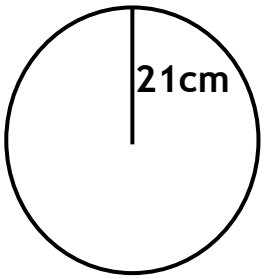
Area of the semi-circle = $\frac{1}{2}\pi r^2$

Area of the quadrant = $\frac{1}{4}\pi r^2$

Area of the three-quarter circle = $\frac{3}{4}\pi r^2$

If the diameter is given, first find the radius and then find the area.

1. Find the area of the circle whose radius is 21cm.



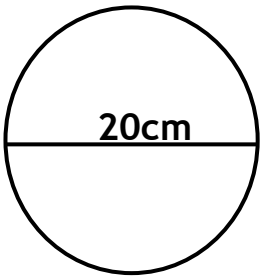
A = πr^2

= $\frac{22}{7}$ x 21cm x 21cm

= 22 x 3cm x 21cm

= 1386cm^2

2. Find the area of the circle whose diameter is 20cm.



R = D ÷ 2 = 20cm ÷ 2 = 10cm

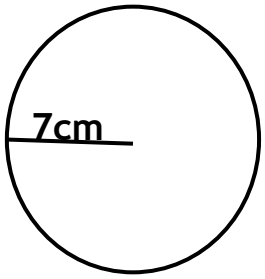
A = πr^2

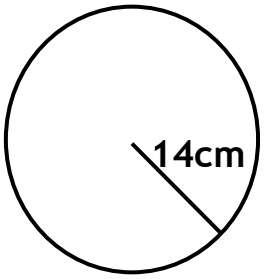
= $\frac{3.14}{100}$ x 10cm x 10cm

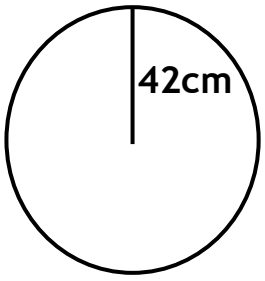
= 314cm^2

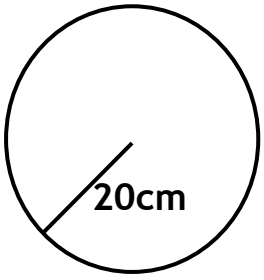
Exercise

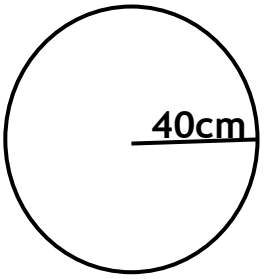
1. Work out the area of the following circles

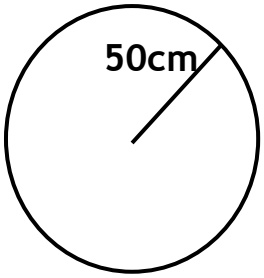


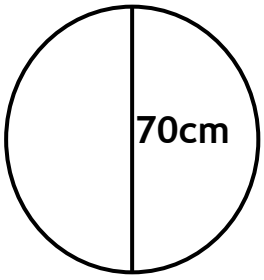


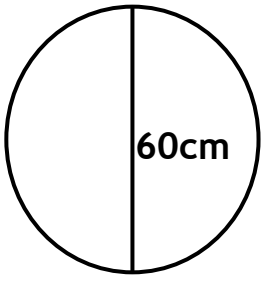


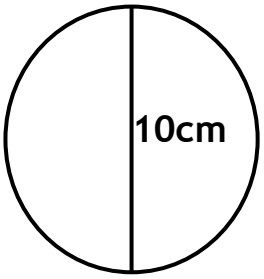


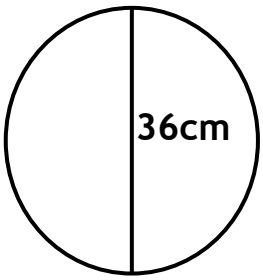


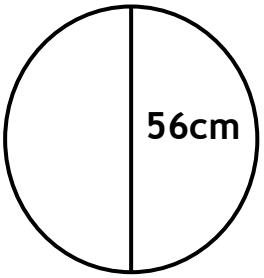


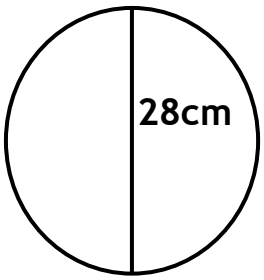




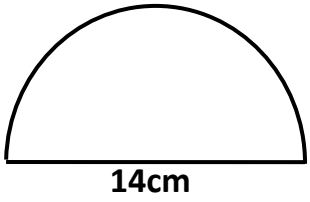


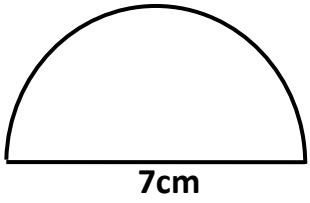


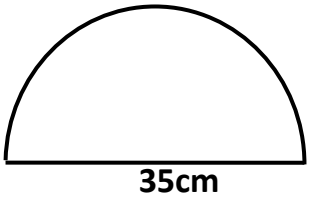


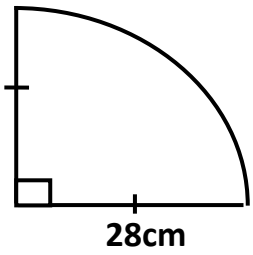


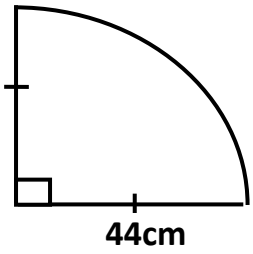
3. Find the area of the shapes below

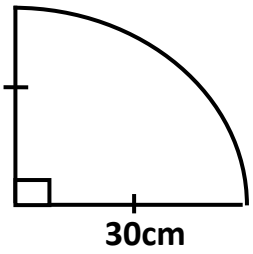


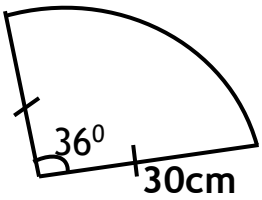


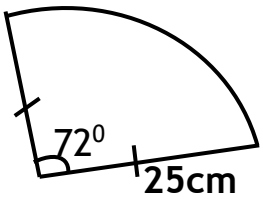


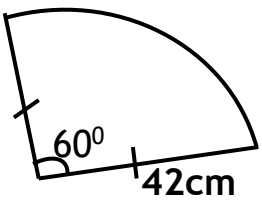


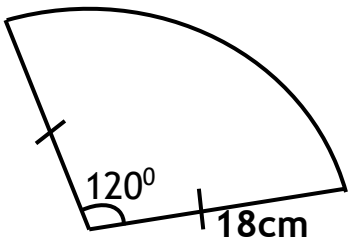


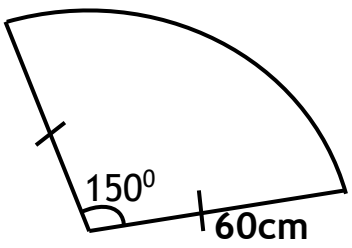












4. Find the area of a semi circle whose radius is 7cm.

5. Find the area of the quadrant whose radius is 40cm.

6. Find the area of a circle whose diameter is;

(a) 35cm	(b) 49cm	(c) 70cm
(d) 140cm	(e) 28cm	(f) 18cm

7. A minute hand of 21 cm length covers 20 minutes. What distance does its tip cover?

8. What distance is covered by a minute hand of the city clock of 70 cm length after covering a period of 12 minutes?
9. What distance is covered by an hour hand of 28 cm length after covering 9 hours?
10. An hour hand of 21 cm length covers 2 hours. What distance does its tip cover?

Finding the area of a circle given circumference

1. Find the area of a circle whose circumference is 44cm.
2. Find the area of a circle whose circumference is 176cm
3. Find the area of a circle whose circumference is 220cm
4. Find the area of a circle whose circumference is 308cm
5. Find the area of a circle whose circumference is 11cm
6. Find the area of a circle whose circumference is 264cm
7. Find the area of a circle whose circumference is 132cm
8. Find the area of a circle whose circumference is 440cm
9. Find the area of a circle whose circumference is 88cm
10. Find the area of a circle whose circumference is 440cm
11. Find the area of a circle whose circumference is 264cm
12. Find the area of a circle whose circumference is 396cm

Finding radius, diameter, when circumference if given.

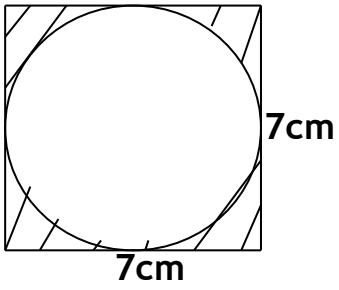
1. The area of a circle is 616cm^2.
   (a) Find its radius.
   $\pi R^2 = A$
   $\frac{22}{7} \times r^2 = 616$
   $\frac{22R2}{7} = 616$
   $R^2 = 616 \times \frac{7}{22}$
   $R^2 = 196cm$
   $R = 14cm$

   (b) Find its diameter
   $D = 2R$
   $= 2 \times 14cm$
   $= 28cm$
   (c) Calculate its circumference
   $C = \pi D$
   $= \frac{22}{7} \times 28cm$
   $= 88cm$

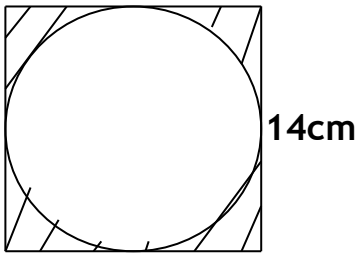
2. Find the radius, diameter and circumference of a circle whose area is;
   (a) 314cm^2 (b) 3850cm^2 (c) 2464cm^2
   (d) 2826cm^2 (e) 5024cm^2 (f) 706.5cm^2
   (g) $38\frac{1}{2}$ cm^2 (h) $346\frac{1}{2}$ cm^2 (i) 200.96cm^2
   (j) 12.56cm^2

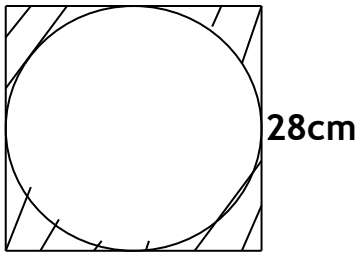
Find area of the shaded parts.

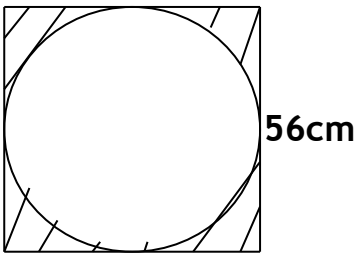
1. Find the area of the shaded part below

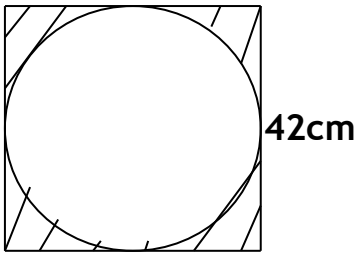


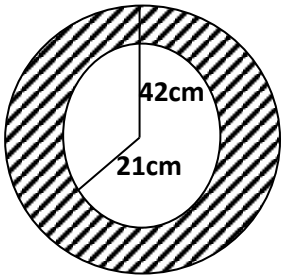
2. What is the area of the shaded regions below?

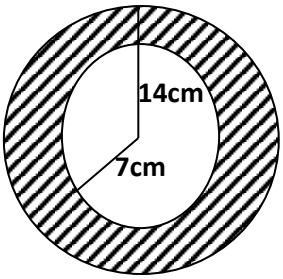


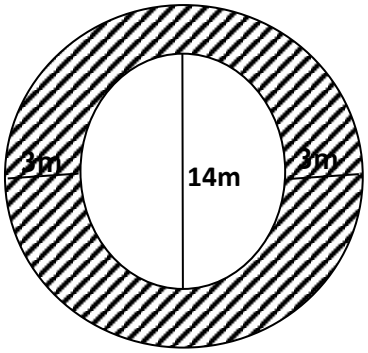


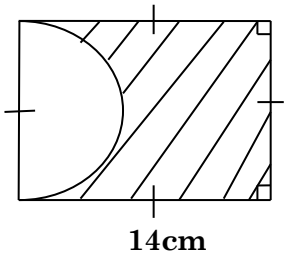


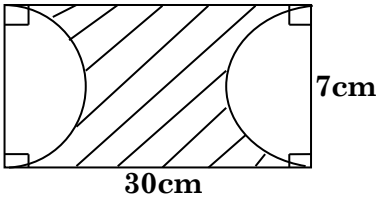


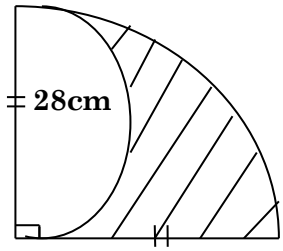


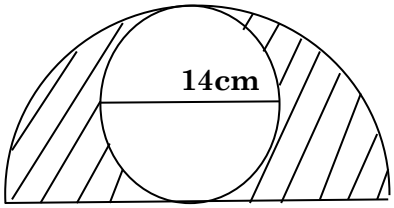


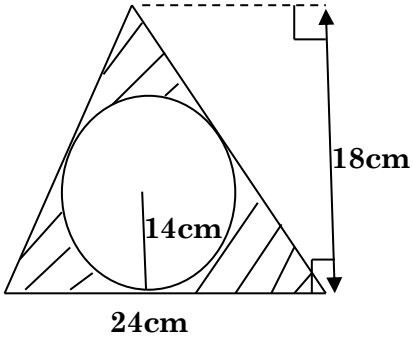


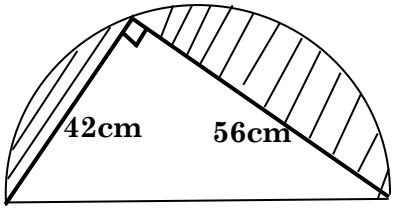


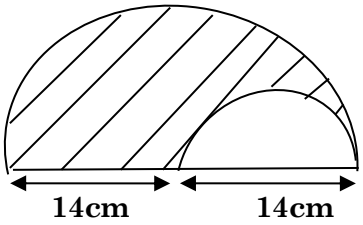


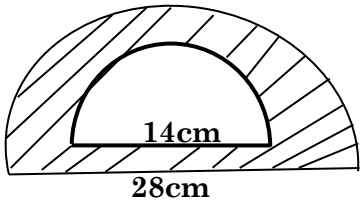


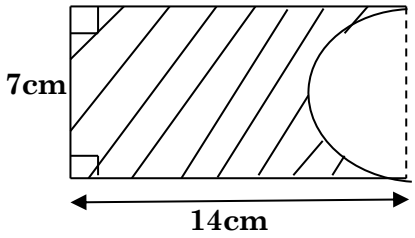






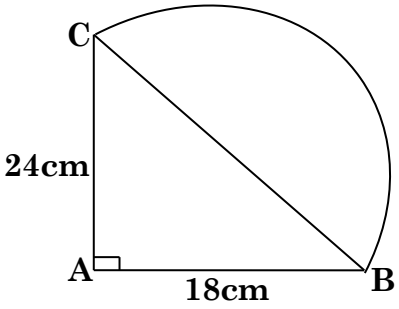






Finding area of the combined shapes

1. Find the area of the figure below



$AC^2 + AB^2 = BC^2$

$24^2 + 18^2 = BC^2$

$576 + 324 = BC^2$

$900 = BC^2$

30cm X 30cm = BC x BC

30cm = BC

Area of a triangle

$= \frac{1}{2}bh$

$= \frac{1}{2}$ x 18cm x 24cm

= 9cm x 24cm

$= 216cm^2$

Area of a semi-circle

$= \frac{1}{2}\pi r^2$

$= \frac{1}{2}$ x $\frac{314}{100}$ x 15cm x 15cm

= 157cm x 9cm

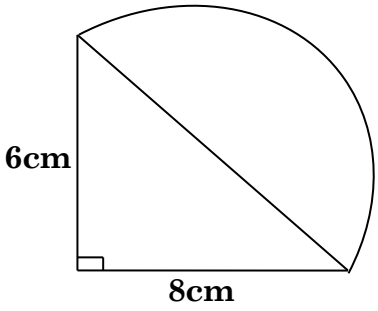
$= 353\frac{1}{4}\ cm^2$

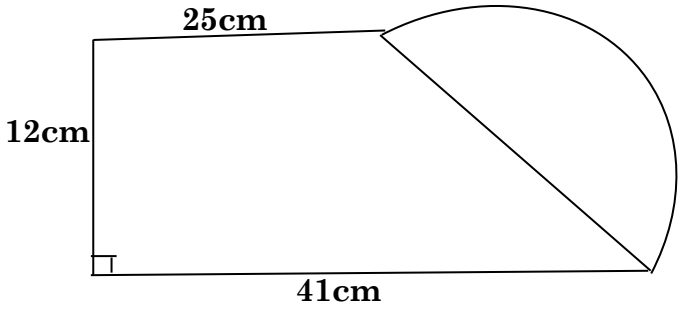
Area of the figure

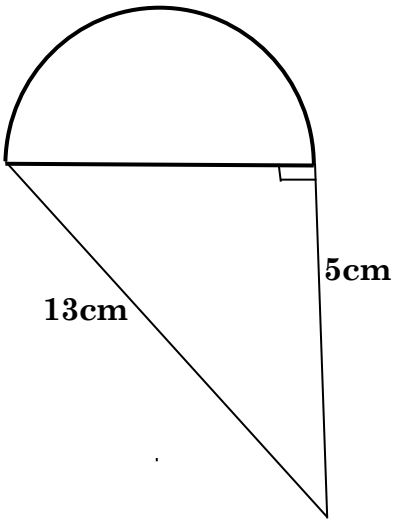
$= 216cm^2 + 353\frac{1}{4}\ cm^2$

$= 569cm^2$

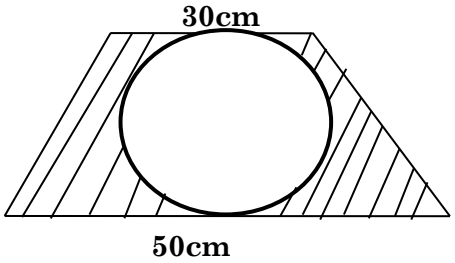
2. Work out the area of the shapes below







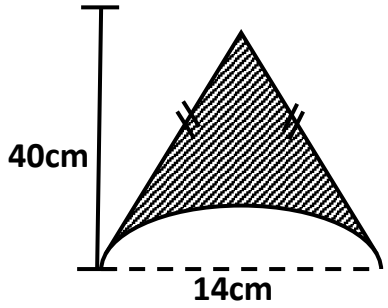
3. Below is a circle enclosed in a trapezium. Use it to answer the questions that follow



(a) If the area of a trapezium is 1120cm^2. Calculate the diameter of a circle.

(b) Find the area of the shaded part

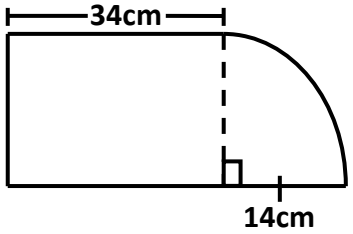
7. Below is a semi-circle enclosed in a triangle. Use it to answer the questions that follow



(a) If the area of the triangle is 560dm^2. Find the diameter of the semi-circle.

(b) Find the area of the shaded part

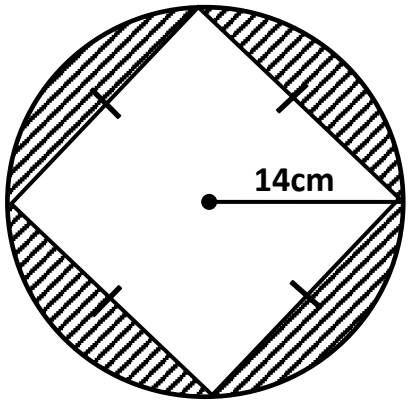
15. The figure below is made up of a rectangle and a quadrant. Use it to answer the questions that follow.



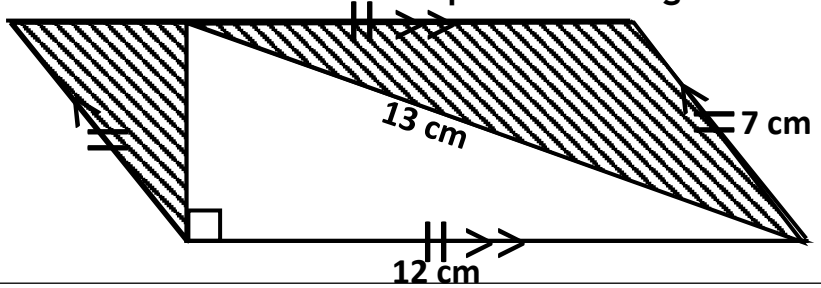
(a) Workout the area of the above figure

(b) Calculate its perimeter.

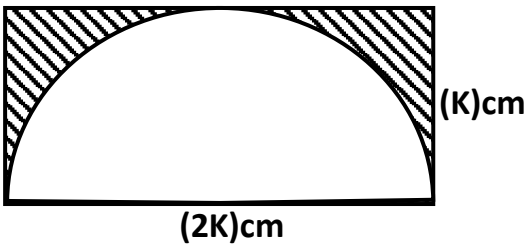
16. Find the area of the shaded part in the figure below.



17. Work out the area of the shaded part in the figure below;



18. The diagram below shows a semi-circle enclosed in a rectangle. Study it and use it to answer the following questions. (Take π as $\frac{22}{7}$)

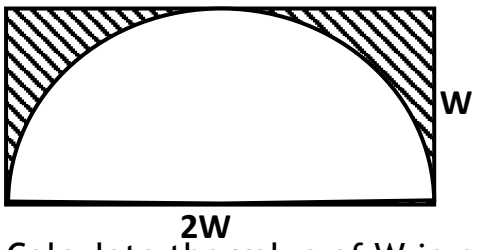


If the area of the shaded part is 84 cm^2,

(a)Find the value of K.

(b)Work out the area of the semi-circle.

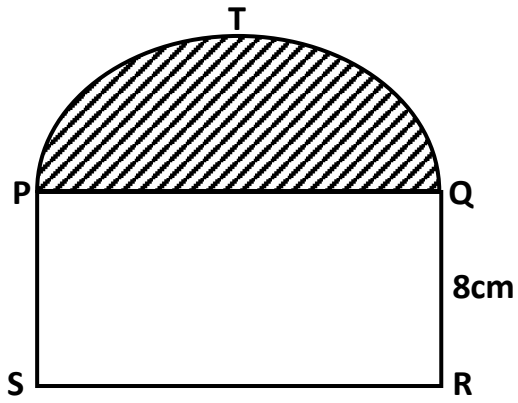
19. The figure below shows a semi-circle enclosed in a rectangle. Study it and use it to answer the questions about it. Given that the area of the shaded region is 21cm^2.



(a) Calculate the value of W in cm. (Take π = $3\frac{1}{7}$)

(b) Work out the area of the semi-circle.

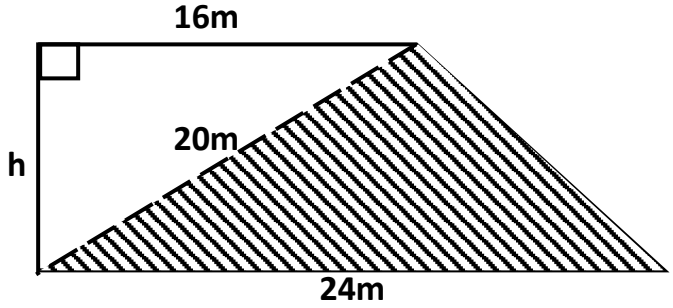
20. In the figure below, PQRS is a rectangle connected to a semi-circle PQT. Given that the area of the shaded part is 77 cm^2.



(a)Find the length RS of the rectangle.

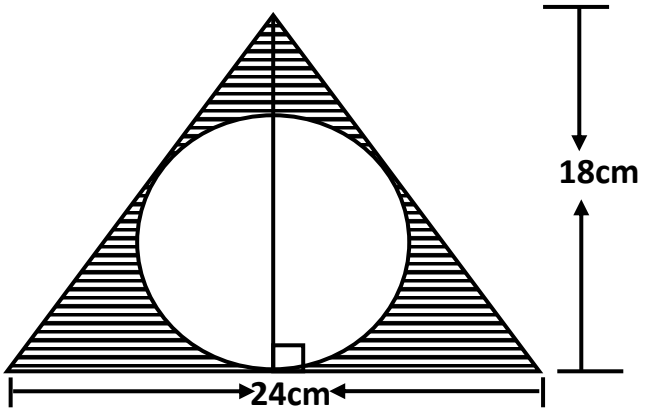
(b)Work out the area of the figure PQRS.

21. The figure below has a trapezoidal piece of cloth.



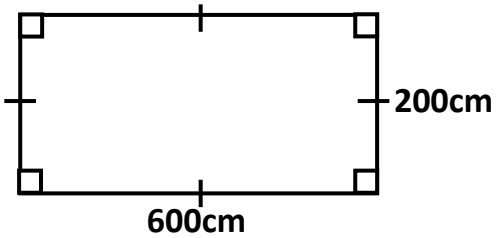
(a) Calculate the height h
(b) Work out the area of the trapezoidal piece of cloth.
(c) Find the area of the shaded part.

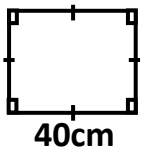
22. The area of the shaded part in the figure below is 62 cm^2. Find the radius of the circle.



Comparing area of different shapes

1. A rectangular floor measures 600cm by 200cm. How many square tiles 40cm by 40cm are required to cover the floor?





Number of tiles = $\frac{l}{l}$ x $\frac{w}{w}$

= $\frac{600}{40}$ x $\frac{600}{40}$

= 15 x 5

= 75 tiles

2. Peter cut out circular plates of diameter 14cm from a rectangular sheet of metal of length 80cm and width 50cm.

(a) How many circular plates did he cut out?

Number of circular plates

$= \frac{L}{D} \times \frac{W}{D}$

$= \frac{80}{14} \times \frac{50}{14}$

$= 5 \times 3$

$= 15$ plates

(b) Find the area of un used sheet after cutting out the circular plates.

$A = L \times W$

$= 80cm \times 50cm$

$= 4000cm^2$

$A = \pi r^2 \times$ Number of plates

$= \frac{22}{7} \times 7 \times 7 \times 15$

$= 22 \times 7 \times 15$

$= 2310cm^2$

Area left $= 4000cm^2 - 2310cm^2$

$= \underline{1690cm^2}$

3. A rectangular floor measures 5m by 3m. How many squares of 30cm are required to cover the floor?

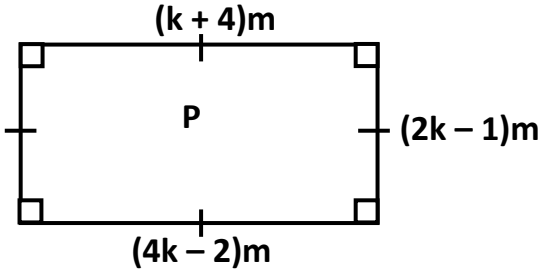
4. A rectangular floor measures 900cm by 500cm. How many square tiles of 50cm by 50cm are needed to cover the floor?

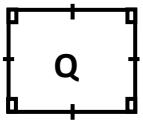
5. Sandra cut circular plates of radius 21cm from a rectangular sheet metal of length 10m by 8m

(a) How many circular plates did she cut out?

(b) Find the area of the un used sheet after cutting out the circular plates.

6. A rectangular sitting room (P) is to be covered with square tiles (Q) of area $400cm^2$ each. If each box contains 25 tiles, how many boxes are required?



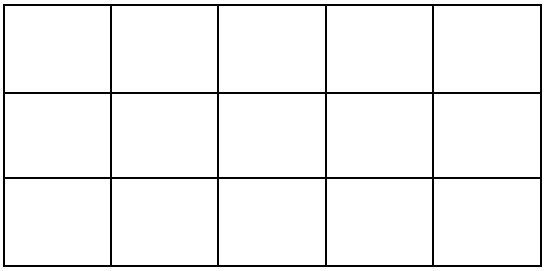


7. A rectangular manilla measures 40cm by 30cm. A teacher cut out circular cards of diameter 3.5cm.

(a) How many circular cards did the teacher cut?

(b) Find the area of the un used sheet after cutting out the circular cards.

8. Study the figure below and use it to answer the questions that follow



(a) If the area of each square is $36cm^2$. Find the area of the whole figure

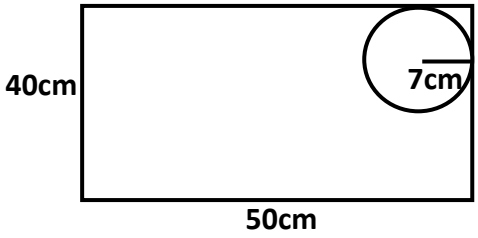
(b) Work out the perimeter of the figure.

9. Bruno prepared a rectangular dough of 75cm by 50cm. If he cut out pancakes of radius 7cm.

(a) How many pancakes did he cut out?

(b) Calculate the area of the remaining dough.

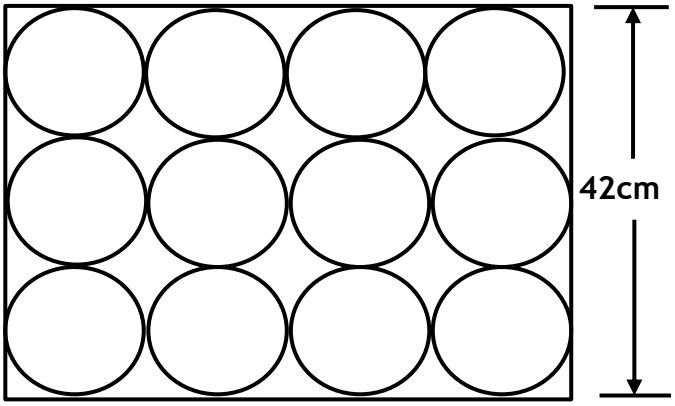
10. Circular cards of radius **7cm** were cut out of the rectangular sheet of paper as shown below.



(a) How many circular cards will be cut from the sheet?

(b) Calculate the area of the sheet which was not used.

10. Calvin cut out circular cards from a rectangular manilla paper whose width is 42 cm as shown in the diagram below. Study the diagram and answer the questions that follow.



(a) Find the length of the manilla paper.

(b) Calculate the area of the pieces of the manilla paper that remained

11. Omule made 20 circular pancakes from a rectangular dough such that he got 5 along the length and 4 along the width. If the total area of all the cut outs pancakes was 770 cm^2,

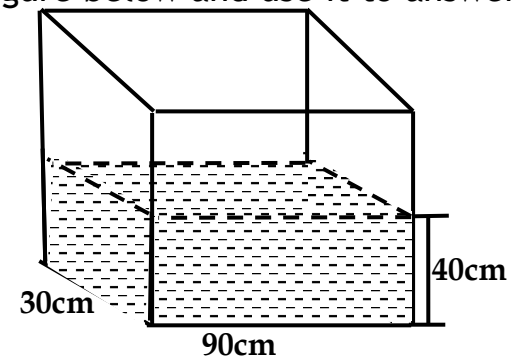
(a) What was the diameter of each pancake?

(b) Find the total area of the rectangular dough before making the pancakes.

(c) How many full pancakes can be obtained from the dough that remained?

MORE ABOUT VOLUME OF CUBOIDS

1. Study the figure below and use it to answer the questions that follow.



(a) If the container is $\frac{2}{5}$ full of water, find the volume of the container when completely full.

Volume of water in the tank

Vol = L x W x H

= 90cm x 30cm x 40cm

= 108000cm^3

Volume of full container

$\frac{2}{5}$ of y = 108000

5 x $\frac{2y}{5}$ = 108000 x 5

2y = 108000 x 5

y = $\frac{108000\ x\ 5}{2}$

y = 54000 x 5

y = 270000cm^3

(b) Find the height of the water needed to make the container full.

$\frac{2}{5}$ x y = 40

$\frac{2y}{5}$ = 40

$y = \frac{40\ x\ 5}{2}$

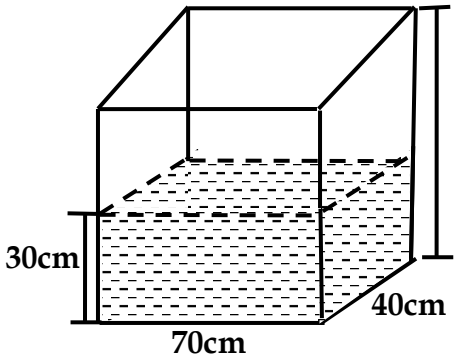
$y = 100cm$

Height needed = 100cm – 40cm

= 60cm

2. Study the figure below and use it to answer the questions that follow

If the container is $\frac{1}{3}$ full of water;

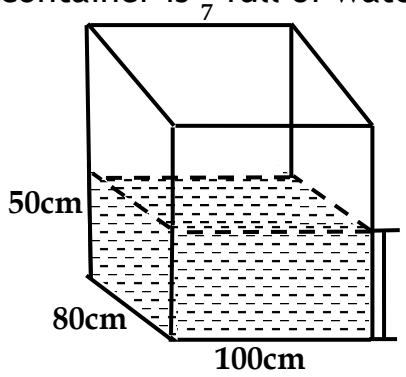


(a) Find the volume and capacity of the full container

(b) Find the height of the full container.

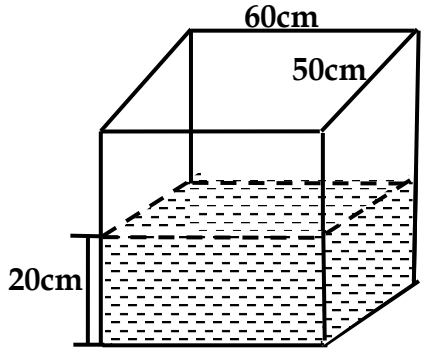
(c) Find the height of the water needed to fill the container

3. Study the figure below and use it to answer the questions that follow
   If the container is $\frac{2}{7}$ full of water;



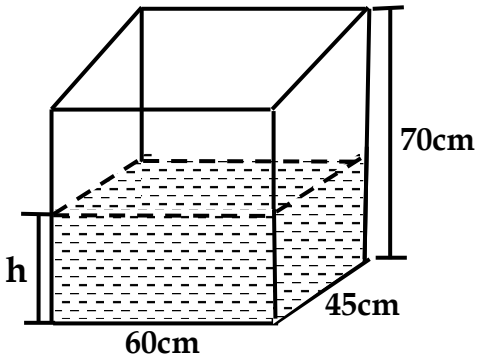
   (a) Find the volume and capacity of the full container
   (b) Find the height of the full container.
   (c) Find the height of the water needed to fill the container

4. Study the figure below and use it to answer the questions that follow
   If the container is $\frac{1}{4}$ full of water;



   (a)Find the volume and capacity of the full container
   (b) Find the height of the full container.
   (c) Find the height of the water needed to fill the container

5. Study the figure below and use it to answer the questions that follow.



   (a) Given that the tank contains **135 litres** of water. Find the value of **h**.

   (b) Find the capacity of the tank when completely full of water.

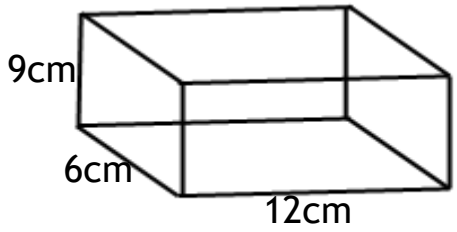
VOLUME AND CAPACITY OF A CUBE

1. The volume of a cube is 27000cm3. Find the length of each side
2. Find the side of a cube whose volume is 8000cm^3.
3. Find the side of a cube whose volume is 1000cm^3.
4. Find the side of a cube whose volume is 64000cm^3.
5. Find the side of a cube whose volume is 125000cm^3.
6. Find the side of a cube whose volume is 216000cm^3.

FINDING THE TOTAL LENGTH OF CUBOIDS AND CUBES

Examples

1. Below is a cuboid made using a wire. Find the length of the wire that was used.



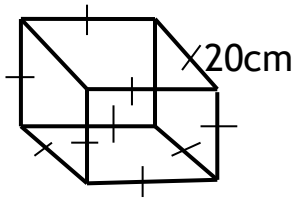
Total length = Length of all edges

= (12cmx4) + (6cmx4) + (9cmx4)

= 48cm + 24cm + 36cm

= 108cm

2. A string was used to make a cube below. Find the length of the string



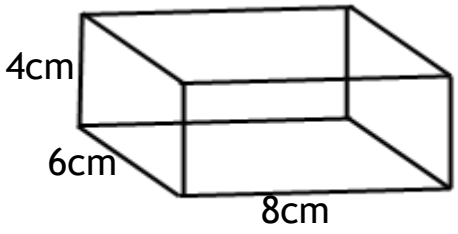
Total length used = S x 12

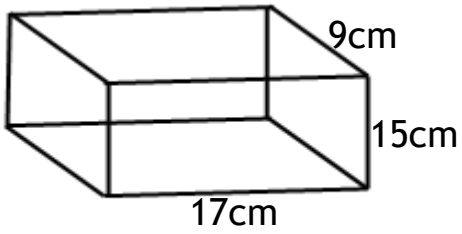
= 20cm x 12

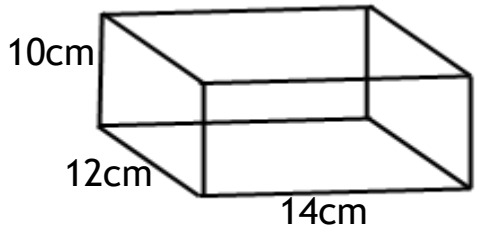
= 240cm

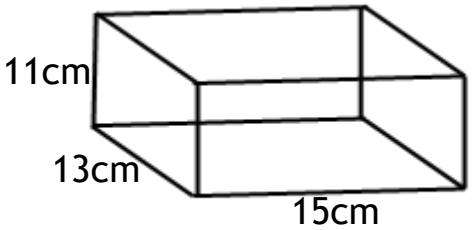
Exercise

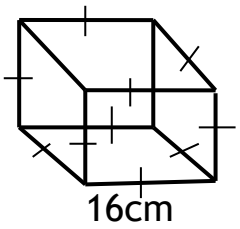
1. Find the total length of the shapes below

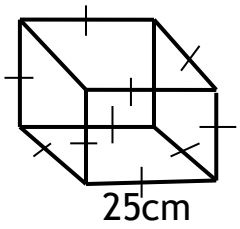


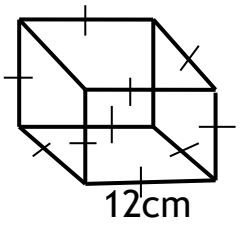




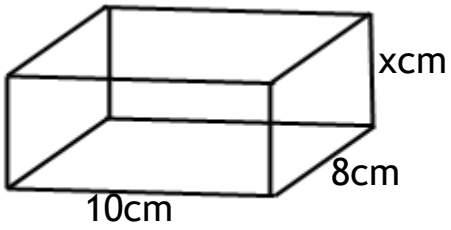




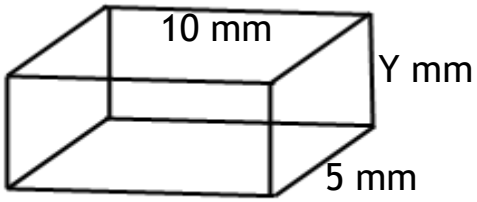




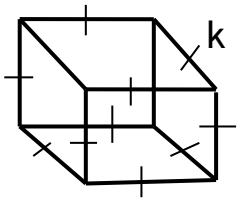
2. The total lengths of all the edges of a rectangular box below is 96cm. Find the length of edge x



3. The total edges of the all of the edges of the cuboid below is 72mm. Find the value of y



4. The total length of edges of a cube below is 36cm. Find the value of k

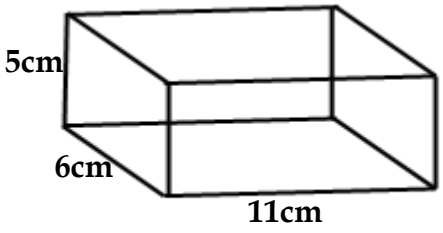


TOTAL SURFACE AREA OF CUBOIDS AND CUBES

Total surface area of an object is the total area of the faces that make up an object.

A closed cuboid or cube has 6 faces and an open cube or cuboid has 5 faces.

1. Find the total surface area of the cuboid below



T.S.A = 2(LxW) + 2(LxH) + 2(WxH)

= 2(11x6) + 2(11x5) + 2(6x5)

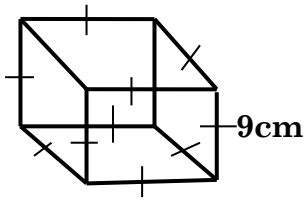
= 2(66) + 2(55) + 2(30)

= (2x66) + (2x55) + (2x30)

= 132 + 110 + 60

= 302cm^2

2. Find the total surface area of the closed cube whose side is 9cm each.



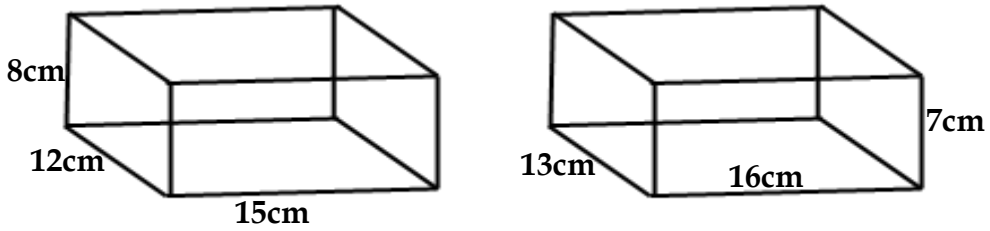
T.S.A = $6S^2$

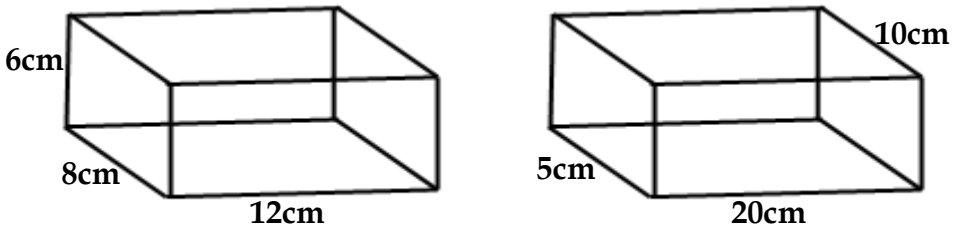
= 6 x S x S

= 6 x 9cm x 9cm

= $486cm^2$

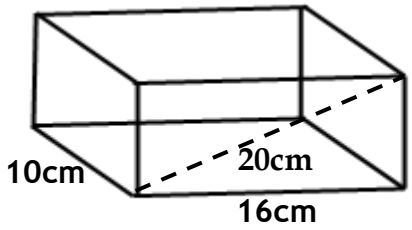
3. Find the Total Surface Area of the following figures



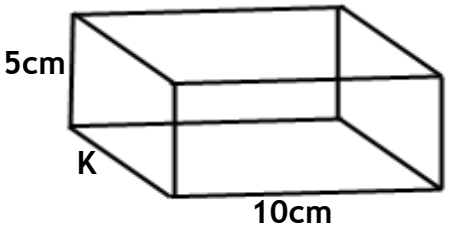


4. Find the total surface area of a closed cube whose side measure 12cm.
5. Find the total surface area of a closed cube whose side measure 6cm
6. Find the total surface area of a closed cube whose side measure 10cm
7. Find the total surface area of a closed cube whose side measure 25cm
8. Find the total surface area of a closed cube whose side measure 8m
9. A closed cube has a total surface area of $600cm^2$. Find the length of one side of the cube.
10. An open cube has a total surface area of $180cm^2$. Find the length of one of its sides.
11. A closed cube has a total surface area of $600cm^2$. Find the length of one side of the cube.
12. An open cube has a total surface area of $125cm^2$. Find the length of one side of the cube.
13. A closed cube has a total surface area of $150cm^2$. Find the length of one side of the cube.

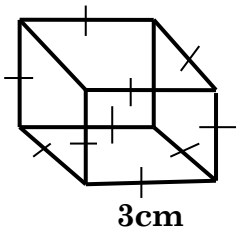
14. The figure below shows a cuboidal container holding water. Calculate its Total Surface Area

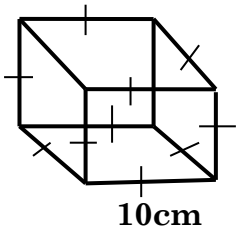


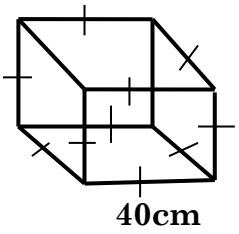
15. The total surface area of the cuboid below is 280cm^2. Find its volume



16. Calculate the total surface area of the following figures





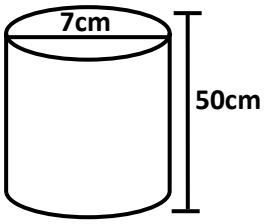


VOLUME AND CAPACITY OF A CYLINDER

A cylinder has a circular base and its volume is given by the area of the cross-sectional area and its height.

Examples

1. Find the volume and capacity of the cylinder below



$V = \pi r^2$

$= \frac{22}{7}$ x 7cm x 7cm x 50cm

$= (22 \times 7 \times 50)\ cm^3$

$= 7700cm^3$

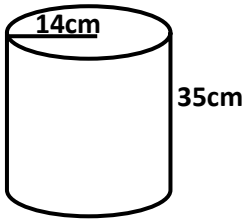
Capacity = $\frac{\text{Volume}}{1000cm^3}$

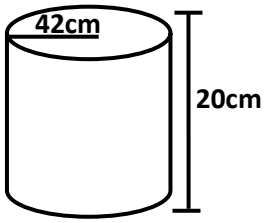
$= \frac{7700cm^3}{1000cm^3}$

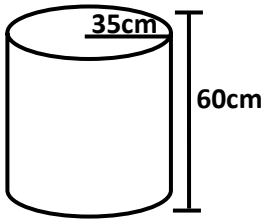
= 7.7 litres

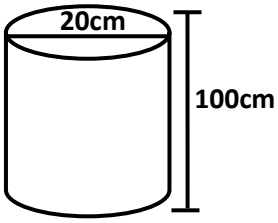
Exercise

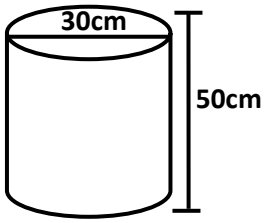
1. Find the volume and capacity of the cylindrical milk can whose radius is 21cm and height 40cm.
2. Find the volume and capacity of the cylindrical tins below

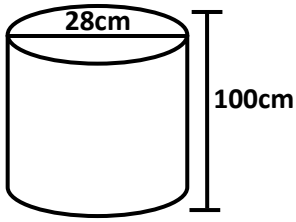






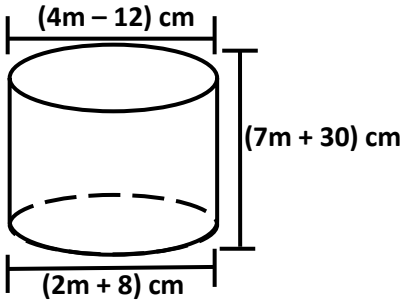


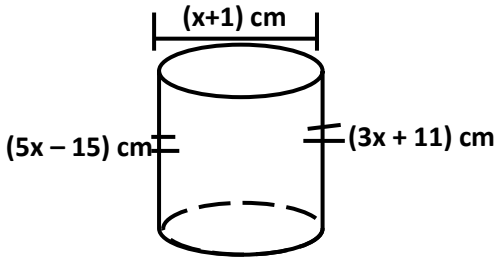




3. Find the volume and capacity of the cylindrical tin whose diameter is 21cm and height 30cm.

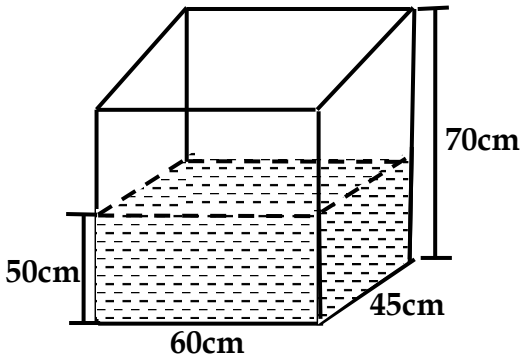
4. Find the volume and Total Surface Area of the following figures





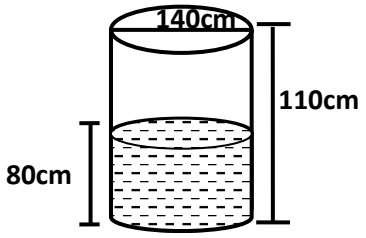
5. Find the volume and capacity of the cylindrical container whose radius is 20cm and height 40cm.
6. Find the volume and capacity of the cylindrical container whose radius is 7cm and height 14cm.
7. A cylindrical water tank has a radius of 50cm and height 100cm.
   (a) Find its volume.
   (b) How many litres of water can it hold when completely full?
8. A cylindrical container has a radius of 14cm and length 23cm.
   (a) Find its volume.
   (b) What is the capacity of the container when completely full?
   (c) Find the volume of a cylinder whose diameter is 42cm and the height is 34cm.

9. Study the figure below and use it to answer the questions that follow.



   (a) How many litres are in the tank?
   (b) How many litres are needed to completely fill the tank?
   (c) How many litres of water are needed to fill the above tank?

10. Study the cylindrical container below and use it to answer the questions that follow.

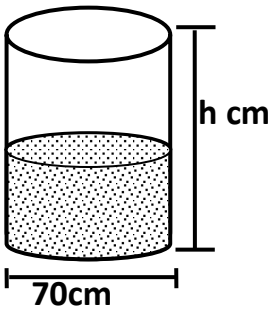


(a) How many litres of a liquid are in the container?
(b) How much liquid does a container hold when completely full?
(c) How many litres of the liquid are needed to completely fill the tank?

Finding height or radius when volume is given

1. Calculate the height of the cylinder whose volume is 1694cm3 and the radius is 7cm. (Take Π as $\frac{22}{7}$)
2. Find the radius of a cylinder whose volume is 62.8cm^3 and height is 5cm.
3. Find the height of the cylinder whose volume is 4928cm^3 and radius is 8cm
4. Find the height of the cylinder whose volume is 18018cm^3 and radius is 21cm
5. Find the height of the cylinder whose volume is 7536cm^3 and radius is 20cm
6. Find the height of the cylinder whose volume is 197.8cm^3 and radius is 3cm
7. Find the radius of a cylinder whose volume is 385cm^3 and height is 10cm
8. Find the radius of a cylinder whose volume is 14784cm^3 and height is 6cm
9. Find the radius of a cylinder whose volume is 22660.8cm^3 and height is 20cm
10. Find the radius of a cylinder whose volume is 706.5cm^3 and height is 9cm
11. A cylindrical container has a diameter of 28cm and height of 20cm. Find the height of the water that remains after removing 154cm^3 of water.

12. The capacity of the tank below is 308 litres when completely full of water. Study it and use it to answer the questions that follow.



(a) Find the value of **h**.

(c) How many litres does the tank hold when it's half full of water?

13. A school bought 5 tins of hand sanitizer whose radius 7cm and height 30cm.
(a) Calculate the capacity of hand sanitizer which was in the tins in litres.
(b) If the hand sanitizer was all poured into a rectangular tank whose base area is 231 cm^2, find the height of the sanitizer in the tank.
(c) What volume of water is needed to fill the tank completely?

MORE ABOUT THE VOLUME OF CYLINDERS

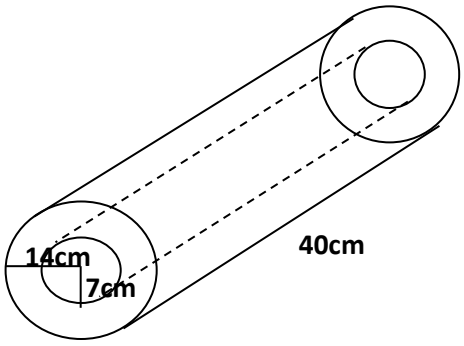
A **cylindrical hollow pipe** has two cylinders. The cylindrical space **(hole)** and the cylindrical material**(concrete).** To find the volume of the concrete, you find the volume of the whole cylinder whose radius is 14cm minus the volume of its cylindrical space whose radius is 7cm.

1. The figure below shows the cylindrical hollow pipe of concrete. Calculate the volume of concrete.

outer radius = 14 cm

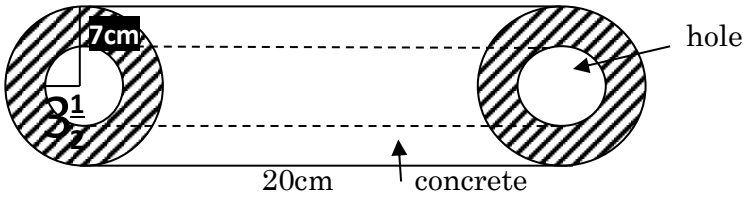
inner radius = 7cm

length of pipe = 40cm



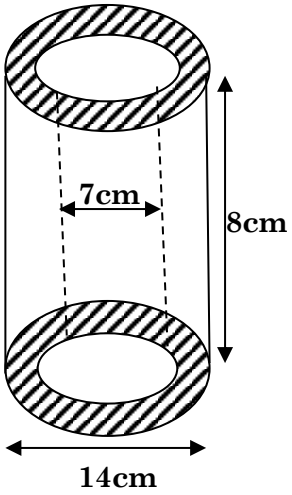
Volume of the outer cylinder	**Volume of inner cylinder**	**Volume of concrete**
$V = \pi r^2 h$	$V = \pi r^2 h$	Vol.of outer cyl–vol.of hole
$= \frac{22}{7} \times 14 \times 14 \times 40\ cm^3$	$= \frac{22}{7} \times 7 \times 7 \times 40\ cm^3$	2 4 6 4 0 cm^3
$= 22 \times 2 \times 14 \times 40\ cm^3$	$= 22 \times 7 \times 40\ cm^3$	- 6 1 6 0 cm^3
$= 24640\ cm^3$	**$= 6160\ cm^3$**	**1 8 4 8 0 cm^3**

2. Find the volume of the concrete in the cylinder below;

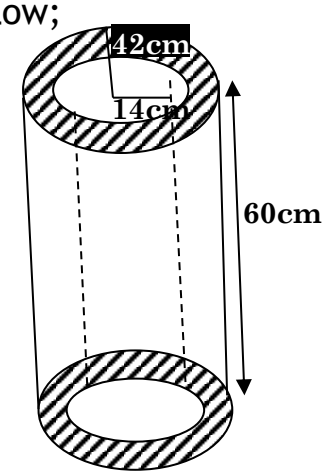


3. Find the volume of the concrete in cylinders below;

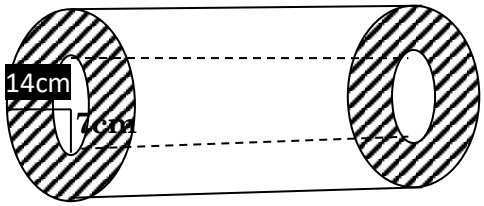
a



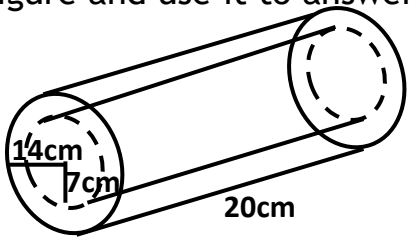
b.



c.



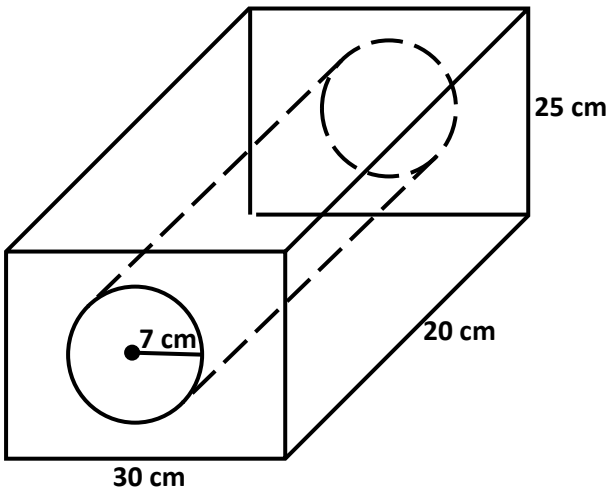
4. Study the figure and use it to answer the questions that follow.



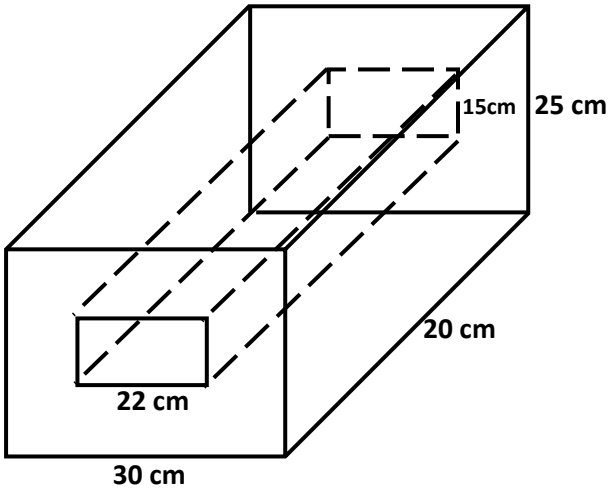
(a) Calculate the volume of the metal in the hallow metallic pipe.

(b) Calculate the **T.S.A** of the inner cylinder.

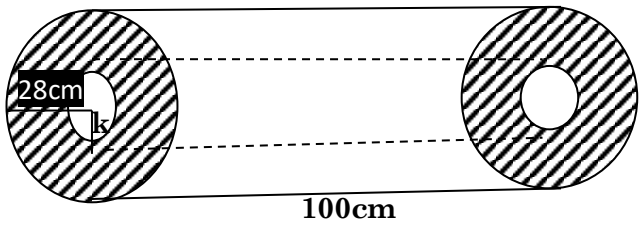
5. Find the area of the concrete in the figure below.



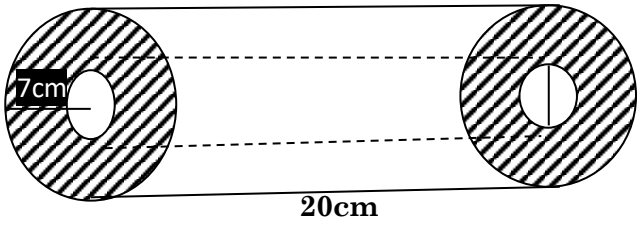
5. Find the area of the concrete below



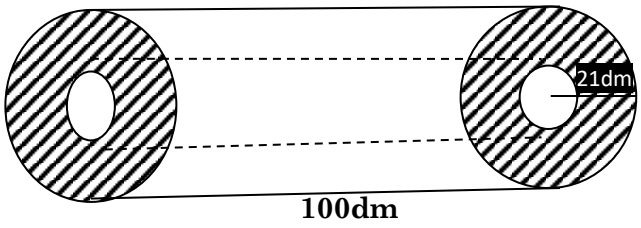
6. The volume of the concrete shown in the figure below is 184800cm^3. Find the length of the radius k.



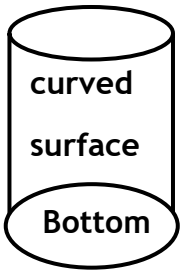
7. The volume of the concrete in the figure below is 3 times the volume of the inner cylinder. Find the value of diameter of the inner cylinder



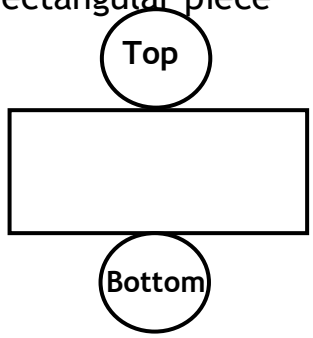
8. The volume of the concrete in the cylinder below is 77000dm^3. Find the radius of the concrete



TOTAL SURFACE AREA OF CYLINDERS



If a cylinder is cut and opened out. There would be two circular pieces and a rectangular piece

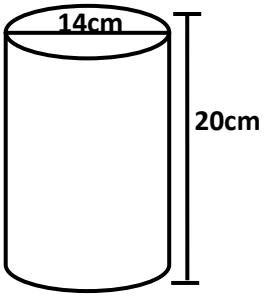


T.S.A of a closed cylinder = $\pi r^2 + 2\pi rh + \pi r^2$

Area of the curved surface = $2\pi rh$

T.S.A of the open cylinder = $\pi r^2 + 2\pi rh$

1. Find the total surface area of the closed cylinder below



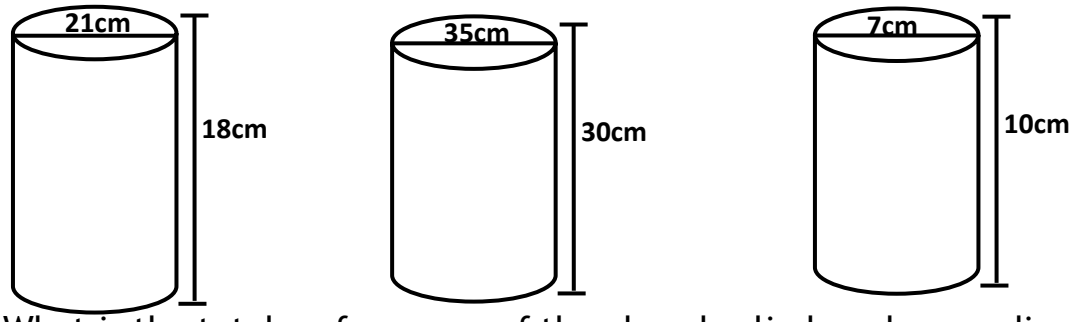
T.S.A = $\Pi r^2 + 2\Pi rh + \Pi r^2$

$=(\frac{22}{7} \times 7 \times 7) + (2 \times \frac{22}{7} \times 7 \times 20) + (\frac{22}{7} \times 7 \times 7)$

$= 154 + 880 + 154$

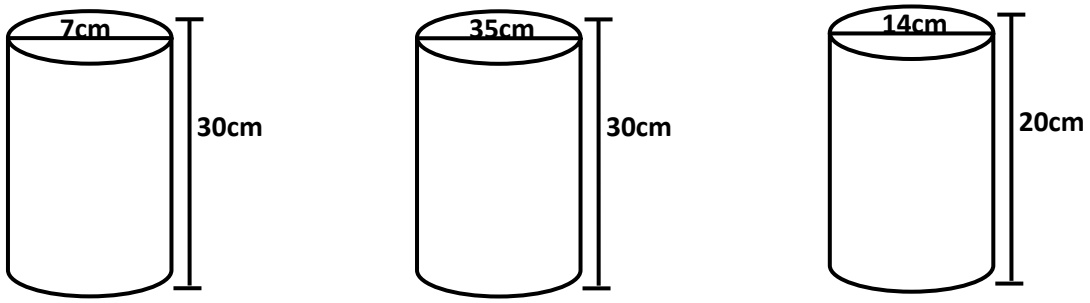
$= 1188cm^2$

2. Find the surface area of the pipe whose length is 49cm and diameter of 60cm.
3. Find the total surface area of the following closed cylinders



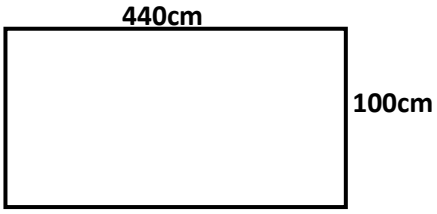
4. What is the total surface area of the closed cylinder whose radius is 14cm and the height of 13cm?
5. Find the surface area of a pipe whose length is 40cm and the radius is 15cm. (Use pi as 3.14)
6. An open cylinder has a volume of 1100cm3 and a height of 14cm. What is the total surface area of the cylinder?

7. Find the curved surface area of the following figures



MORE ABOUT SURFACE AREA AND VOLUME OF CYLINDERS

1. A welder was given a metal sheet of measurements as shown in the diagram below. He welded it into a hollow cylinder making a height of 100cm



(a) What is the surface area of the metal needed to cover the bottom of the cylinder?

$2\Pi r = C$

$2 \times \frac{22}{7} \times r = 440$

$\frac{44r}{7} = 440$

$r = 440 \times \frac{7}{44}$

$r = 70cm$

$= \Pi r^2$

$= \frac{22}{7} \times 70cm \times 70cm$

$= 22 \times 10cm \times 70cm$

$= 15400cm^2$

(b) Calculate the volume of the water the cylinder will hold.

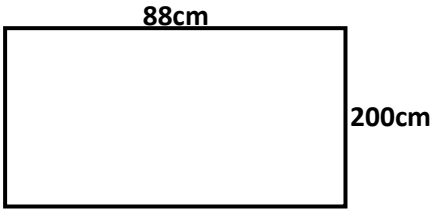
Vol = Πr2h

$= \frac{22}{7} \times 70cm \times 70cm \times 100cm$

$= 22 \times 10cm \times 70cm \times 70cm$

$= 1540000cm^3$

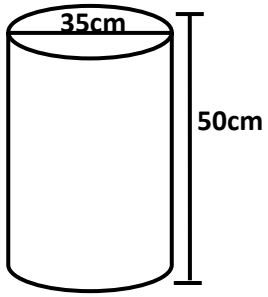
2. Juma folded a rectangular sheet of metal below to form a hollow cylinder of height 200cm



(a) Find the total surface area of the cylinder formed.

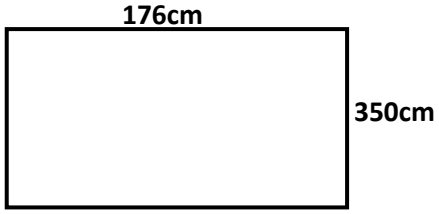
(b) Find the volume of the cylinder formed.

3. A cylindrical tank below was cut open to form a rectangular sheet.



(a) Find the area of the rectangular sheet formed.
(b) Find the total surface area of the curved surface

4. Hassan folded a sheet of paper given below to form a hollow cylinder of height 350cm.



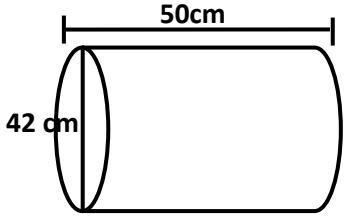
(a) Find the total surface area of the cylinder formed
(b) Find the volume of the cylinder formed

5. If the cylindrical tin of height 150cm and the diameter of 56cm is cut open to form a rectangular sheet. What is the area of the rectangular sheet formed?
6. A rectangular sheet of metal was curved to form walls of a cylindrical tank whose height is 100cm.
(a) Find the radius of the tank formed
(b) Calculate the area of the sheet needed to cover the base of the tank.
(c) Calculate the capacity of the tank

7. The rectangular sheet of length **44cm** was curved to form a wall of cylindrical tin of height **30cm**.
(a) Find the radius of the tank.
(b) Find the area needed to cover the base area of the tank.
(c) What is the capacity of the tank?

8. A rectangular sheet of metal measuring 44 cm long by 30cm wide was folded to form a hollow cylinder.
(a) Work out the radius of the cylinder formed.
(b) Calculate the capacity of the cylinder when full of milk.

9. A welder cut rectangular metal sheets each measuring 14 cm by 8 cm out of the hollow cylindrical drum below.



(i) Find the length of the hollow cylindrical drum when cut open. (Take $\pi = \frac{22}{7}$)

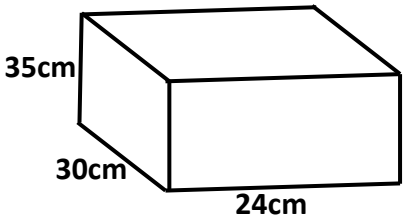
(j) How many rectangular metal sheets were cut out of it?

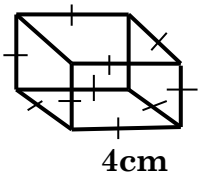
(k) Calculate the area of the drum that was left after making the rectangular sheets.

PACKING CUBES AND CUBOIDS IN BOXES

1. A box measures 24cm by 30cm by 35cm.

(a) How many cubes of sides 4cm can fit into the box?





Number of cubes packed'

Along the length = $\frac{Length}{Length} = \frac{24}{4}$ = 6 cubes

Along the width = $\frac{Width}{Width} = \frac{30}{4}$ = 7 cubes

Along the height = $\frac{Height}{Height} = \frac{35}{4}$ = 8 cubes

Total number of cubes packed

= 6 x 7 x 8

= 336 cubes

(b) Find the space left empty after packing all the cubes in the box

Volume of the box

= l x w x h

= 24cm x 30cm x 35cm

= 25200cm^3

Volume of cubes

= s x s x s

= 4cm x 4cm x 4cm x 336

= 21504cm^3

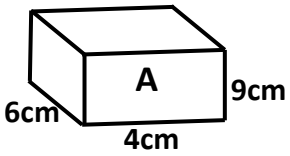
Space left

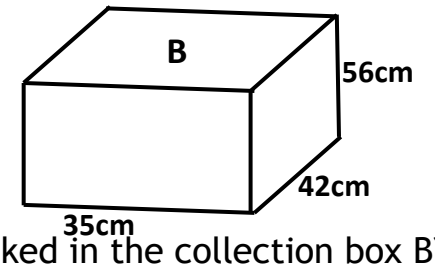
= 25200cm^3

- 2104cm^3

3696cm^3

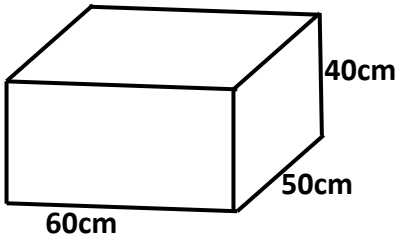
2. Below is a ballot box A and a big collection box B in which ballot boxes of size A from different polling stations were packed before being taken to the district tallying centre.

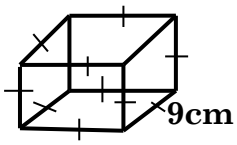




(a) How many ballot boxes A were packed in the collection box B?
(b) Calculate the space left empty in the collection box B after packing it with ballet boxes A.

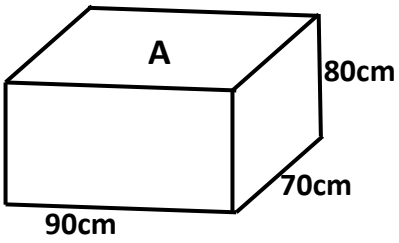
3. The diagram below shows a big box 60cm long, 50cm wide and 40cm high. A small box 9cm long, 9cm wide and 9cm high. If such small boxes are to be packed into the big box,

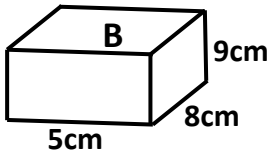




(a) Find the number of small boxes that will be packed in the first layer of the big box
(b) How many layers will fill the big box?
(c) Find the space left in the big box after packing all the small boxes in the big box.

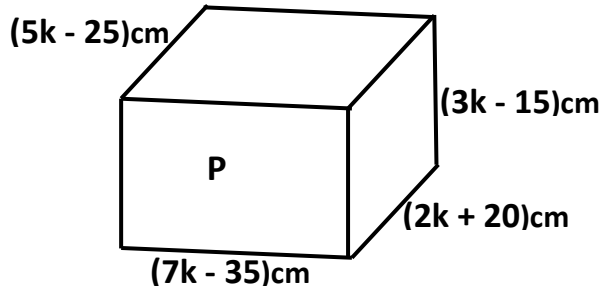
4. Study the figure below and use it to answer the questions that follow

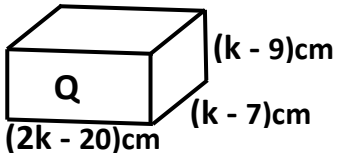




If such small boxes B are to be packed into the big box A,
(a) How many small boxes will fill the big box?
(b) How many small boxes can fill the bottom layer of the big box?
(c) Find the space left in the big box after packing the small boxes in the big box.

5. Study the figure below and use it to answer the questions that follow





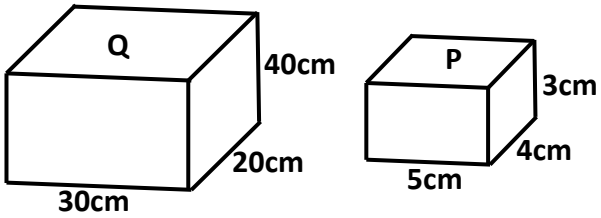
If such small boxes Q are to be packed into the big box P,

(d) How many small boxes will fill the big box?

(e) How many small boxes can fill the bottom layer of the big box?

(f) Find the space left in the big box after packing the small boxes in the big box.

6. Mrs. Agatha packs small boxes of size **P** into a big box of size **Q** as shown below.



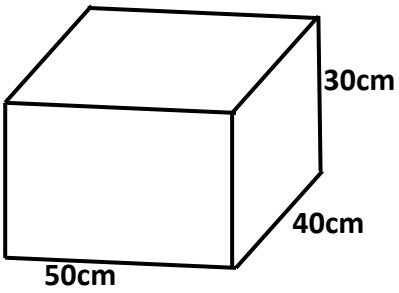
(a) How many small boxes of size P can be packed in the first layer of a big box Q?

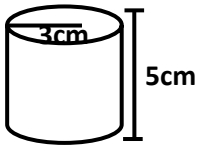
(b) Find the volume of the space left in big box Q after packing the small boxes of size P.

(c) If the small box of size P is a cup, how many visitors will one serve if container of size Q is completely full of milk?

PACKING CYLINDERS IN BIG BOXES

1. A box measures 50cm long, 40cm wide and 30cm high
   (a) How many cylindrical tins of radius 3cm and height 5cm can fit into the box?





Number of tins packed

Along the length = $\frac{Length}{Diameter} = \frac{50}{6}$ = 8 cubes

Along the width = $\frac{Width}{Diameter} = \frac{40}{6}$ = 6 cubes

Along the height = $\frac{Height}{Height} = \frac{30}{5}$ = 6 cubes

= 8 x 6 x 6

= 288 tins

(b) Find the space left after packing all the tins in the box.

Volume of the box

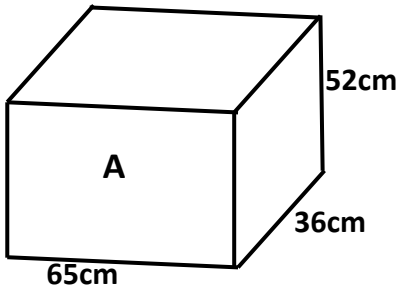
= l x w x h

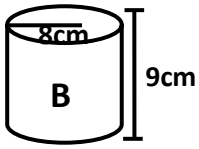
= 50cm x 40cm x 30cm

= 60000cm^3

Volume of cubes	**Space left**
= s x s x s	**= 60000cm^3**
= 4cm x 4cm x 4cm x 336	**- 40644.4cm^3**
= 21504cm^3	**19305.6cm^3**

2. Study the figure below and use it to answer the questions that follow

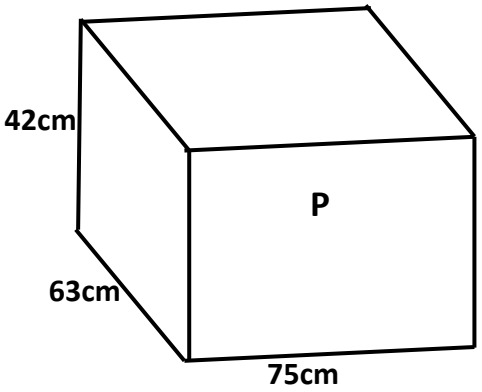


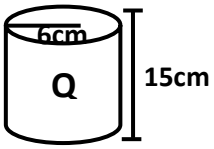


(a) How many cylindrical tins of B can be packed in the big box A?

(b) Calculate the space left after packing the tins in the big box

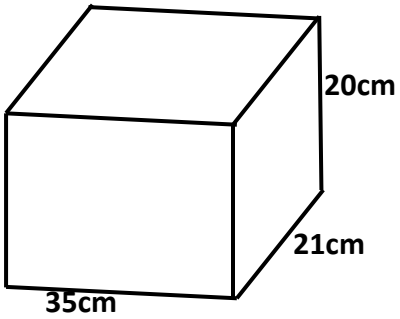
3. Study the figure below and answer the questions that follow

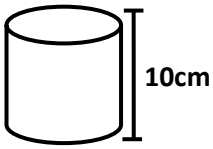




(a) How many tins of size Q can fill the first layer of the big box P?
(b) How many layers can be formed in the big box?
(c) How many tins of Q can be packed in the big box P?
(d) Calculate the space left after packing all the tins in the box.

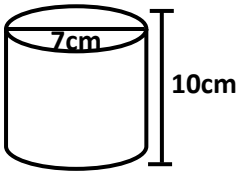
4. How many cylindrical tins of diameter 7cm and height 10cm can fill a box below?

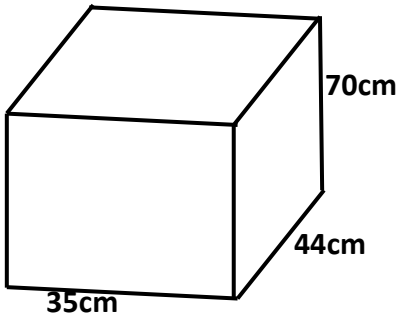




(b) Calculate the space left after packing all the tins in a big box.

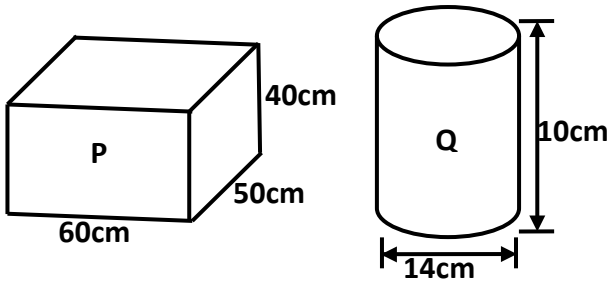
5. The figures below represent the cylindrical cups and rectangular tank. Use them to answer the questions that follow





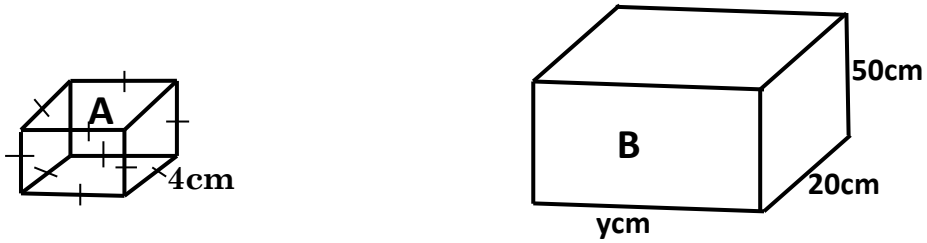
(a) How many cups can be packed in a rectangular tank?
(b) Work out the volume of the space left after packing the cylindrical cups.

6. A boy packed cylindrical tins of size **Q** into a rectangular box of size **P**. Study it carefully and use it to answer the questions that follow.



(a) Find the maximum number of cylindrical tins of size **Q** that can fill the big box of size **P**.
(b) Calculate the space that will remain after packing the maximum number of tins in the big box.

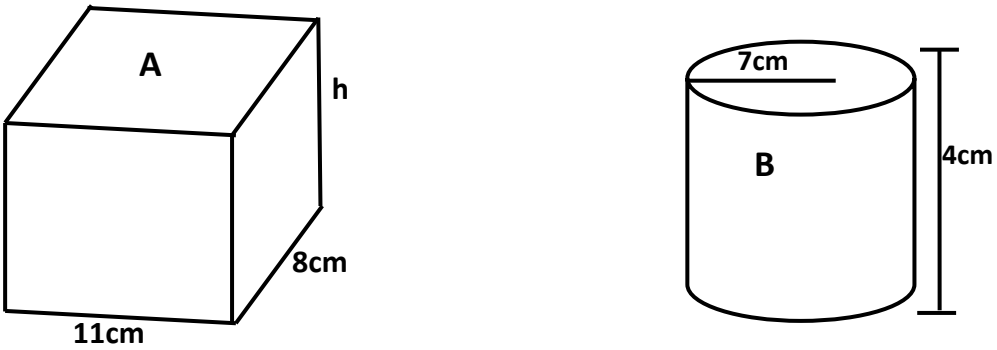
7. Cubes of size A were packed in a box of size B such that the space left was 3,120 cm^3.



If 420 cubes of size A were packed to fill the whole box completely,
(a) Find the volume of the big box.
(b) Work out the number of cubes that were packed in only one layer.

COMPARING VOLUMES OF DIFFERENT OBJECTS

1. The figure below has the same volume. Find the height of A.



Volume of B = Volume of A

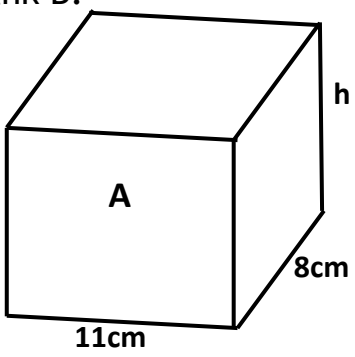
$\frac{22}{7}$ x 7 x 7 x 4 = 11 x 8 x h

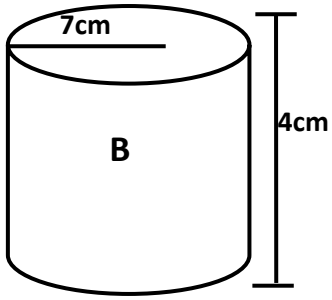
$\frac{616}{88} = \frac{88h}{88}$

7 = h

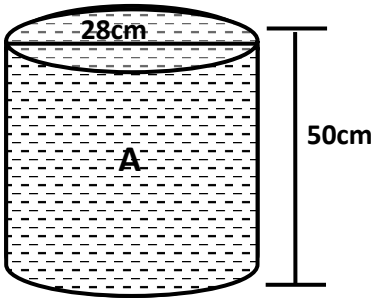
h = 7cm

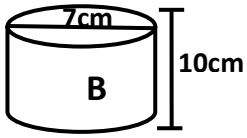
2. A rectangular water tank A which is 70cm long, by 40cm wide and by 110cm high was filled with water. The water from tank A was all poured into the cylindrical B of diameter 70cm. Find the height of tank B.



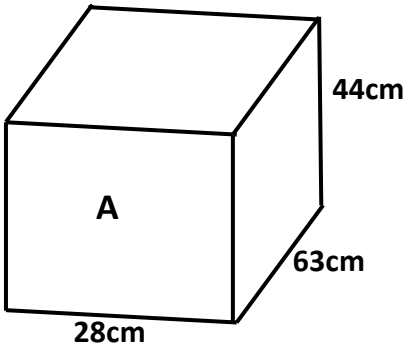


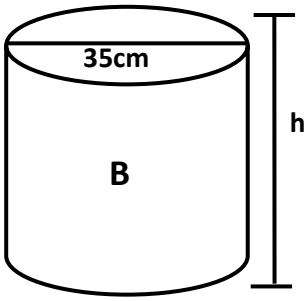
3. Betty filled container A below with drinking water. She served visitors with water using cups of size B as shown below. Find the number of cups she served the visitors



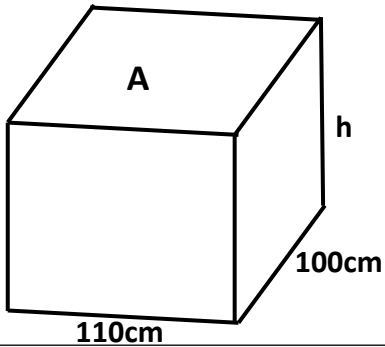


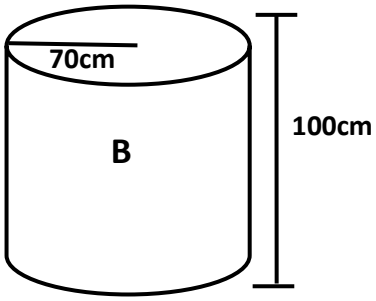
4. If tank A and tank B has the same volume. Find the value of h





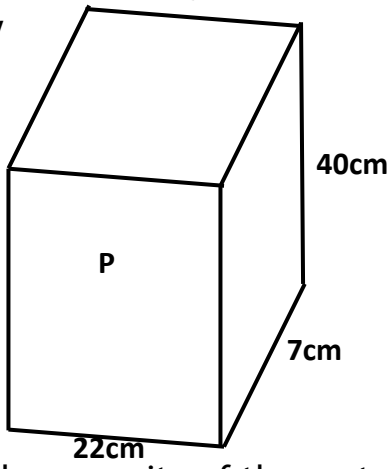
5. Tank A and B have the same volume when full of milk.

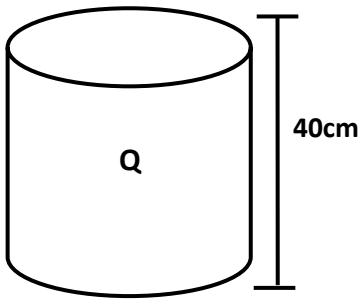




(a) If milk in tank B is poured in tank A. Find the height of tank A.
(b) If the cost of one litre of milk is sh.1800, how much would one pay for a half full tank B?
(c) Find the area of the curved surface of tank B.

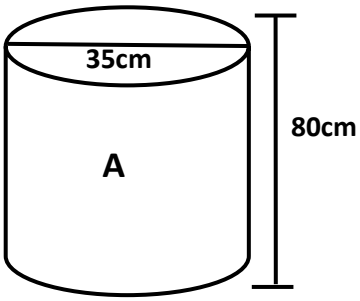
6. A mother filled a rectangular tank P with milk measuring 40cm by 22cm by 7cm. She later decided to pour all the milk into the cylindrical tank Q and the milk reached a height of 40cm as shown below

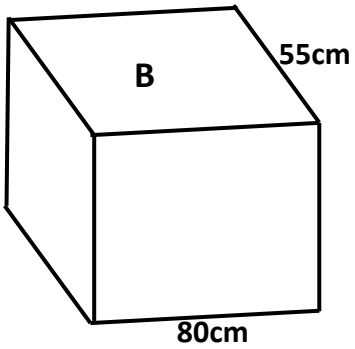




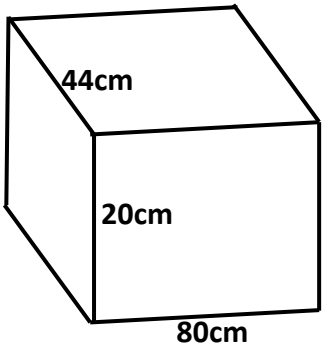
(a) Find the capacity of the rectangular tank P.
(b) Find the diameter of the cylindrical tank Q

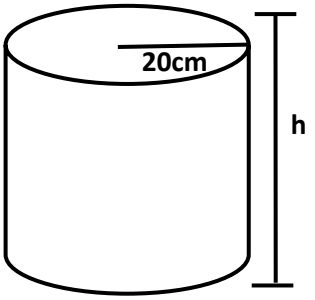
7. The diagrams below show the two tanks. Study them and answer the questions that follow. If tank A is full of water and all the water is poured into tank B. To what height will the water rise?





8. Two tanks below A and B hold the same amount of water when completely full of the liquid.

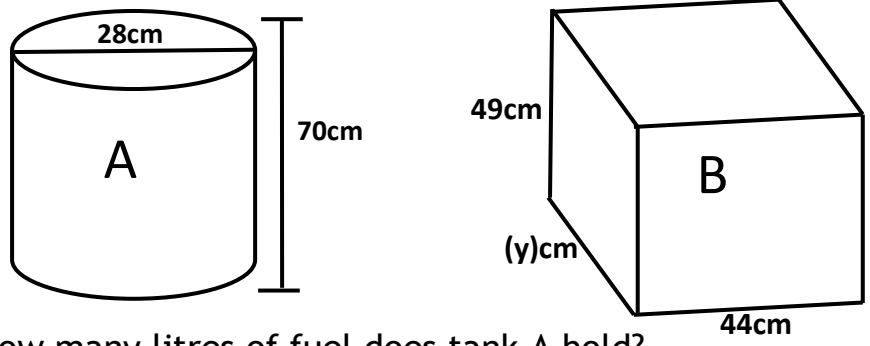




(a) Find the value of h

(b) How many litres can tank B hold when completely full.

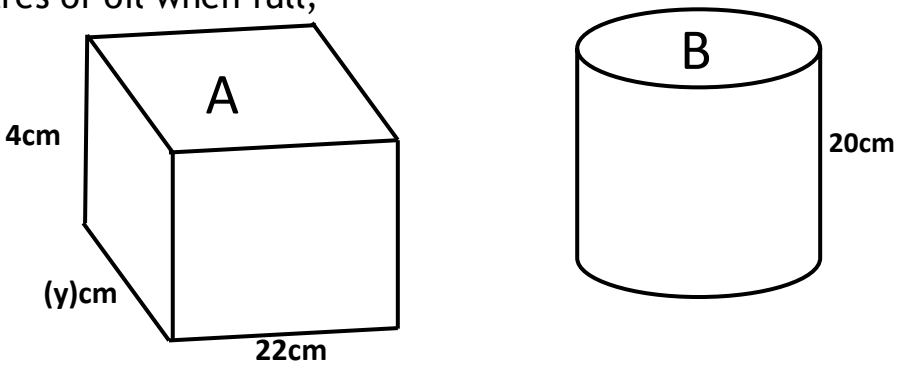
9. The two tanks (A) and (B) given below hold the same capacity of fuel when full. Use them to answer the questions that follow. (Take $\pi = \frac{22}{7}$)



(a) How many litres of fuel does tank A hold?

(b) Calculate the value of y.

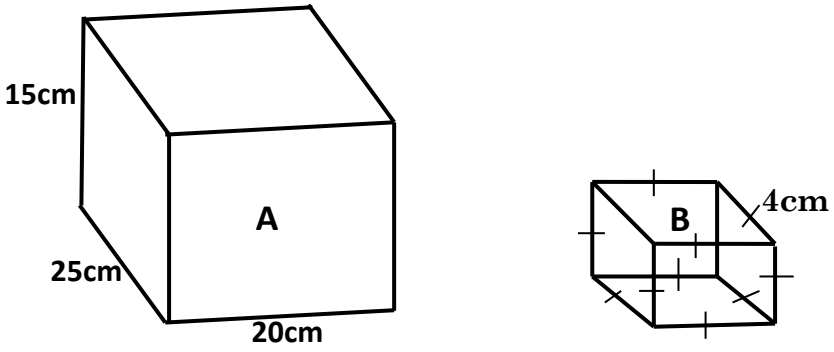
10. (a) Tank A has the same capacity as tank B. If tank B contains 3.08 litres of oil when full,



(a) Find the radius of tank B

(b) Find the value of y in tank A

11. Cubes of size B were packed into a big box of size A. Study it carefully and use it to answer the questions that follow



(a) How many cubes that will be packed in the big box altogether?

(b) If each cube costs sh.800, how much money will one pay for 5 boxes full of Royco cubes such as the above cube?

12. A land lady had a big tank 1800 litres of water in it. He sold each container measuring 40cm by 25cm by 20cm full of water at sh.400. Calculate the total amount of money she got from the sale of all the water

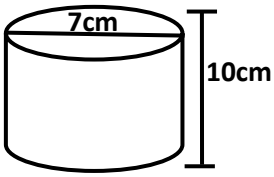
13. A milk seller has 3.6 litres of milk. He sells milk using a rectangular container measuring 6cm by 5cm by 3cm.

(a) If he sold all the milk that day, how many containers did he sell that day?

(b) If he sold each full container at sh.750, how much money did he collect that day?

14. A milk seller has 30.8 litres of milk in his big container. He sells it using a big container of diameter 14cm and height 10cm. Find the number of small containers that can be obtained from all the milk.

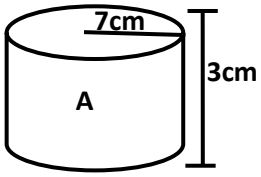
15. A milk seller uses a cup to sell his milk as shown below. Use it to answer the questions that follow

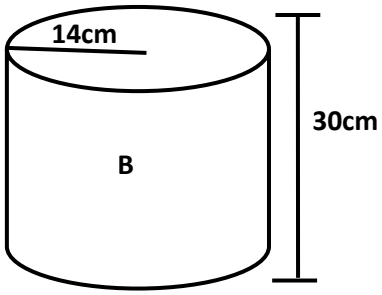


If he sold 19.25 litres of milk that day, how many cups of milk did he sell that day?

16. A cylindrical container of diameter 210 cm and height 240 cm was full of water. A cup of radius 7 cm and height 20 cm was used to serve the visitors with water. If each visitor took 3 cups of water, how many visitors were served?

17. How many containers of size A can be drawn from a drum of size B as shown below?



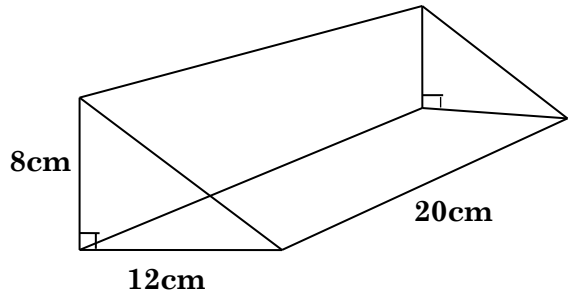


VOLUME OF A TRIANGULAR PRISM

A triangular prism has 3 rectangular faces and 2 triangular faces.

Volume = (base area) × its length (V = $\frac{1}{2}$ x b x h x l)

1. Find the volume of the triangular prism below,



The base is triangular

Volume = (base area) x length

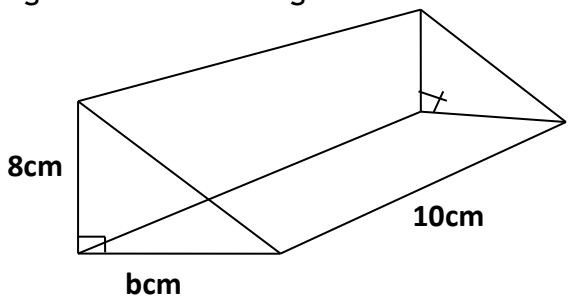
= ($\frac{1}{2}$ x 12cm x 8cm) x 20cm

= (6cm x 8cm) x 20cm

= (48 x 20) cm^3

= 960 cm^3

2. The volume of the triangular prism is **240 cm^3**. Calculate the base of the prism if the height is **8cm** and length **10cm.**



The base is triangular

Base area x length = volume

($\frac{1}{2}$ x b x 8) x l0 = 240 cm^3

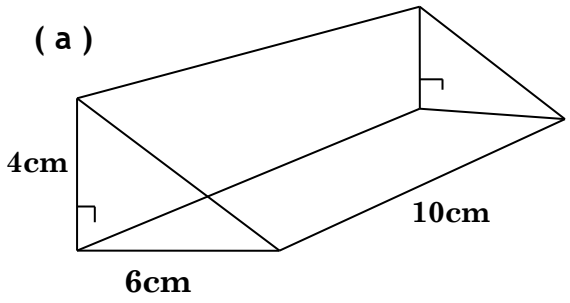
= $\frac{1}{2}$ x b x 8 x l0 = 240 cm^3

$\frac{40b}{40} = \frac{240\ cm^3}{40\ cm^3}$

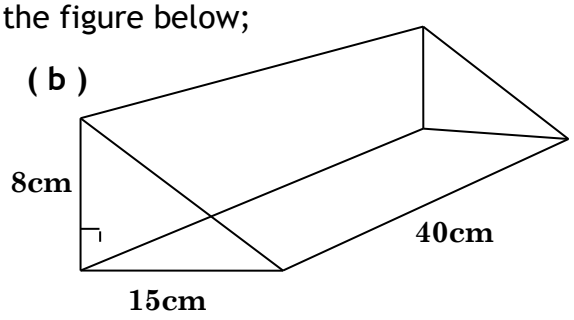
b = 6 cm

3. Find the volume of the triangular prism in the figure below;

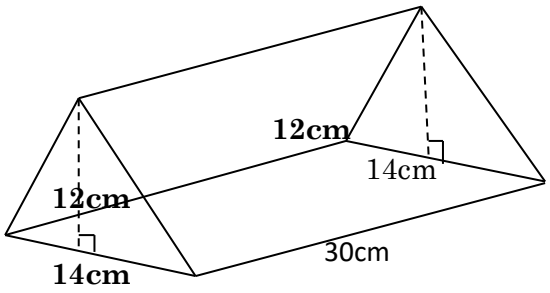
(a)



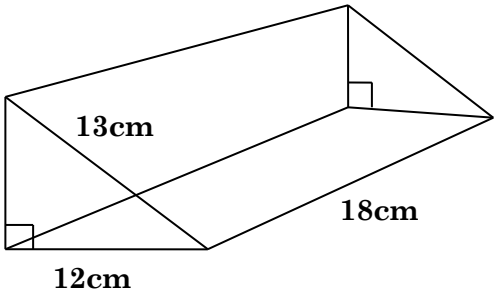
(b)

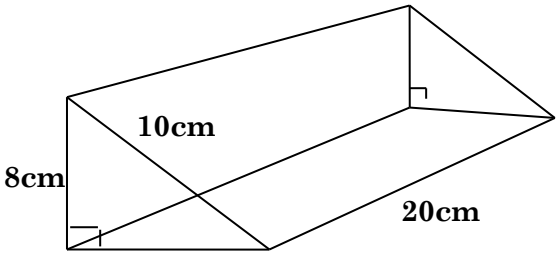


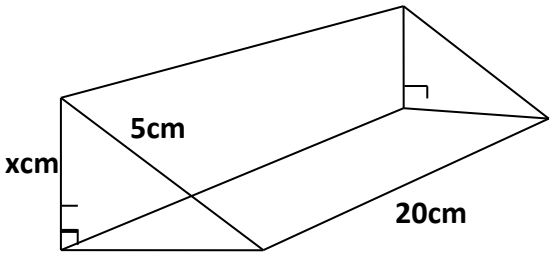
(c)

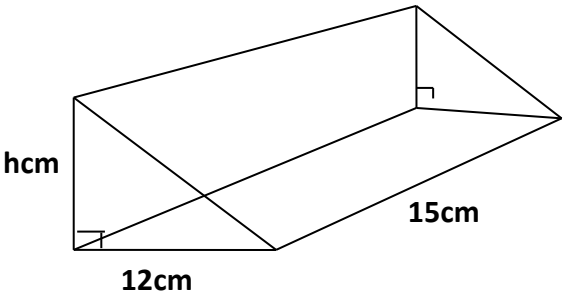


2. Find the volume of the figures below









Find:

(a) the value of **x**.

(b) Calculate the volume.

Find h if the volume is **720cm^3**

ALGEBRA

Simplifying algebraic expressions

1. Simplify: 3a + 2a – 4a
   = 5a – 4a
   = a

2. Simplify: 2(x - 2) -3(1 - x)
   = 2x – 4 – 3 + 3x
   = 2x + 3x – 4 – 3
   = 5x – 7

3. Simplify: $\frac{2}{3}$ (6k + 3) + $\frac{1}{2}$ (4k - 10)
4. Simplify: 3x – 4ax + 7ax

5. Simplify: 6p – 10q + 4q – 3p
6. Simplify: 7m - 5m
7. Simplify: 10a – 3a – 6a
8. Simplify: 4x + 3x + 5x
9. Simplify: 3t – 4r + 2t + 6r
10. Simplify: 8k – 4l – 3l + k
11. Simplify: 7q – 4p +2p – 4q
12. Simplify: 12k – 9k + 3k
13. Simplify: 3x – (x + 6)
14. Simplify: 6m – 3 + 2m
15. Simplify: $\frac{1}{6}$ (18x - 6)
16. Simplify: $5k - 2(3 - k)$
17. Simplify: $3a + a - 2a$
18. Simplify: 36y – 6(4y + 5)
19. Simplify: 7pq – 3ab – 2pq + 4b
20. Simplify: 4t – 2k + 5k – t
21. Simplify: 8a – 6a + 2a
22. Simplify: 6x – 9(x - 2)
23. Simplify: 2(3x - 1) – 4(x - 1)
24. Simplify: 11t + 9t
25. Simplify: 13y + 4y – 7y
26. Simplify: 5k – 3k + k
27. Simplify: 6w + 3x – 5x – 4w
28. Simplify: m + 2m + m + 3m
29. Simplify: $n^3 \times n \times n^4$
30. Simplify: $m^7 \div m^5$

Substitution

1. If x = 4, y = 2 and z = 0.25. Calculate the value of $\frac{xy}{z}$

   $= \frac{x\,x\,y}{z} = \frac{4\,x\,2}{0.25} = \frac{8}{0.25} = 8 \div 0.25$

   $= \frac{8}{1} \div \frac{25}{100} = \frac{8}{1} \times \frac{100}{25}$

   = 32

2. Given that a = $\frac{1}{4}$, b = $\frac{1}{3}$ and c = $\frac{1}{2}$. Find the value of c + 3b + 2a

   = c + (3 x b) + (2 x a)

   = $\frac{1}{2}$ + (3 x $\frac{1}{3}$) + (2 x $\frac{1}{4}$)

   = $\frac{1}{2}$ + 1 + $\frac{1}{2}$

   = $\frac{1}{2}$ + $\frac{1}{2}$ + 1

   = 1 + 1

   = 2

3. If a = 3, b = 7 and c = 0. Find the value of ab + bc.
4. Given that a = 8, b = 12 and c = 4. Find the value of $\frac{ab}{c}$
5. If x = 2, y = -3 and z = -5. Find the value of xyz.
6. Given that a = 6, b = 3 and c = 10. Find the value of $\frac{ab + c.}{a + b}$
7. Find the square root of $a^2 + b^2 + c^2$ if a = 0, b = 3 and c = 4.
8. If w = $\frac{2}{3}$ and x = $\frac{1}{6}$. Find the value of x + y.
9. If m = $\frac{4}{5}$ and n = $\frac{1}{5}$. Find the value of $\frac{m}{n}$
10. If a = $\frac{4}{5}$ and n = $\frac{1}{6}$. Find the value of 20m – 30n.
11. If a = $\frac{1}{3}$, b = $\frac{2}{3}$ and c = $\frac{1}{6}$. Evaluate b + ac
12. Given that x = $\frac{1}{2}$, y = $\frac{3}{4}$ and z = $\frac{1}{4}$. Find the value of x + (y - z)
13. If a = 2, b = 1 and c = 0.5. Find the value of $\frac{ab}{c}$
14. Given that x = 3, y = 6 and z = -2. Evaluate: $\frac{3c-4ac}{b}$
15. If a = $\frac{1}{2}$, b = $\frac{1}{3}$ and c = $\frac{1}{4}$. Find the value of a + b + 3c.
16. If w = -3 and x = 4. Find the value of $w^2 + x^2$
17. If p = r, r = -4 and q = 3. Work out $\frac{pq}{r}$
18. If p = 45 and q = 55. Find the value of (p + q) (q - p)
19. Given that k = 1 and m = 3. Find the value of 3k – 3m.
20. Given a = 2, b = 4 and c = -6. Work out: b(a + c)
21. If t = 2, r = 3 and s = 5. Find the value of 3t + r + s.
22. What is the value of $\frac{bc - d}{c^2}$, when b = 8, c = 3 and d = 6
23. Given that x = 30, y = 40 and z = 60. Find the value of $\frac{xy}{z}$
24. Given that m = 2 and y = -3. Work out $\frac{2(ym)+2}{(m-y)-6}$
25. Given that p = -3 and b = 4. Find the value of 2a + 2b.
26. Given that k = 3, l = 4 and m = -2. Find the value of $\frac{kl}{m}$

27. Given that k = 2 and p = -3. Find the value of 3k + 2p
28. Given that a = 3 and b = -2. Find the value of $a^2 - b^3$
29. Given that m = 3k and k = 4. Find the value of 2k + 6m
30. Given that t = $\frac{1}{2}$p and p = 8, find the value of 6t + 5p
31. Given that a = -2, b = 3 and c = 4. Find the value of $b(a^2 + c)$
32. Given that k = 3and t = -4. Evaluate $\frac{2k + t}{t}$
33. Given that p = $\frac{1}{3}$ and b = $\frac{1}{27}$ Find the value of $\frac{a}{b}$
34. Given that x = 2 and y = -3. Find the value of 3x + 2y.
35. Given that m = 2and y = -3. Work out the value of $\frac{2(ym)+2}{(m-y)-6}$
36. Given that t = -6, r = 3, n = -2 and x = 1. Find the value of $\frac{tx}{nr}$
37. Given that a = x + y, y = 3x and x = 8. Find the value of 2a + 2y.
38. If k = $\frac{4}{5}$ and p = $\frac{1}{3}$. Find the value of 2k + 3p
39. Given that x = $\frac{1}{2}$ and y = $\frac{3}{4}$. Find the value of y(x + y)

Solving simple equations

1. Solve: k + 7 = 11
   K + 7 – 7 = 11 – 7
   K = 4
2. Solve: $\frac{3p-1}{2} = \frac{7p+1}{6}$
   6 x $(\frac{3p-1}{2}) = \frac{7p+1}{6}$ x 6
   3(3p - 1) = 7p + 1
   9p – 3 = 7p + 1
   9p – 7p = 1 + 3
   2p = 4
   $\frac{2p}{2} = \frac{4}{2}$
   P = 2

3. Solve: $y^2 - 1 = 24$
4. Solve: 4(m + 2) = 8
5. Solve: 4(3n - 5) -2(6 + n) = - 12
6. Solve: 3w – 6 = 10 – w
7. Solve: 3q –(2+ q) = 10
8. Solve: 2(3b - 5) – 3(1 - b) = 28
9. Solve: 3t – 3 = 15 + t
10. Solve: 2x – 5 = x – 1
11. Solve: $\frac{3}{5}$ (2c - 3) = 3
12. Solve: $d - 1 = 2d + 5$

13. Solve: $3(2-r)$ = 15
14. Solve: $\frac{3}{2p+2} = \frac{2}{p+3}$
15. Solve: $\frac{1}{2}$p + 1 = 7
16. Solve: 3 – (x - 1) = 2(p + 5)
17. Solve: y + $\frac{1}{4}$y = 10
18. Solve: 2(q + 1) + 3(q + 1) = 30
19. Solve: 3(a - 2) – (a - 3) = 7
20. Solve: 7(3x - 1) – 4(x - 1) = 82
21. Solve: $\frac{3}{5}m^2 - 1 = 15$
22. Solve: $0.2t = 4$
23. Solve: 0.4t – 0.2 = 2
24. Solve: $2^{3n} \div 2^n = 2^4$
25. Given that $\frac{3m-2}{4} = \frac{m+1}{3}$. Find the value of m
26. Find the value of x from $\frac{x+2}{3} - \frac{x}{2} = 8$
27. Solve for x in $\frac{3x-1}{2} = \frac{7x+1}{6}$
28. Subtract (2x - 1) from (x + 9)
29. Solve for x in 3(5x - 2) + x = 74
30. Find the value of k: 5k – 2(k + 1) = 1
31. Solve for p in $(3p^2 - 6) - (p^2 + 4) = 8$
32. Given that $\frac{3m-2}{4} = \frac{m+1}{3}$. Find the value of m.
33. What is the value of h in $\frac{3h-2}{4} = \frac{h+3}{2}$
34. Solve for n given that $\frac{2n-3}{3} = \frac{2n+7}{5}$
35. Find the value of 2x + 6 = x – 1
36. Solve: 5(p - 2) -3(p + 2) = 0
37. Subtract (4x - 7) from (6x - 3)
38. Subtract (3x – 7) –2(x + 1)
39. Solve for x in $\frac{4}{3y+1} = \frac{2}{y+2}$
40. Subtract 4x – 7 from 6x - 3
41. Subtract 3(2x + 4) -2(x - 1)
42. Solve for k in $\frac{k+1}{3} + \frac{k}{4} = 2$
43. Solve for k in $\frac{5k}{6}$ – 8 = 42
44. Solve for k: $\frac{1}{2}$p + $\frac{1}{5}$ = $2\frac{7}{10}$
45. Find the value of x: $\frac{x+4}{2} = \frac{6x-2}{3}$

1. Solve: $\frac{2}{3}$p – p = 5
2. Solve: 3(3x - 1) – 6(x - 2) = 24
3. Solve: $0.4t - 0.8 = 2.4$
4. Solve: X + 4 = 17
5. Solve: 2p = 20 + p
6. Solve: y – 7 = 4
7. Solve: 8 – k = 10
8. Solve: 4 – 3x = 13
9. Solve: 7n + 2 = 30
10. Solve: 9 + 2k = k + 3
11. Solve: $\frac{3}{5}$x + 6 = x + 2
12. Solve: 18p – 5(3p + 7) = 13
13. Solve: −3(y - 1) = 9
14. Solve: $\frac{2m}{5}$ = 8
15. Solve: 14y + 3 = 10
16. Solve: 3 + 4t = 12 + 3t
17. Solve: $6x$ −9(x - 2) = 3
18. Solve: $2a + 3 = 18 -$ a
19. Solve: 3x – (x + 3) = 3
20. Solve: 2(3k - 1) – 4(k - 1) = 4
21. Solve: 2(p + 1) – 3(-1 + 2p) = -3
22. Solve: 4 – 2p = 6
23. Solve: 6 – x = 2x
24. Solve: $\frac{1}{2}$ m + 7 = 2m – 2
25. Solve: $\frac{10}{m}$ + 4 = 24
26. Solve: $\frac{m+2}{2} = \frac{4m-4}{11}$
27. Solve: $\frac{2p+4}{5}$ – 6 = 0
28. Solve: $\frac{1}{2}$(3y - 2) = $\frac{2}{3}$ (2y + 3)
29. Solve: x - $\frac{1}{3}$ = 3x + 1
30. Solve: 0.25(3w - 7) = 2 – 3w
31. Solve: 3p – 6 = 18 + p
32. Solve: $\frac{3}{4}$m + $\frac{1}{3} = \frac{7}{12}$
33. Solve: $\frac{12}{3} = \frac{x}{4}$
34. Solve for x in $\frac{6}{7x} = \frac{3}{36}$

46. What is the value of x from 2(x + 3) + 5 = 43
47. Find the value of m in $2m^2 = 72$
48. Solve for k given that $10k^2 = 9000$
49. Solve: 3x2 = 27
50. Solve: $1\frac{1}{2}$ h – 2 = 10
51. Solve: $\frac{2}{5}$h – 1 = 19
52. Solve: 6(x + 2) – 3(x + 1) = 21
53. Solve: 4(3t - 5) -2(6 + t) = -12
54. Solve: $\frac{3}{4}$ k + 2 = 7
55. Solve: $\frac{3}{y-6} = \frac{3}{y-4}$
56. Solve: $\frac{1}{3}$ (3y - 9) = $\frac{2}{3}$ (6y - 9)
57. Solve: 0.09p = 1.8
58. Solve: $\frac{2}{3}$ (6w - 3) - $\frac{1}{2}$ (4 – 2w) = 1
59. Solve: $\frac{2}{3}$ p^2 = 24
60. Solve: 2 - $\frac{2x}{3}$ = 4
61. Solve: 4n – (n + 6) = 6
62. Solve: 4p – 2 = 2p + 8
63. Solve: 5 + $\frac{k}{3}$ = k – 3
64. $\frac{k}{5}$ + 4 = 9
65. Solve: $\frac{15}{2x}$ = 10
66. Solve: $\frac{1}{2}$n + 3 = 7
67. Solve: 4(3h - 5) -2(6 + h) + 5(h + 5) = 53

Solving inequalities and giving solution sets

1. Find the solution set for -4 ≤ x ≤ 3
   This can not be solved further but we can only give the solution set
   This implies that x values range from -4 up to 3
   X = {-4, -3, -2, -1, 0, 1, 2, 3}

2. Find the solution set for -1 < x ≤ 4
   This implies that x is from 0 to 4
   X = {0, 1, 2, 3, 4}

3. Solve and state the solution set for $8 > 4x \geq -12$

   $8 > 4x \geq -12$

   $\frac{4}{4} \quad \frac{4}{4} \quad \frac{4}{4}$

   $2 > x \geq -3$

   $X = \{-3, -2, -1, 0, 1, 2\}$

4. Solve the inequality and find the solution set for $6 \geq -2(y - 1)$

   $6 \geq -2y + 2$

   $6 - 2 \geq -2y + 2 - 2$

   $4 \geq -2y$

   $2 \geq -y$

   $-1(2) \leq (-y)-1$

   $-2 \geq y$

   $y \geq -2$

   $y = \{-2, -1, 0, 1, 2, 3, 4, \ldots\}$

5. Find the solution set for each of the following inequalities

   (a) $x > 4$
   (b) $m \leq -3$
   (c) $7y < -35$
   (d) $-3 < x < 5$
   (e) $-2 \leq 2x \leq 6$
   (f) $8 \geq 4x > -16$
   (g) $2m < -12$
   (h) $-p > 4$
   (i) $-2k \geq 6$
   (j) $-3x + 7 < 16$
   (k) $3 - 2m < 15$
   (l) $9 - 2k > k + 3$
   (m) $\frac{2}{3}(m+3) + \frac{1}{2}(m+30) < 31$

   (a) $12 < 2x < 20$
   (b) $\frac{2}{3}x \geq 4$
   (c) $8 - 3k < 14$
   (d) $9 \leq -3(y - 1)$
   (e) $-2p + 4 > 6$
   (f) $\frac{1}{2}x + 7 > 2x - 2$
   (g) $3(m + 4) < 5m - 2$
   (h) $2(3x - 1) - 4(x - 11) > 4$
   (i) $9 \leq -3(y - 1)$
   (j) $2x - 2 \geq \frac{1}{4}x + 5$
   (k) $\frac{y+2}{2} < \frac{4y-4}{11}$
   (l) $3y + 4 > y + 8$

Word statements involving algebra

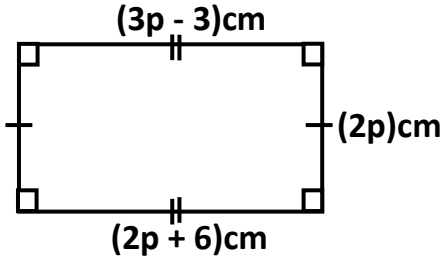
1. Subtract $a - 7$ from $3a - 4$
2. Subtract $2x - 3$ from $6x + 1$
3. Subtract $-a$ from $2a + 3$
4. Allen is x years old and Barbra is 3 years younger. Their total age is 23 years. Find the value of x.
5. The ages of three brothers are $(y + 10)$ years, $(2y - 3)$ years and $(3y + 1)$ years. Find the age of the youngest brother if their total age is 50 years.

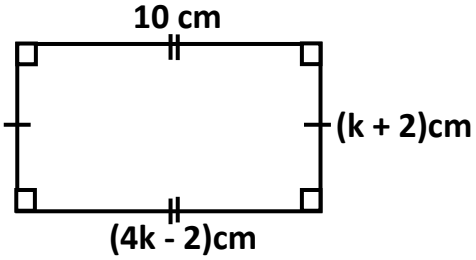
6. The three sides of a rectangular plot taken in order are (t + 5)m, (t - 2)m and (3t - 9)m. Find the value of t.
7. A flask costs sh.12000 more than a plate. Their total cost is sh.22,000. Find the cost of a flask
8. A geometry set costs a half as much as a book. A book costs sh.600 more than a fountain pen. If the total cost the three items is sh.6900. Find the cost of the geometry set.
9. A cup costs sh.1500 less than a plate. A basin costs two and a half times the cost of the cup. If the basin costs as much as the cost of the cup and the plate.
10. A book costs sh.3,000 more than a fountain pen and a geometry set costs four-fifth as much as the book. All the three items cost sh.11000. Find the cost of each item.
11. Acahn's father bought 8 books at sh.(x - 150) each and 2 geometry sets at sh.(x + 100) each. She spent sh.53,000. How much money did he spend on books?
12. An art book costs four times as much as a ruler and a graph book costs sh.700 less than the art book. Given that all the items cost sh.6,500. Find the cost of the graph book
13. A certain workshop, a table costs sh.38,000 more than a stool and the chair costs a half as much as the table. If three items cost sh.112,000. Find the cost of the chair.
14. Kato is 38 years old and his sister is 24 years old. How many years of age was Kato three times as old as his sister?
15. Abdul is 15 years and Hassan is 43 years old. After how many years will their total age be 94 years?
16. Namusoke is 28 years older than Namutebi. In 13 years' time, Namutebi's age will be a half Namusoke's age. How old is Namusoke now?
17. Wasswa is 2 years old and Babirye is 19 years old. After how many years will Babirye's age be twice as old as Wasswa?
18. Opoti is four years younger than Atim and Okidi is 22 years older than Atim. If Okidi's age is twice the sum of Opoti's and Atim's age, how old is Atim?
19. A book costs sh.(2k + 200). A pen costs sh.600 less than a book. Amuriat paid sh.2200 for 3 pencils and 2 books. How much money did Amuriat spend on books?
20. Mwine is 33 years old and Chwakire is 21 years. After how many years ago was the Mwine's age thrice the age of Chwakire?
21. A mother is 50 years old and the daughter is 34 years old. X years ago, the mother was twice as old as the daughter. How old is the daughter and the mother now?

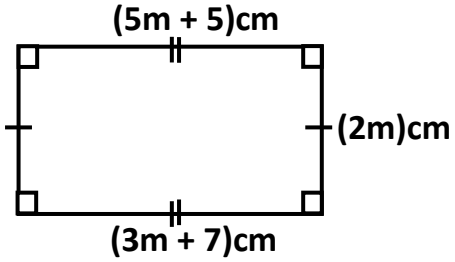
22. Jenipher is thrice as old as James. After 15 years, their total age will be fifty-four years. How old is Jenipher and James now?
23. A father is 18 years older than his son. In 10 years', the father's age will be twice the age of the son. Find the son's age.
24. Muduma bought two geometry sets each at sh.(t + 500) and a counter book at sh.3(t - 100). If he spent sh.5700 altogether. Find the cost of each of the items.
25. Kato is 30 years old and Kisha is 11 years old now. In how many years, time will Kisha be a half the age of Kato?
26. In a certain shop, a book costs sh.500 more than a pen and the pen costs sh.200 more than a pencil. Calculate the cost of a book if the three items cost sh.2100.
27. Tom is three times as old as his son, Amooti. The difference in their ages is 20 years. Find Amooti's age.
28. Joseph is thrice as old as his son, Paul. In 5 years' time their total age will be 46 years. How old is Joseph now?
29. A parent bought 20 items of different. Some items were bought at sh.5,000 while others were bought at sh.3,000 each. The parent spent sh.90,000 altogether. How many items of each type did he buy?
30. Peter is 24 years older than John. Nine years ago, their total age was 36 years. Find their total ages.
31. A mother is three times as old as her daughter. In ten years' time, the difference between their ages is 50 years. How old was the daughter 10 years' ago?
32. A father is 34 years old and his son is 12 years old now. In how many years' time will the father be twice as old as his son?
33. Omoding is thrice the age of Opio. In 8 years, time the difference in their ages will be 26 years.
    (a) Find the age of each person in 8 years, time.
    (b) How old will Omondig be in 17 years' time?
34. Accram is 20 years younger than Musa. In 15 years time to come, Musa will be twice as old as Accram. How old will Accram be in 15 years' time?
35. Mary, Peter and Paul shared sh.360,000 in such away that Mary got sh.600 more than Paul and Peter got three times as much as Paul. How much did each get?
36. The Headteacher distributed textbooks to different upper primary classes as follows;
    Primary five got 2p + 5
    Primary six got 10 more textbooks than primary five
    Primary seven got as twice as much as primary five. If the Headteacher gave out 370 textbooks altogether, how many books did each get?

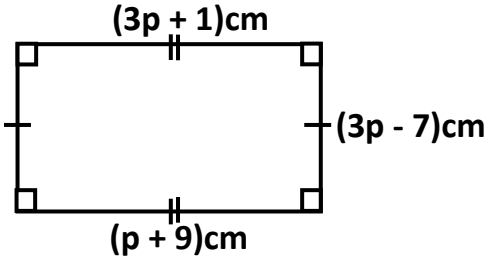
37. Moses bought 5 exercise books and 3 pens at sh.25000. If the cost of a book is sh.200 more than the cost of a pen. Find the amount of money he spent in each item.
38. In an open market, the cost of a jerrycan is sh.2800 more than the cost of a basin. A basin costs three fifth of the cost of a saucepan. Calculate the cost of a saucepan if the total cost of the three items is sh.29,200.
39. Wasswa, Kato and Kizza shared 180 mangoes. Wasswa got twice as much as Kato and Kizza got 30 mangoes more than Wasswa. How many mangoes did each get?
40. The father is thrice as old as his son. The difference in their ages is 54 years. How old was son in 7 years go?
41. Moses had some sweets and Wekesa had 4 sweets less than Moses, Juma had twice as much sweets as Moses and Wekesa had. If they altogether had 30 sweets, how many sweets did each have?
42. A father is thrice as old as his son now. In 12 years' time, the father will be twice as old as his son.
    (a) How old is the son now?
    (b) How old will the father be then?
43. A book costs three times as much as a pencil. A pen costs sh 300 more than a pencil. If a book costs as much as a pen and a pencil, find the cost of a book.

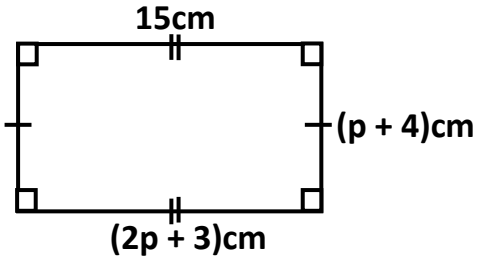
1. **<u>Find the area and perimeter of the following figures</u>**

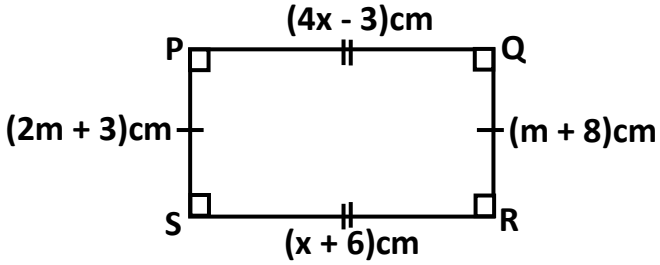




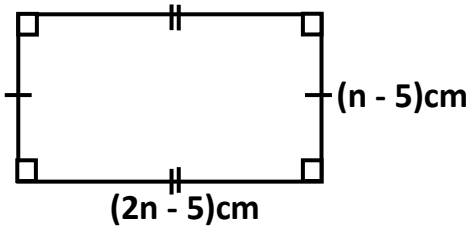




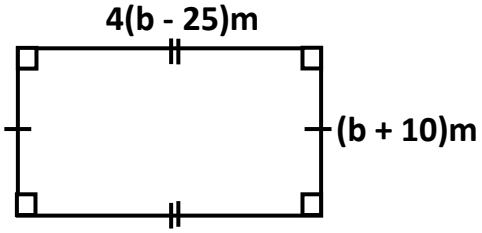




2. The length of the figure below is thrice its width. Work out its perimeter

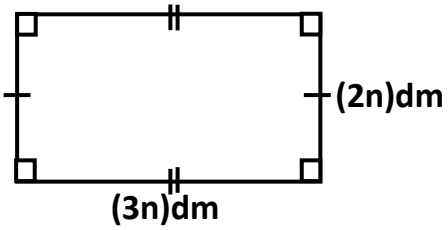


3. A pupil ran thrice around the rectangular field below to cover 960 metres distance.



(a) Work out the value of b
(b) Work out its area

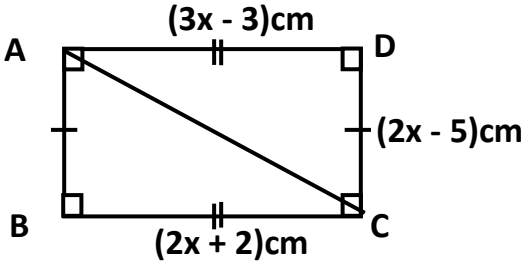
4. The area of the figure below is **96dm²**. Use it to answer the questions that follow.



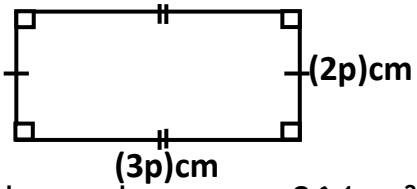
(a) Find the value of **n**.

(b) Workout its perimeter

Find the length of AC in the figure below



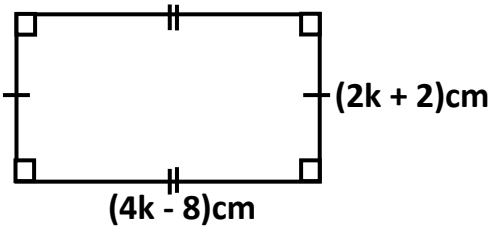
5. Study the figure below and use it to answer the questions that follow.



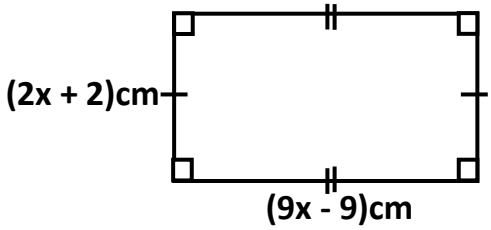
(a) If the garden covers **864cm²**. Find the value of **P**.

(b) Work out the distance around the figure above.

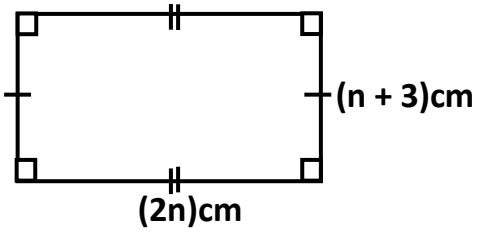
6. The perimeter of the figure below is 120cm. Work out its area



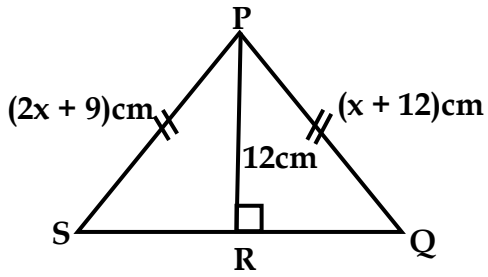
7. Work out the area of the figure below if the total distance round the figure is 52cm.



8. Find the area of the figure below if its perimeter is 30cm.



9. Study the figure below and use it to answer the questions that follow.

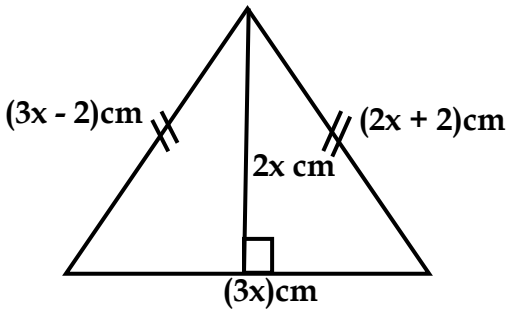


(a) Find the value of **x**.

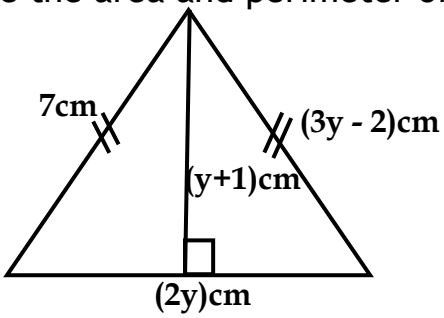
(b) Work out the area of the figure **PQS**.

(c) Calculate its perimeter.

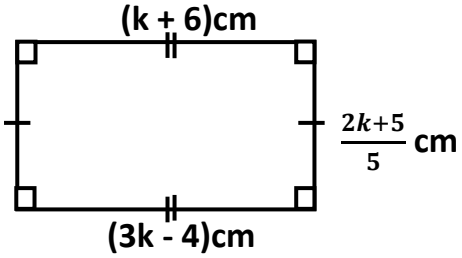
10. Find the area and perimeter of the figure below



11. Calculate the area and perimeter of the figure below

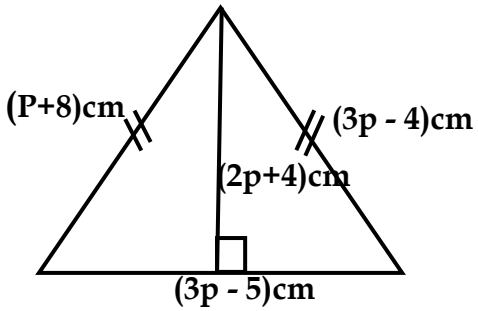


12. The figure below is a rectangle. Use it to answer the questions that follow



(a) Find the value of k
(b) Work out its perimeter
(c) Calculate its area

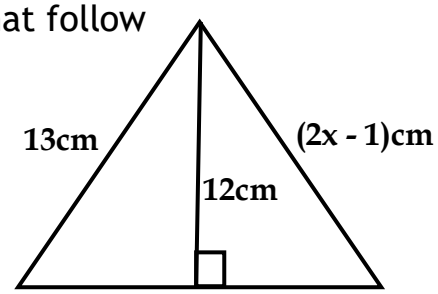
13. The figure below is an isosceles triangle. Study it carefully and use it to answer the questions that follow



(a) Find the value of p
(b) Calculate the area of the figure

(c) Work out its perimeter

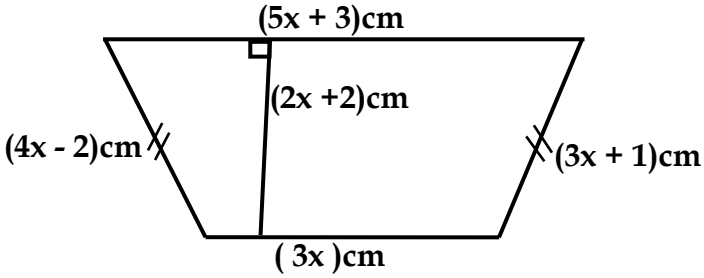
14. The figure below is an isosceles triangle. Study it and answer the questions that follow



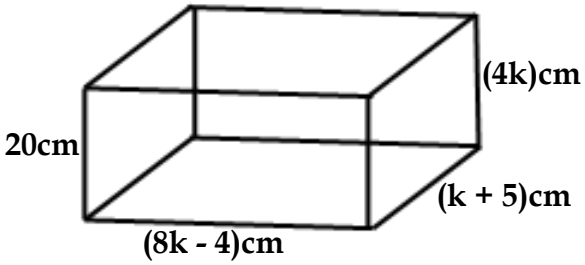
(a) Find the value of x

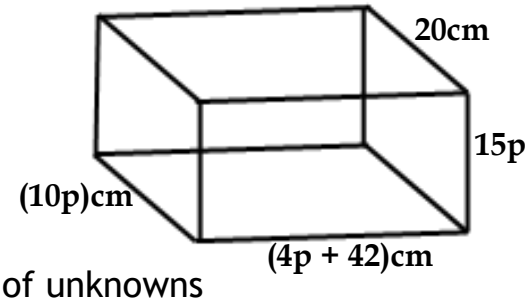
(b) Find the area of the figure below

15. Calculate the area and perimeter of the figure



16. Study figures A and B and use it to answer the questions that follow





(a) Calculate the values of unknowns

(b) Calculate their volumes.

(c) Calculate their Total Surface Area

17. The parent served his children with a cup A from container B. If she served all the children with full cups of milk in container A, how many children did she have altogether?