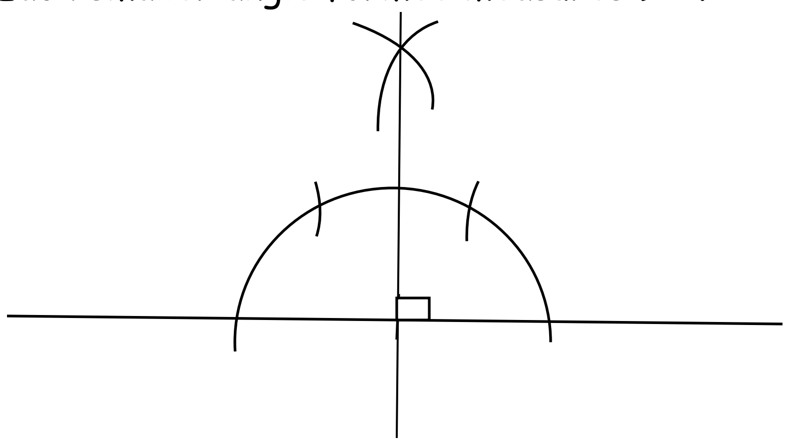
GEOMETRIC CONSTRUCTION

Construction of special angles (90^0 and 60^0)

i) 90^0

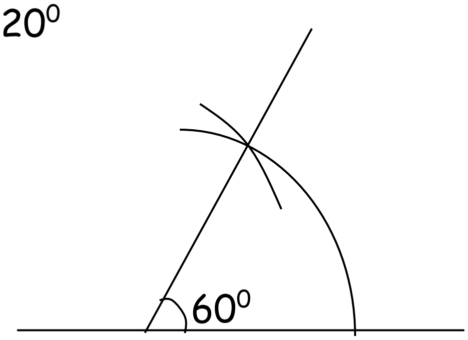
- Draw a horizontal straight line and mark off its centre.
- Basing at the centre of the line, draw a semi-circle / two arcs intersecting either side of the line.
- Use the two points of intersection of the arcs and the line to draw two intersecting arcs above the straight line.
- Connect the point of intersection of the arcs to the centre of the line.
- Each smaller angle formed measures 90^0.

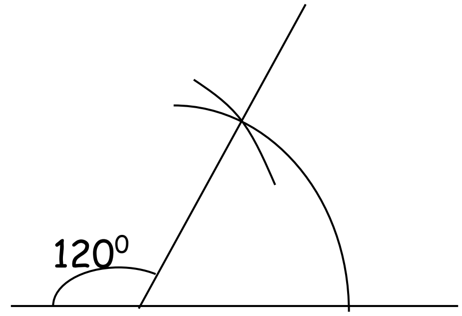


(i) 60^0

- Draw a horizontal straight line and mark off its centre.
- Draw a big arc intersecting one side / either side of the line, basing at the centre.
- Use the new point of intersection of the line and the arc to draw another smaller arc to intersect the first one.
- Connect the point of intersection of the arcs to the centre of the straight line.

- The smaller angle formed is an angle of 60^0 while the larger angle is 120^0





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ACTIVITY

Using a pair of compasses, a ruler and a pencil only, construct the following angles.

a) 90^0
b) 60^0
c) 120^0
d) 270^0

Bisecting angles

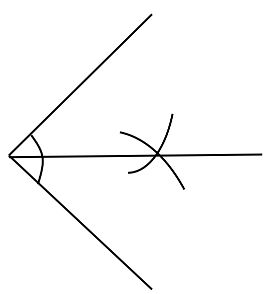
To bisect an angle means to divide that particular equally into two parts.

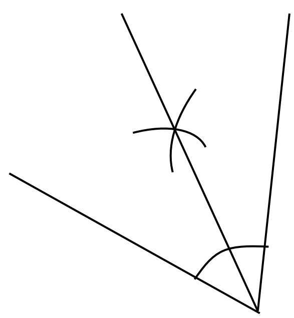
When you bisect the special angles, other smaller angles are formed. e.g

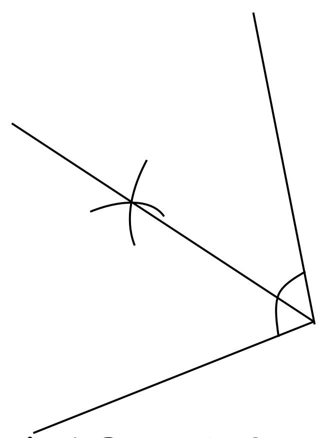
(i) Bisecting an angle of 90^0 forms that of 45^0

(ii) Bisecting an angle of 60^0 forms that of 30^0

Bisecting drawn angles







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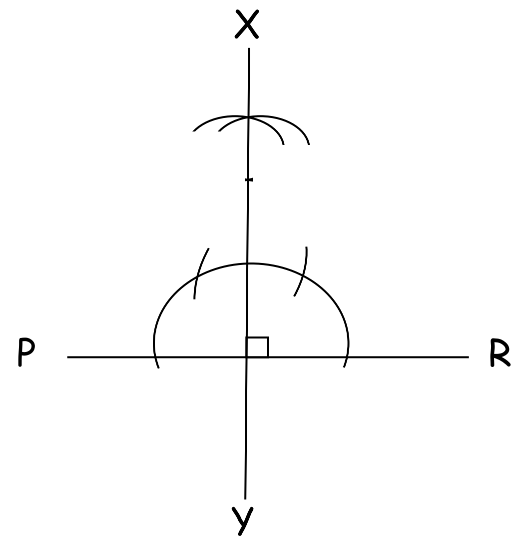
Constructing perpendicular lines.

Constructing a perpendicular line XY through line PR

- Place the compass point at P draw two arcs, one above the line PR and another below it.
- Place the compass at R and draw another arc intersecting the first one respectively.
- Drop a straight line through the points of intersection of the arcs.



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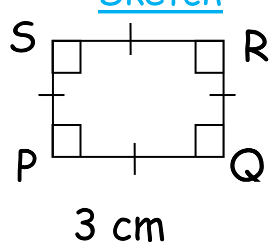
Construction of squares

Example

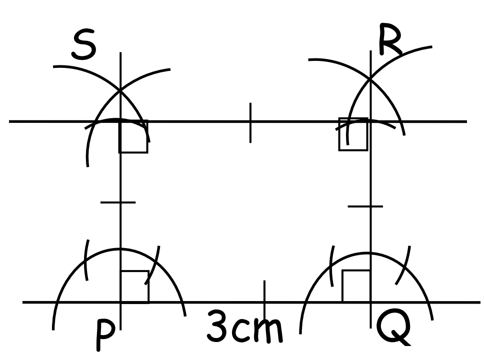
Using a ruler, pencil and a pair of compasses, construct a square PQRS of side 3cm

(i)Draw a sketch. (ii) Follow the sketch to draw an accurate diagram.

Sketch



Accurate diagram



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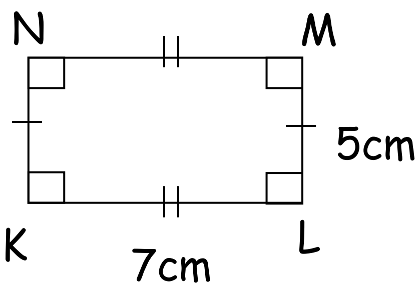
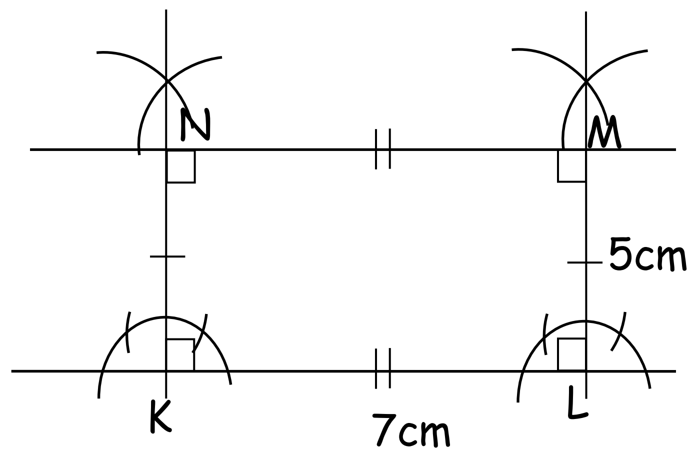
Construction of rectangles

Example

Using a ruler, a pencil and a pair of compasses, construct rectangle KLMN where KL = 7cm and LM = 5 cm. (ii) Follow the sketch to draw an accurate diagram.

i) Sketch

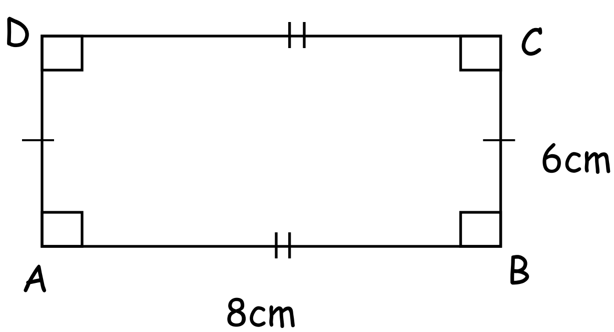




ACTIVITY

Using a pair of compasses, a ruler and a pencil only, construct the following.

1. A square ABCD where line AB = 5cm
   Measure the length of its diagonal.
2. A square KLMN where line MN = 6cm
   Measure the length of its diagonal
3. A rectangle WXYZ where line WX = 7cm and line XY = 5 CM.
   Measure the length of its diagonal.
4. Below is a sketch of a rectangle.



a) construct the rectangle
b) Work out the area of the triangle ABC

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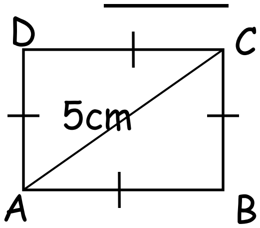
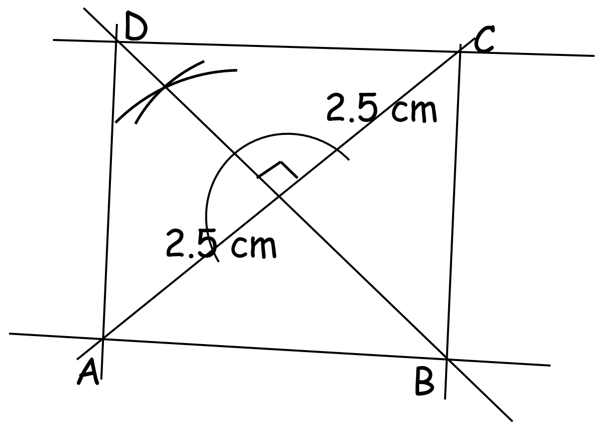
Constructing a square given the length of the diagonal

Examples

a) Using a pair of compasses, a ruler and a pencil only, construct a square ABCD where diagonal AC = 5cm.
b) Measure the length of its side.

Sketch

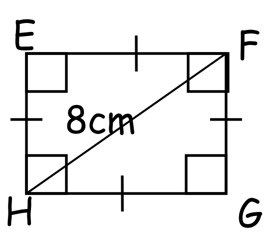




Length of the AB = 3.5 cm

ACTIVITY

1. a) Using a pair of compasses, a ruler and a pencil only, construct a square PQRS where line PR = 10cm.
   b) Measure the length of line RS.
2. Construct a square whose length of the diagonal is 3cm. Measure the length of its side.
3. a) Using a ruler, a pencil and a pair of compasses only, construct a square whose sketch is shown below.



b) Measure the length of side HG

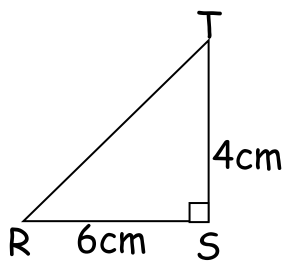
Construction of triangles.

- When length of each of the three sides is given.
- When length of one side and two base angles are given.
- When lengths of two sides are given with an angle.

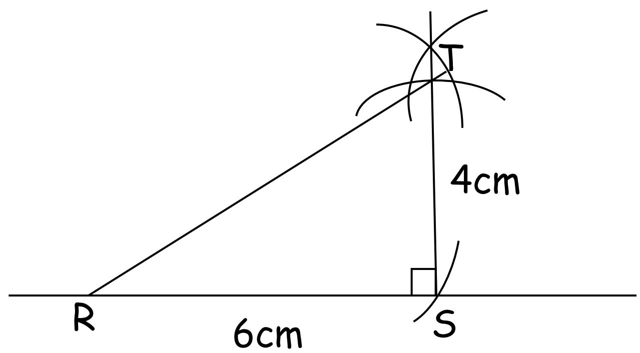
Examples

(i) Construct triangle RST such that RS = 6 cm, ST = 4 cm and angle RST = 90^0

Sketch

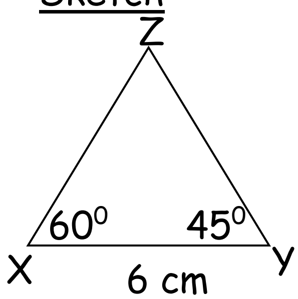


Accurate diagram

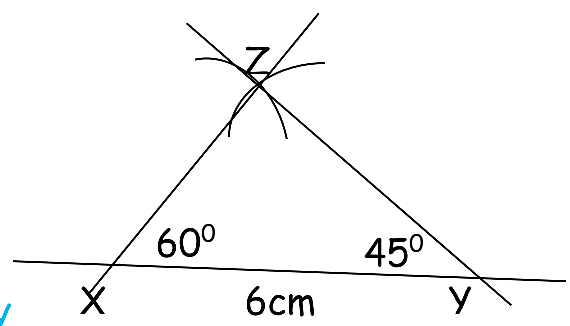


Construct triangle XYZ in which XY = 7 cm, angle XYZ = 45^0, ZXY = 60^0

Sketch



Accurate diagram



ACTIVITY

1. Construct a triangle ABC such that line AB = 5cm, line BC = 4 cm and line AC = 4cm.
2. Construct a triangle RST where angle R = 60^0, angle S = 45^0 and RS = 5cm

3. Construct a triangle KLM in which angle K = 90^0, lines KL= Km = 6cm.
4. Construct a triangle RST such that RS = 6cm, RT = 7cm and angle R = 90^0. Measure angle RST and line ST.

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Construction of a regular hexagon.

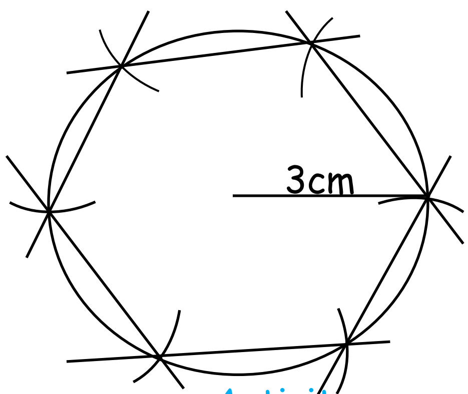
Example

Construct a regular hexagon in a circle of radius 3cm

(i)Draw a circle of the given radius.

(ii) Use the same radius to mark off six arcs around the circle.

(iii) Connect the points such that a regular hexagon is formed.



Activity

1. Construct a regular hexagon in a circle of radius;
a) 3.5 cm
b) 2.5 cm
c) 4cm
2. Construct a regular hexagon in a circle of diameter;
   a) 6 cm
   b) 5cm
   c) 7cm

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Construction of a regular pentagon

Note:

(i) A regular pentagon has all its five sides equal in length.

(ii) The centre angle / exterior angle of a regular pentagon is 72^0 ie $360^0 \div 5 = 72^0$

Example

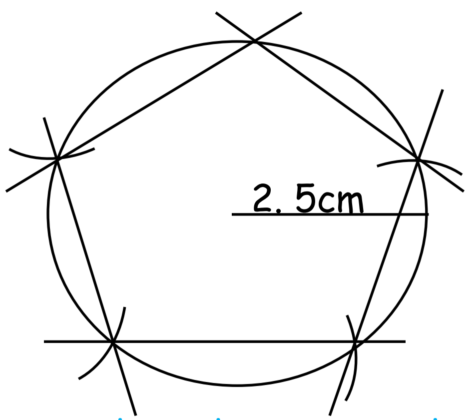
Using a ruler, pencil and a pair of compasses, construct a regular pentagon ABCDE in a circle of radius 2.5cm.

(i) Draw a circle of the given radius and mark its centre with letter O.

(ii) Place your protractor at the centre "O" to measure and mark off the centre angle (72^0)

(iii) Use the adjacent AB to mark off other points around the edge of the circle.

(iv) Connect / join the points such that a pentagon is formed.



Constructing regular polygons given length of sides

- Calculate the interior and exterior angles of the given polygon
- Draw a line AB of given measurements.
- Measure the interior angles at point A and B respectively.
- Mark the given measurements from A and B to get points C and D respectively.

- Repeat the above procedure until you get the asked polygon.

Examples

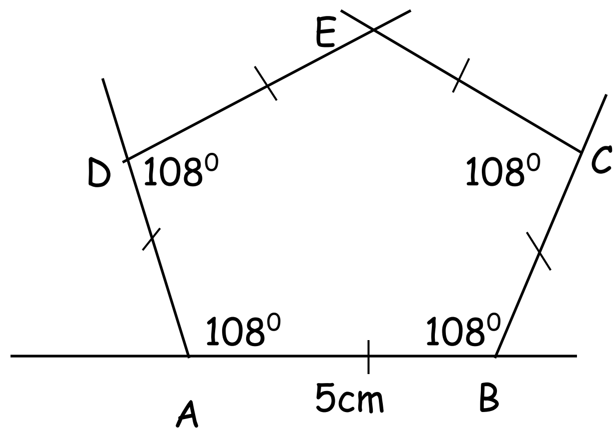
1. Construct a regular pentagon of side 5cm

Exterior angle

$360^0 \div 5 = 72^0$

Interior angle

$180^0 - 72^0 = 108^0$



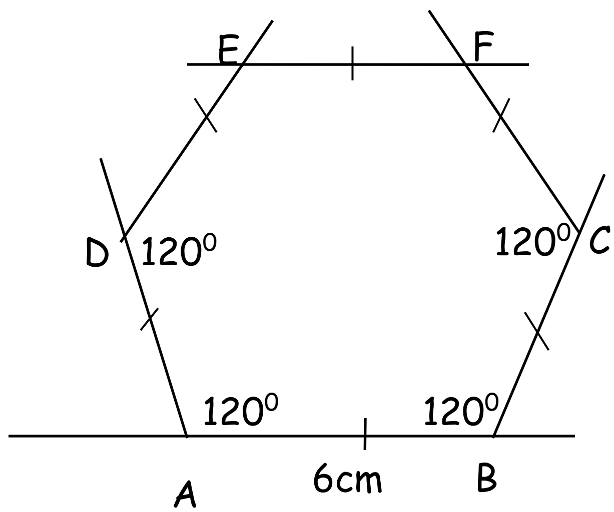
2. Construct a regular hexagon of side 6cm

Exterior angle

$360^0 \div 6 = 60^0$

Interior angle

$180^0 - 60^0 = 120^0$



Activity

Construct the following polygons

1. A regular pentagon of side 5cm.
2. A regular hexagon of side 4.5 cm.
3. A regular octagon of side 4.5cm.

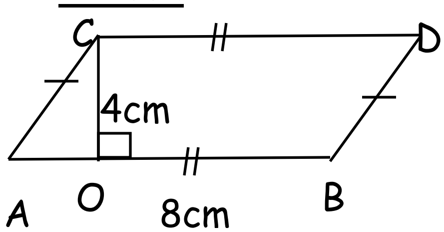
CONSRUCTING PARALLELOGRAMS

- A parallelogram has two of its opposite sides parallel and equal.

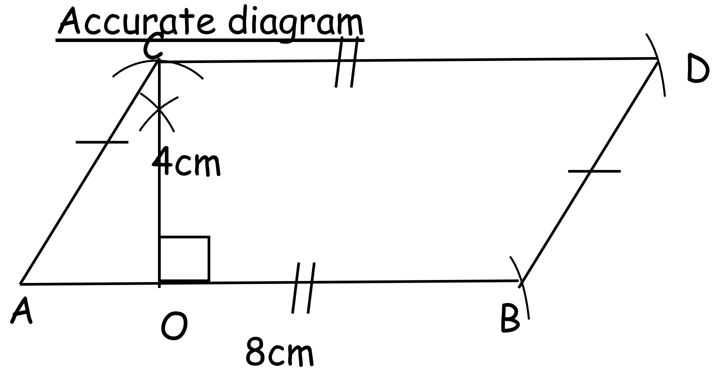
Examples

1. Follow the following instruction and construct a parallelogram.
    - Draw a line AB = 8 cm.
    - Bisect line AB such that the perpendicular bisector meet line AB at point O.
    - Mark 4 cm on the perpendicular bisector from point O to get point D.
    - Join point A to D.
    - Complete the construction such that line AB = line CD

Sketch

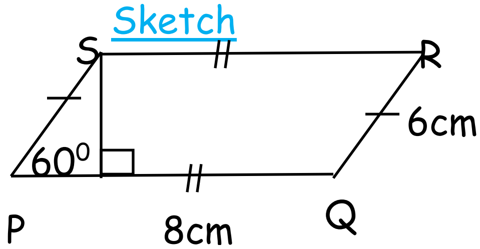


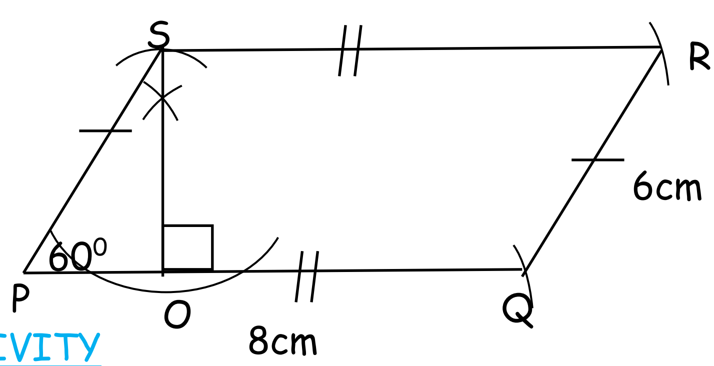
Accurate diagram



2. Using a pair of compasses, a ruler and a pencil only, construct a parallelogram PQRS where line PQ = 8cm, line QR = 5cm and angle SPQ = 60^0. Drop a perpendicular line from point S to meet line PQ at point O. Measure line SO

Sketch





ACTIVITY

1. Construct a parallelogram PQRS whose longer side QR = 7cm, angle Q = 45^0 and the shorter side PQ = 4cm. measure the length of its diagonals.
2. Construct a parallelogram ABCD where AB = 6cm, angle ABC = 120^0 and line AD = 4.5cm. Measure the length of its diagonals.
3. Construct a parallelogram EFGH where EF = 8cm, EH = 6cm and diagonal FH = 10cm. measure diagonal EG.

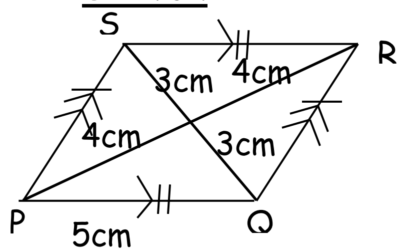
Constructing a Rhombus

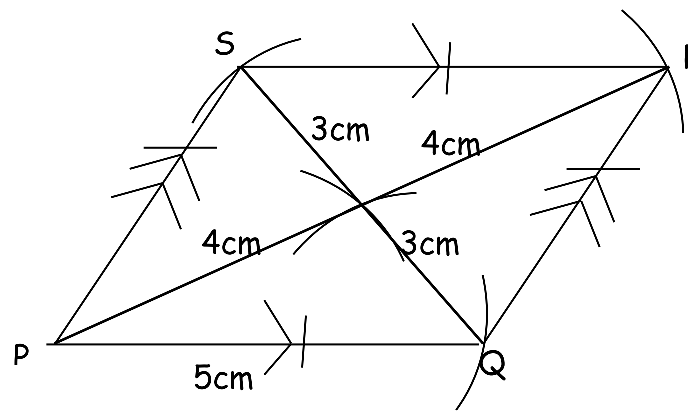
- A rhombus has all sides equal.
- The diagonals intersect at an angle of 90^0
- Its opposite sides are parallel.

Examples

1. Construct a Rhombus PQRS where line PQ = 5cm, diagonal PR = 8cm and diagonal QS = 6cm.

Sketch

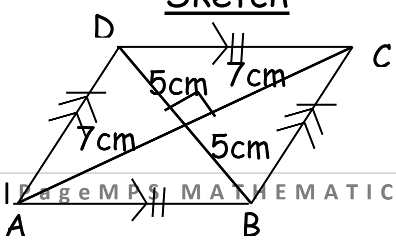


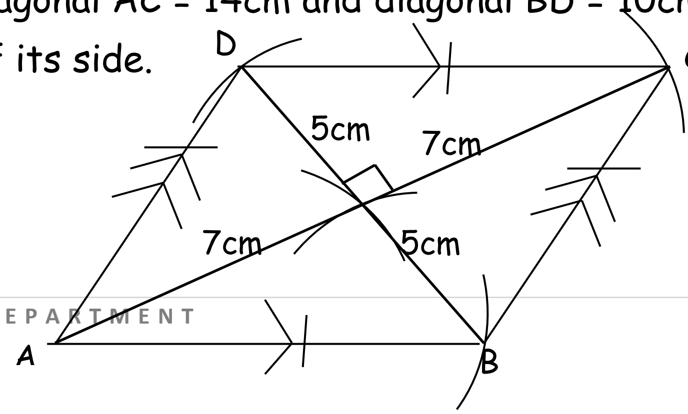


2. a) Using a pair of compasses, a ruler and a pencil only, construct a Rhombus ABCD where diagonal AC = 14cm and diagonal BD = 10cm.

b) Measure the length of its side.

Sketch





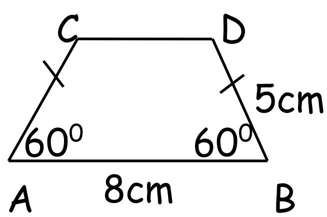
Activity

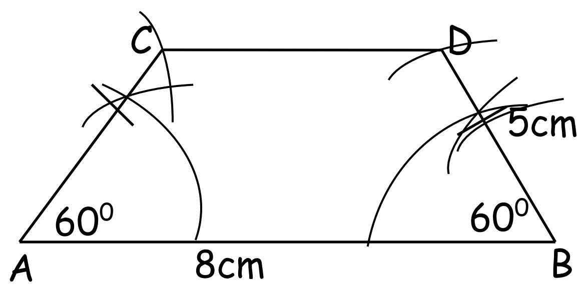
1. Construct a Rhombus ABCD where AB = 6cm, diagonal AC = 10.4 cm and line BD = 6cm. measure angle ABC.
2. Construct a Rhombus PQRS where QR = 7cm, angle Q = 45^0 and PQ = 3.5cm. Measure angle PRS.
3. Construct a Rhombus RSTU where triangle RSU is an equilateral triangle of side 5cm. Measure line SU.

Constructing a trapezium

1. Construct a trapezium ABCD where line AB = 8cm, lines AC = BD = 5cm and angles ABC = BAC = 60^0. Measure line CD.

Sketch





2. Construct a trapezium PQRS where line PQ = 7cm, line PS = 5cm, line RS = 4cm angle QPR = 90^0 and angle PQR = 45^0. Measure line

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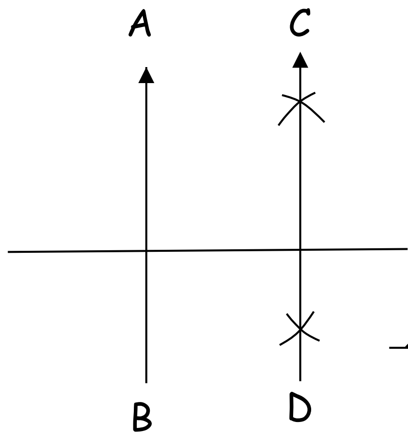
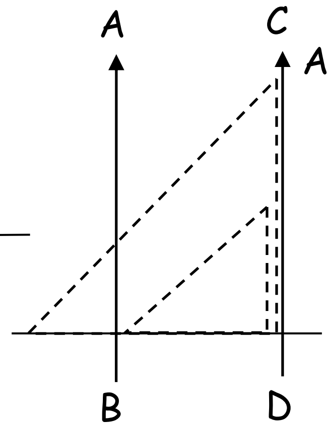
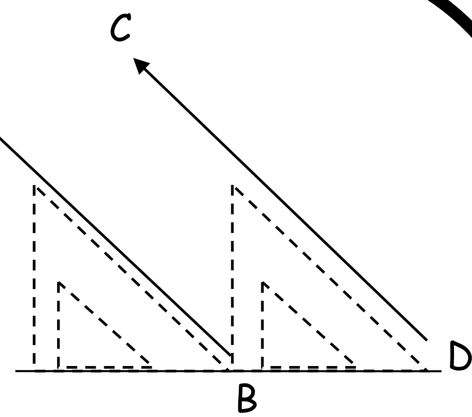
LESSON 9

Constructing parallel lines

Lines are parallel only if they are unable to meet at any point.
Parallel lines keep the same distance apart at every point.
Example
Construct line CD parallel to line AB
i) Using a pair of compasses. ii) Using a protractor







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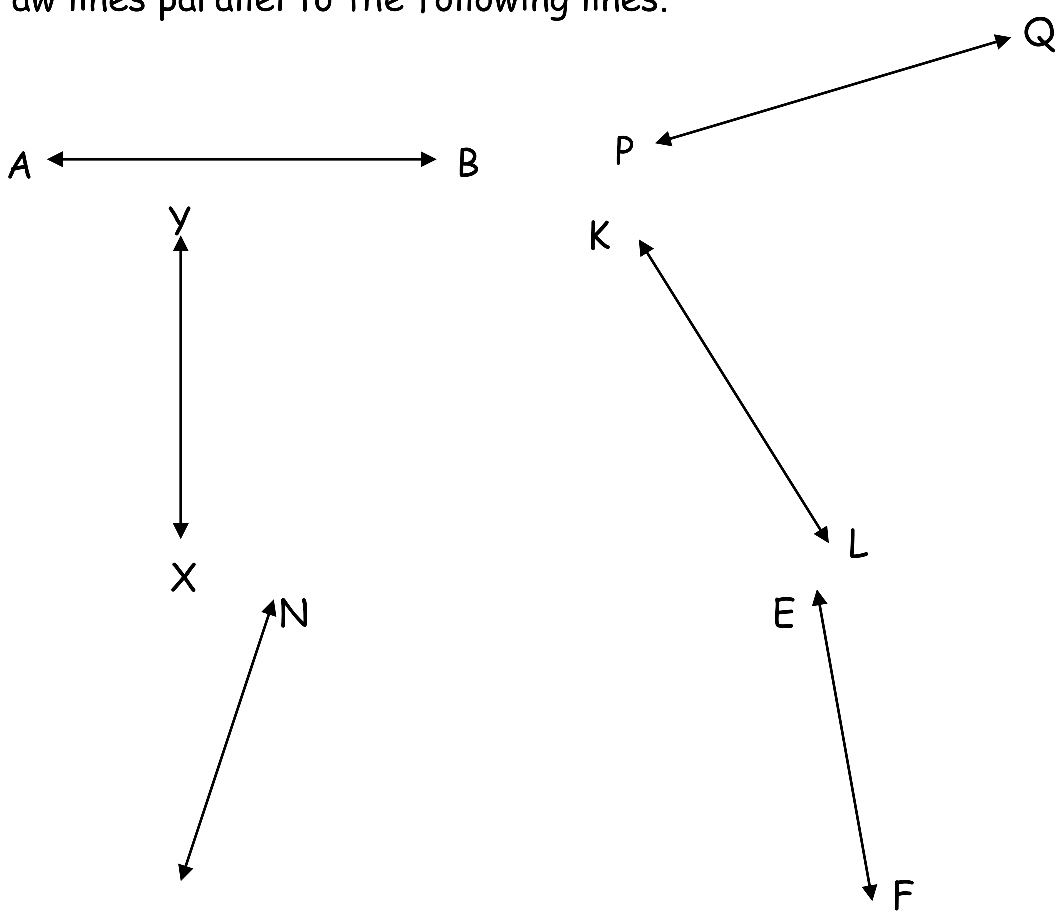
ACTIVITY

Draw lines parallel to the following lines.

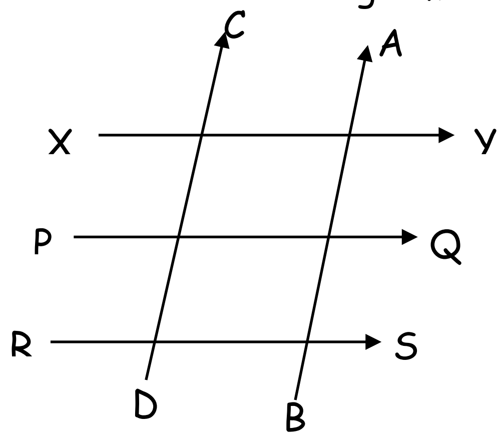


Identifying parallel lines

- // is the symbol for parallel lines.
- The arrows on lines show the which lines are parallel to each other.

Example

Name the parallel lines in the diagram below.



(i) AB//CD

(ii) XY//PQ//RS

(iii) XY is not //to AB.

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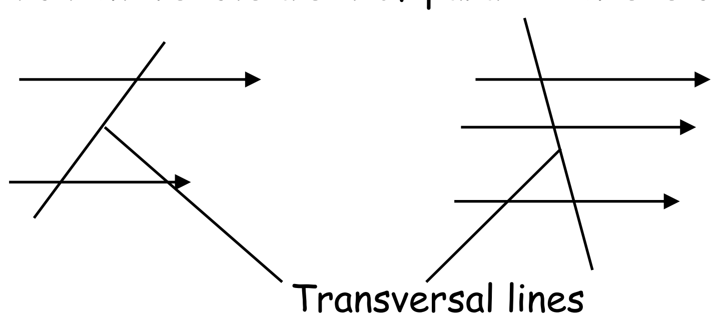
Angle properties of parallel lines

A line which intersects a set of parallel lines is called a transversal line.

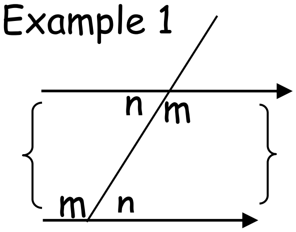
e.g



When a transversal line intersects a pair of parallel lines, there are several angles formed.

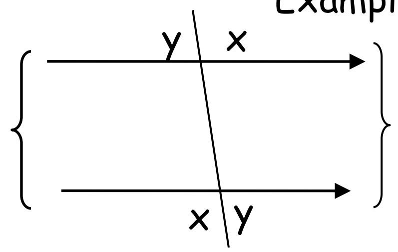
(a) Co-interior and co-exterior angles.

Example 1



Co interior)

Example 2



Co exterior)

Angles $m + n = 180^0$ (co interior)

Angles $x + y = 180^0$ (Co exterior)

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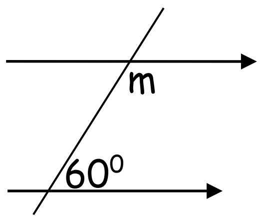
Examples

Find the value for the unknown angle.

a)

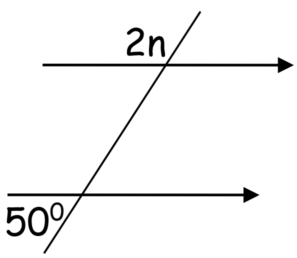


$M + 60^0 = 180^0$

$M + 60^0 - 60^0 = 180^0 - 60^0$

$M = 120^0$

b)



$2n + 50^0 = 180^0$

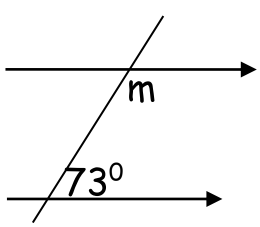
$2n + 50^0 - 50^0 = 180^0 - 50^0$

$\frac{\cancel{2}^{1}n}{\cancel{2}_{1}} = \frac{\cancel{130}^{65}{}^0}{\cancel{2}_{1}}$

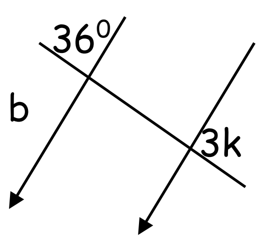
Activity

Solve for the unknown.

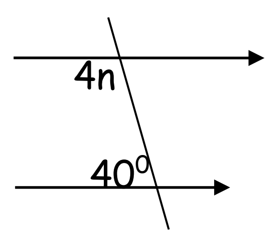
a)



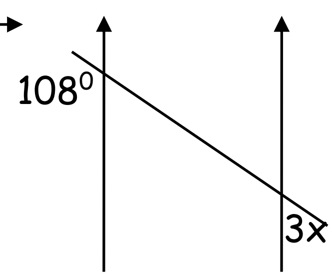
b



c



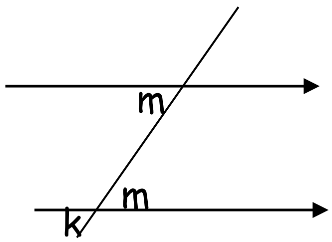
d



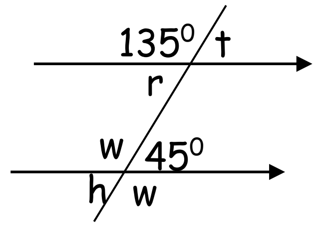
(b) Corresponding angles.

✓ Corresponding angles are equal.

Example 1



Example 2



✓ Angle k is corresponding to angle m.

Angle k = m

✓ Angle t is corresponding to 45^0

Angle h = r

✓ Angle w is corresponding to 135^0

Angle w = 135^0

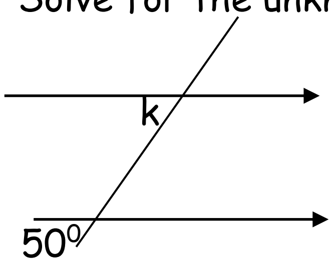
✓ Angle t is corresponding to angle 45^0.

Angle t = 45^0

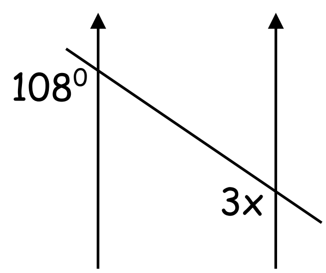
Activity

Solve for the unknown

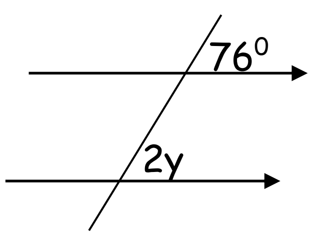
a)



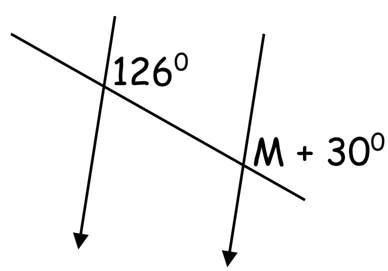
c



b)



d



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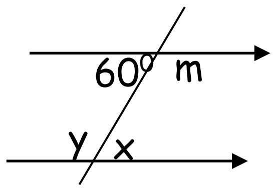
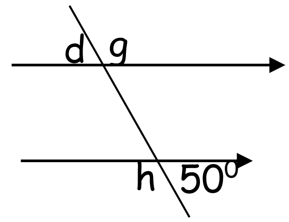
LESSON 13

(C) Alternate angles.

✓ Alternate angles are equal.





- Angle x = 60^0 (Alternate interior)
- Angle d = 50^0 (Alternate exterior angle.
- Angle m = y (alternate interior angles)
- Angle g = h (alternate exterior angles)

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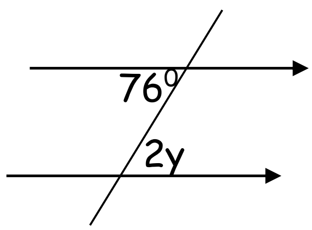
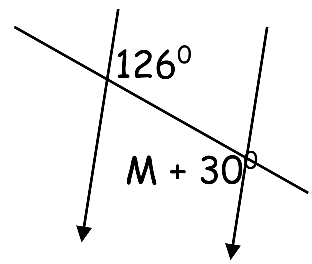
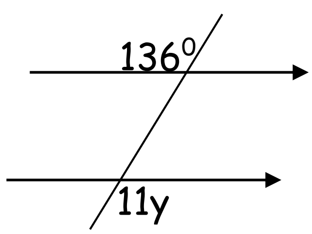
Activity

a)

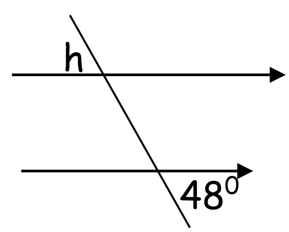




b)



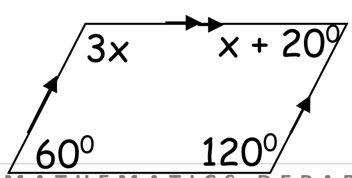
d



Recognizing angles formed by parallel lines.

Example

Find the value of x in the figure below.



i) $3x + 60^0 = 180^0$ (co-interior angles)

$$3x + 60^0 - 60^0 = 180^0 - 60^0$$

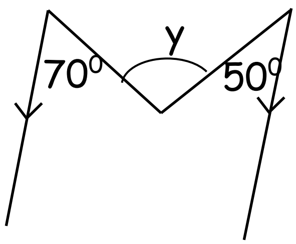
$$3x = 120^0$$

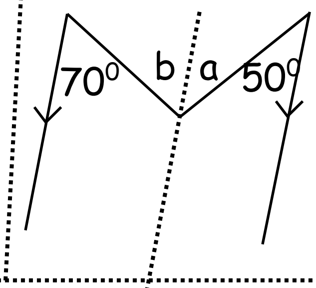
$$\frac{3x}{3} = \frac{120^0}{3}$$

$$x = 40^0$$

(i) $(x + 20) + 120^0 = 180^0$ (co-interior angles)

Find the value of y





Angle a = 50^0

Angle b = 70^0

Angle y = $50^0 + 70^0$

$Y = 120^0$

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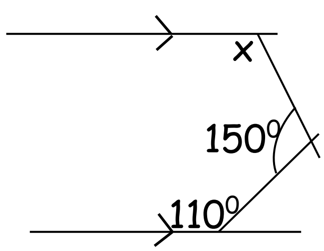
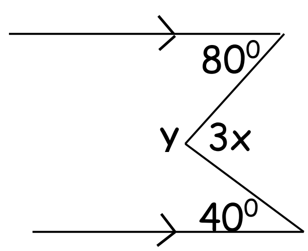
Activity

Find the values of the letters on the diagram.

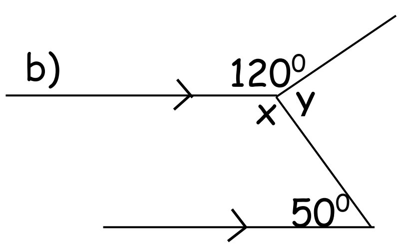
a)



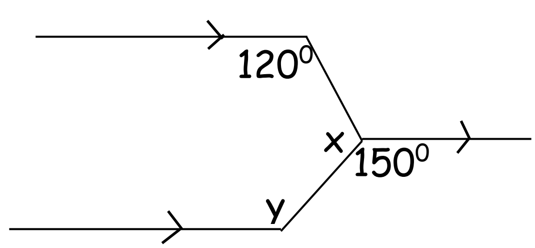
c)



b)

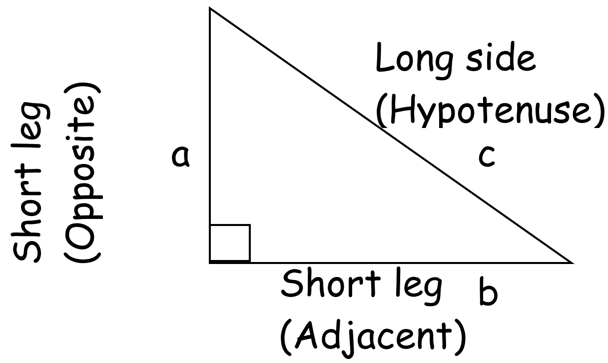


d)



Introduction to pythagoras theorem.

Study the two triangles below.



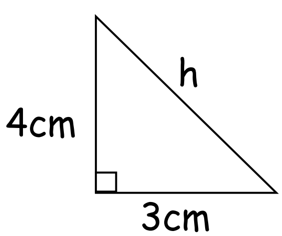
- The pythagoras theorem states that the sum of the square of the opposite and the square of the adjacent is equivalent to the square of the hypotenous.

  $a^2 + b^2 = c^2$

Finding the longest side (hypotenuse) of a right angled triangle.

Example

Find the value of h.



$a^2 + b^2 = c^2$

$3^2 + 4^2 = h^2$

$(3 \times 3) + (4 \times 4) = h^2$

$9 + 16 = h^2$

$25 = h^2$

$5 = h$

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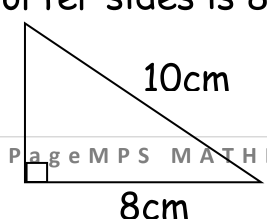
Finding the length of the short side of a right angles triangle.

Example

The longest side of a right angled triangle is 10cm and one of the shorter sides is 8cm. find the length of the other side.



$a^2 + 8^2 = 10^2$

$a^2 + 8 \times 8 = 10 \times 10$

$a^2 + 64 = 100$

$a^2 + 64 - 64 = 100 - 64$

$a^2 = 36$

$a = 6cm$

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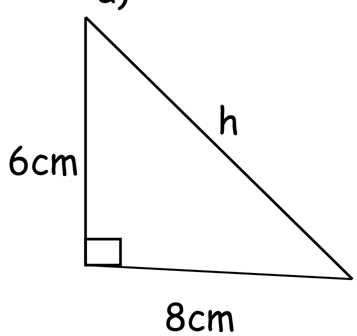
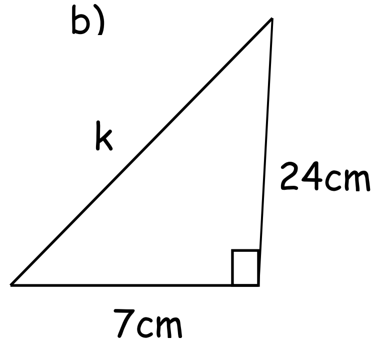
Activity

Find the missing side of each of the following triangle.

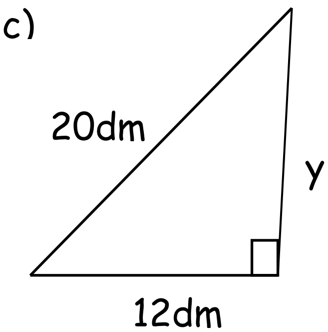
a)



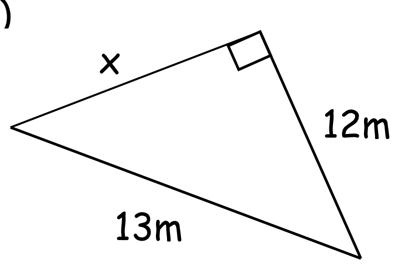
b)



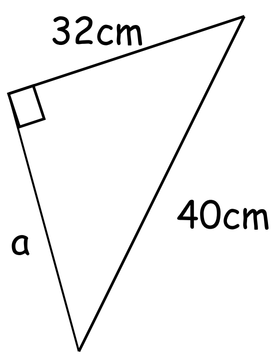
c)



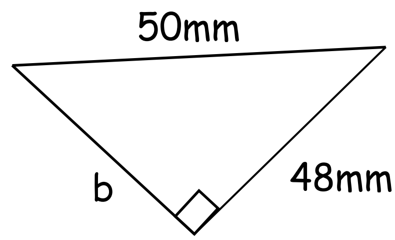
d)



e)



f)

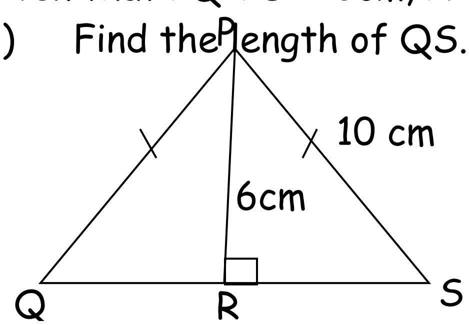


An isosceles triangle and Pythagoras Theorem

Example

Given that PQ=PS =10cm, PR = 6cm and bisects angle QPS.

(i) Find the length of QS.



$(RS)^2 + (PR)^2 = (PS)^2$

$(RS)^2 + 6^2 = 10^2$

$(RS)^2 + 36 = 100$

$(RS)^2 + 36 = 100$

$\quad - 36 \quad - 36$

$(RS)^2 = 64$

Line QS

= (8 + 8) cm

= 16 cm

$(RS)^2 = 64$

$RS = 8cm$

(ii) Calculate the perimeter of the figure above.

$P = 10cm + 10cm + (8x2)\ cm$

$20\ cm + 16\ cm$

$= 36\ cm$

(iii) Find the area of the figure.

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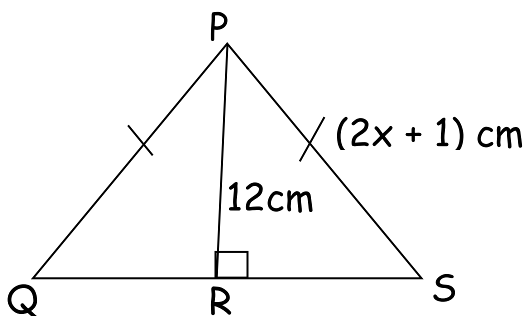
Activity

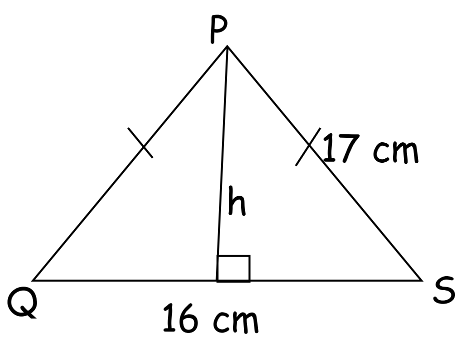
1. PQR is an isosceles triangle. PQ is 13 cm

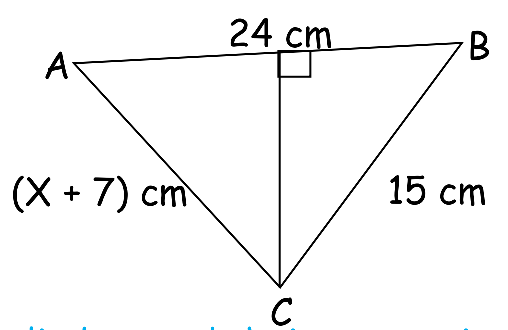


a) Find the value of x.

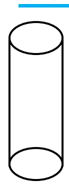
b) Find the length QS

2. Find the height, perimeter and the area of the following figures.

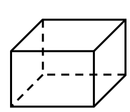




Solid figures (prisms, cylinders and their properties)

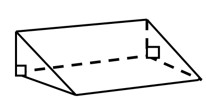


Cylinder



Rectangular prism

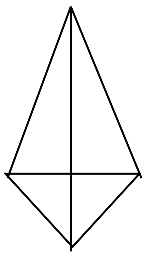
(Cuboid)



Triangular prism

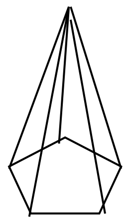
Pyramids and their properties.

Names of pyramids come from the shape of their bottom face.

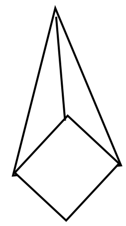


Tetrahedron

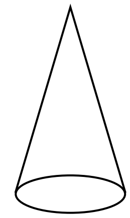
Triangular pyramid



Pentagon based pyramid



Square based pyramid



Square based pyramid

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Regular polygons

Name of polygon	Number of sides
Equilateral triangle	3 sides
Square	4 sides
Pentagon	5 sides
Hexagon	6 sides
Heptagon	7 sides
Octagon	8 sides
Nonagon	9 sides
Decagon	10 sides
Nuodecagon	11 sides
Duodecagagon	12 sides

Facts about regular polygons

- The centre angle of all regular polygons is 360^0.
- The sum of all exterior angle is 360^0
- Interior and exterior angles of a regular polygon add up to 180^0

Examples

1. The interior angle of a regular polygon is 120^0. Find the size of its exterior angle.

Let the exterior angle be y.

Interior angle + exterior angle = 180^0

$$Y + 120^0 = 180^0$$

$$Y + 120^0 - 120^0 = 180^0 - 120^0$$

$$Y = 60^0$$

2. The interior angle of a regular polygon is 20^0 more than the size of its exterior angle find the size of each;
   i) Interior angle
   ii) Exterior angle

Let the exterior angle be k

Exterior	Interior	Sum
k	$K + 20^0$	180^0

$$K + k + 20^0 = 180^0$$

$$2k + 20^0 = 180^0$$

$$2k + 20^0 - 20^0 = 180^0 - 20^0$$

$$\frac{2k}{2} = \frac{160^0}{2}$$

$$K = 80^0$$

ii) Interior angle

$80^0 + 20^0$

$= 100^0$

3. The interior angle of a regular polygon is 3 times the size of its exterior angle. Find the size of each exterior and interior angle.

Exterior	Interior	Total
Y	3Y	180^0

$$Y + 3Y = 180^0$$

$$4Y = 180^0$$

$$\frac{4Y}{4} = \frac{180^0}{4}$$

$Y = 45^0$

Exterior angle

$= 45^0$

Interior angle

$= 45^0 \times 3$

$= 135^0$

4. The interior and exterior angles of a regular polygon are in the ratio of 2:3 respectively. Find the size of each exterior and interior angles.

Total ratio = 3 + 2

=5

Interior angle	Exterior angle
$\frac{3 \times \cancel{180^0}\ 36^0}{\cancel{5}}$ $= 3 \times 36^0$ $= 108^0$	$(180^0 - 108^0)$ $= 72^0$

Activity

1. The exterior angle of a regular polygon is 20^0. What is the size of its interior angle?
2. The interior angle of a regular polygon is 36^0 more than the size of its exterior angle.
   a) Calculate the size of the exterior angle.
   b) What is the size of its interior angle?
3. The interior and exterior angles of a regular polygon are in the ratio of 3:7 respectively. Find the size of each angle.
4. The interior angle of a regular polygon is 5 times the size of its exterior angle. Work out the size of each angle.

Finding number of sides of a regular polygon.

Number of sides of a regular polygon = $\frac{\text{all exterior angles}}{\text{Each exterior angle } (360^0)}$

Examples

1. The exterior angle of a regular polygon is 72^0.
   a) Work out the size of its exterior angle.
   Exterior angle = $\frac{360^0}{72^0}$
   = 5 sides
   b) Name the polygon
   A pentagon

2. The interior angle of a regular polygon is 120^0.
   a) How many sides has the polygon?
   Let the exterior angle be y.

Interior angle + exterior angle = 180^0

$Y + 120^0 = 180^0$

$Y + 120^0 - 120^0 = 180^0 - 120^0$

$Y = 60^0$

Number of sides = $\frac{360^0}{60^0}$

= 6 sides

b) name the polygon

A hexagon

3. The interior and exterior angles of a regular polygon are in the ratio of 2:7 respectively. Find the size of each exterior. Name the polygon.

Total ratio = 2 + 7

=5

Interior angle

$\frac{2}{\cancel{9}} \times \cancel{180^0}\ 20^0$

$= 2 \times 20^0$

$= 40^0$

Number of sides

$= \frac{360^0}{40^0}$

= 9 sides

A nonagon

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Activity

1. The exterior angle of a regular polygon is 30^0.
   a) How many sides has the polygon?
   b) Name the polygon.
2. The interior angle of a regular polygon is 108^0.
   a) What is the size of each exterior angle?
   b) Name the polygon.
3. The interior and exterior angles of a regular polygon are in the ratio 1: 2. Name the polygon.
4. Calculate the number of sides of a regular polygon whose interior angle is 4 times the size of its exterior angle.

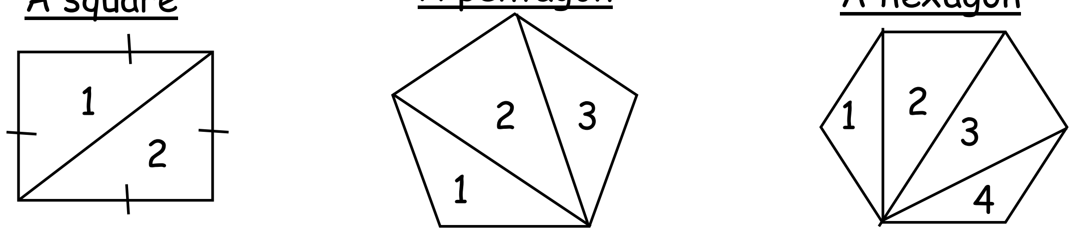
5. One of the exterior angles of a regular polygon is 18^0. How many sides has the polygon?

Finding number of triangles in a given polygon. (triangulation)

- Triangulation is the formation of triangles in a regular polygon from the common vertex.
- The number of triangles formed depends on the number of sides the polygon has.

Illustration of triangulation

A square   A pentagon   A hexagon



Two triangles   3 triangles   4 triangles

Name of polygon	Number of sides(n)	Number of triangles
Equilateral triangle	3	(3 - 2) = 1
Square	4	(4 – 2) = 2
Pentagon	5	(5 – 2) = 3
Hexagon	6	(6 – 2) = 4
Heptagon	7	(7 – 2) = 5
	n	(n – 2) = 2

Therefore number of triangles = n -2

Examples

1. How many triangles can be formed from an octagon?

$$n - 2 = 8 - 2$$
$$= 6 \text{ triangles}$$

2. If 10 triangles can be formed from a regular polygon. How many sides has the polygon?

$$n - 2 = \text{number of triangles}$$
$$n - 2 = 10$$
$$n - 2 + 2 = 10 + 2$$

n = 12 sides

Activity

1. Find the number of triangles in a regular polygon whose number of sides are;
   a) 9 sides?
   b) 13 sides?
   c) 20 sides?
   d) 18 sides?
   e) 36 sides
   f) 15 sides?
2. Calculate the number of sides of a regular polygon whose number of triangles are;
   a) 8 triangles
   b) 7 triangles
3. Name the regular polygon whose number of triangles are;
   a) 10 triangles
   b) 14 triangles
   c) 11 triangles

Finding number of right angles in a regular polygon.

- There are two right angles in a triangle.
- Therefore number of right angles = 2 (n - 2)

  = 2n – 4

Examples

1. Calculate the number of right angles in a polygon with 5 sides

Number of right angles = 2 (n - 2)

= 2(5 - 2)

= 2 x 3

= 6 right angles

2. Name the regular polygon with 12 right angles

2 (n – 2) = number of right angles

2n – 4 = 12

2n -4 + 4 = 12 + 4

2n = 16

Activity

1. Find the number of right angles of a regular polygon with;
   a) 5 sides
   b) 7sides
   c) 12 sides
2. Find the number of sides of a regular polygon whose number of right angles are;
   a) 18 right angles
   b) 20 right angles
   c) 24 right angles
3. Name the regular polygon whose number of right angles are;
   a) 14 right angles
   b) 16 right angles
   c) 10 right angles

Interior angle sum

We can find interior angle sum in three ways.

1. Each interior angle x number of sides
2. Number of right angles (2n - 4) x size of each right angle (90^0)
3. Number of triangles (n - 2) x size of each triangle (180^0).

Examples

1. One of the interior angles of a regular hexagon is 120^0. Calculate the interior angle sum of the polygon

   Interior angle sum = interior angle x number of sides
   = $120^0 \times 6$
   = 720^0

2. Calculate the interior angle sum of a regular polygon with 7 sides.

   Method 1 (triangulation)

   Interior angle sum = $180^0(n - 2)$
   = $180^0(7 - 2)$
   = $180^0 \times 5$

   Method 2 (using right angles)

   $90^0(2n - 4)$
   $90^0(2\times7 - 4)$
   $90^0(14 - 4)$
   = $90^0 \times 10$
   = 900^0

$= 900^0$

Activity

1. The size of each interior angle of an equilateral triangle is 60^0. Calculate its interior angle sum.
2. Calculate the interior angle sum of a nonagon whose interior angle is 40^0.
3. A regular polygon has 10 sides. Calculate its interior angle sum.
4. Calculate the interior angle sum of a regular nuodecagon.
5. A regular polygon has 20 sides. Calculate its interior angle sum.

More about interior angle sum

Examples

1. Each exterior angle of a regular polygon is 300. Calculate the interior angle sum of the polygon.

Method 1

Number of sides = 3600 ÷ 300

=12 sides

Interior angle = $180^0 - 30^0$

$= 150^0$

Interior angle sum = $150^0 \times 12$

$= 1800^0$

Method 2

$90^0(2n - 4)$

$90^0(2\times 12 - 4)$

$90^0(24 - 4)$

$90^0 \times 20$

$= 1800^0$

Method 3

$180^0(n - 2)$

$180^0(12 - 2)$

$180^0(12 - 2)$

$180^0 \times 10$

$= 1800^0$

Activity

1. Each interior angle of a regular polygon is 45^0. Calculate the interior angle sum of the polygon.
2. The size of each interior angle of a regular polygon is 140^0. Calculate the interior angle sum of the polygon.
3. Calculate the interior angle sum of a regular polygon whose exterior angle is 36^0.
4. The size of each interior angle of a regular polygon is 90^0. Calculate its interior angle sum.

5. Find the interior angle sum of a regular polygon whose interior angle is 108^0.
6. A regular polygon has one of its exterior angle as 400.
   a) How many sides has the polygon?
   b) How many right angles has the polygon?
   c) Calculate the interior angle sum of the regular polygon.

Solving problems involving interior angle sum.

Examples

1. The sum of interior angles of a regular polygon is 1440^0

a) How many sides has the polygon?

$180^0(n - 2)$ = number of right angles

$180^0 (n - 2) = 1440^0$

$180^0n - 360^0 = 1440^0$

$180^0n - 360^0 + 360^0 = 1440^0 + 360^0$

$\frac{180^0n}{180^0} = \frac{1800^0}{180^0}$

n = 10 sides

b) Find the size of each exterior angle.

Exterior angle = $\frac{360^0}{10}$

$= 36^0$

Activity

1. The sum of interior angles of a regular polygon totals to 12 right angles.
   a) How many sides has the polygon?
   b) What is the size of each exterior angle?
2. The interior angle sum of a regular polygon is 1260^0.
   a) Calculate the number of sides of the polygon.
   b) Find the size of each interior angle.

BEARING AND SCALE DRAWING

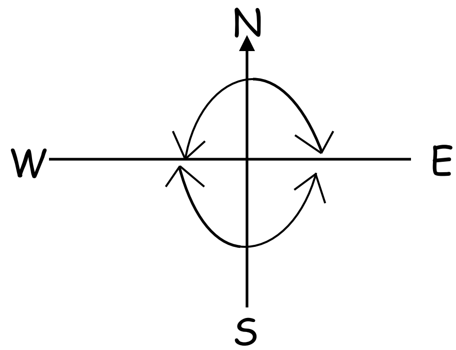
BEARING

There are two types of bearing.

i) True bearing
ii) Ordinary bearing.

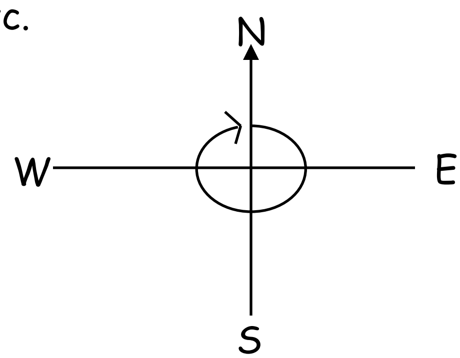
Ordinary bearing.(direction)

- Ordinary bearing is measured from North or South towards East or West.



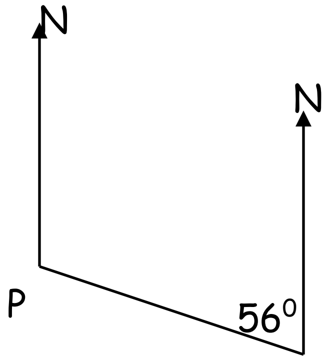
True bearing

- True bearing is measured from north in a clock wise direction.
- They are always given as 3-digit bearing e.g. 030^0, 059^0, 099^0, 123^0 etc.



Examples

1. Use the figure below to answer the questions that follow.



a) What is the direction of;

i) P from Q?

ii) Q from P?

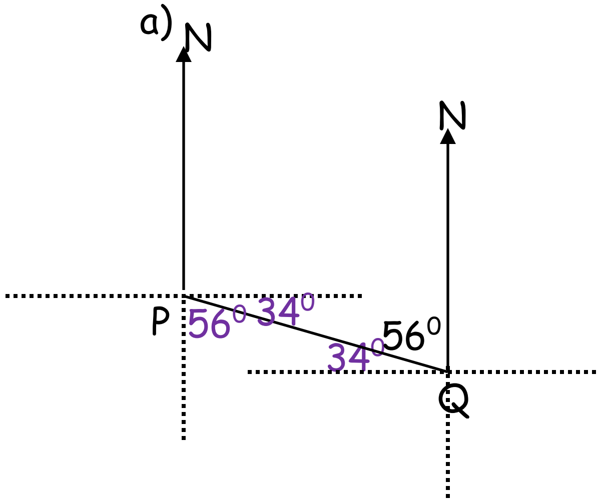
b) Find the bearing of:

i) P from Q

ii) Q from P

Solution

a)



a) Direction

i) P from Q?

$N56^0W$

ii) Q from P

$S56^0E$

ii) Q from P

$S\ 56^0E$

b) Bearing

i) P from Q

$= 270^0 + 34^0$

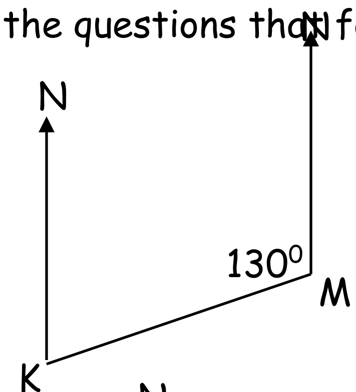
$= 304^0$

ii) Q from P

$= 90^0 + 34^0$

$= 124^0$

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



a) What is the direction of;

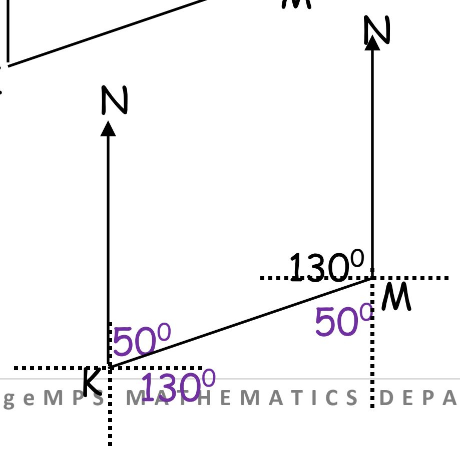
iii) M from K?

iv) K from M?

b) Find the bearing of:

iii) M from K

iv) K from M



b) Direction

j) M from K?

$N50^0E$

ii) K from M

$S50^0W$

b) Bearing

i) M from K

= 050^0

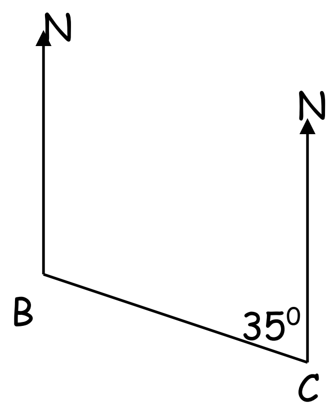
ii) K from M

= $180^0 + 50^0$

= 230^0

Activity

1.



a) What is the direction of;

i) A from B?

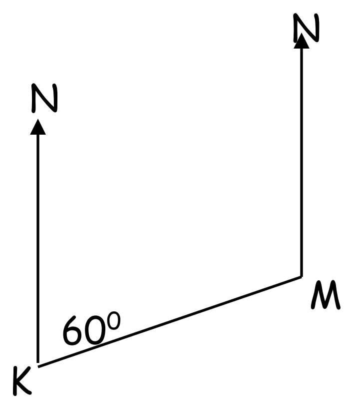
ii) B from A?

b) Find the bearing of:

i) A from B

ii) B from A

2.



a) What is the direction of;

i) K from M?

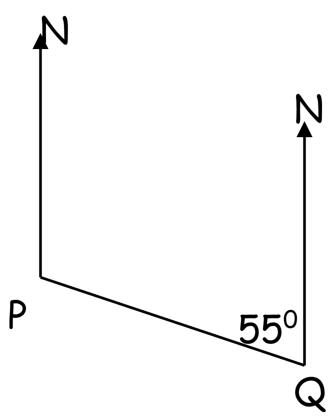
iii) M from K?

b) Find the bearing of:

i) K from M

ii) M from K

3.



a) What is the direction of;

i) P from Q?

ii) Q from P?

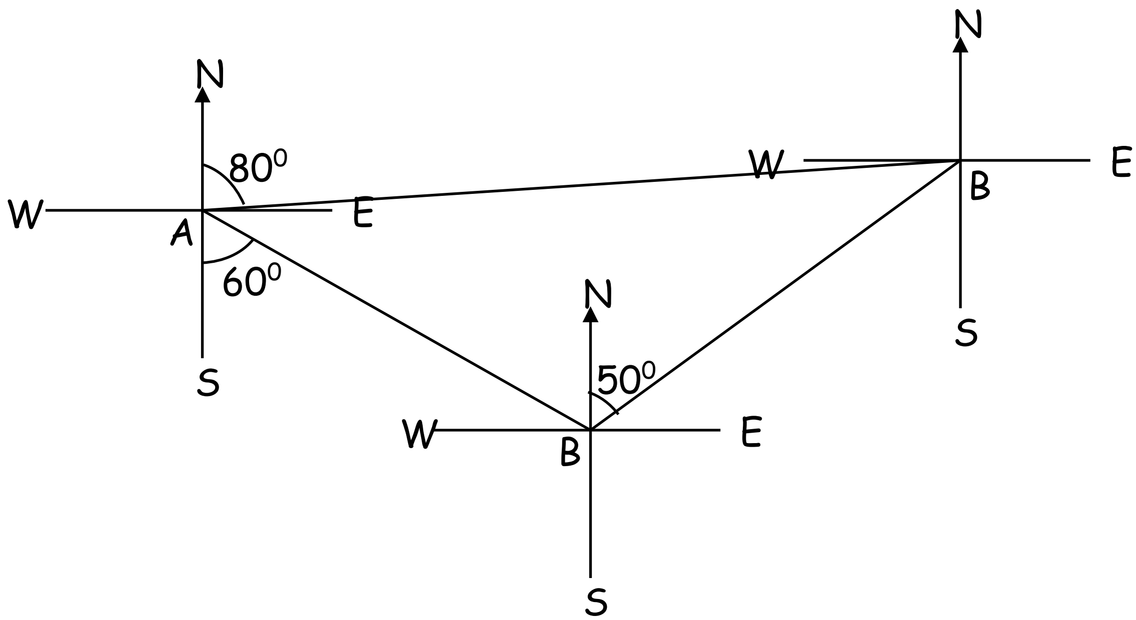
b) Find the bearing of:

i) P from Q

ii) Q from P

More examples

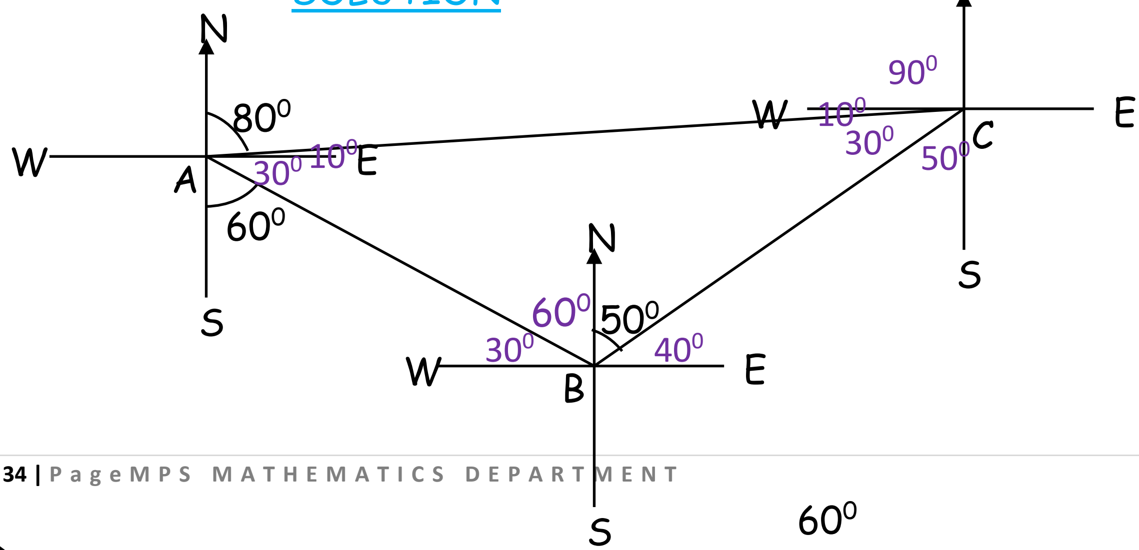
Use the diagram below to answer the following questions.



Questions

1. What is the direction of;
   a) A from B? c) B from A? e) C from B?
   b) A from C? d) B from C? f) C from A?
2. Find the bearing of;
   a) A from B? c) B from A? e) C from B?
   b) A from C? d) B from C? f) C from A?

SOLUTION



1. Direction

a) A from B
N60^0W

c) B from A?
S60^0E

e) C from B?
N50^0E

b) A from C
S80^0W

d) B from C?
S50^0W

f) C from A?
N80^0E

2. Bearing

a) A from B
$= 180^0 + 90^0 + 30^0$
$= 300^0$
OR
$360^0 - 60^0$
$= 300^0$

b) A from C
$= 180^0 + 50^0 + 30^0$
$= 260^0$
OR
$360^0 - 100^0$
$= 260^0$

C) B from A
$= 90^0 + 30^0$
$= 120^0$
OR
$180^0 - 60^0$
$= 120^0$

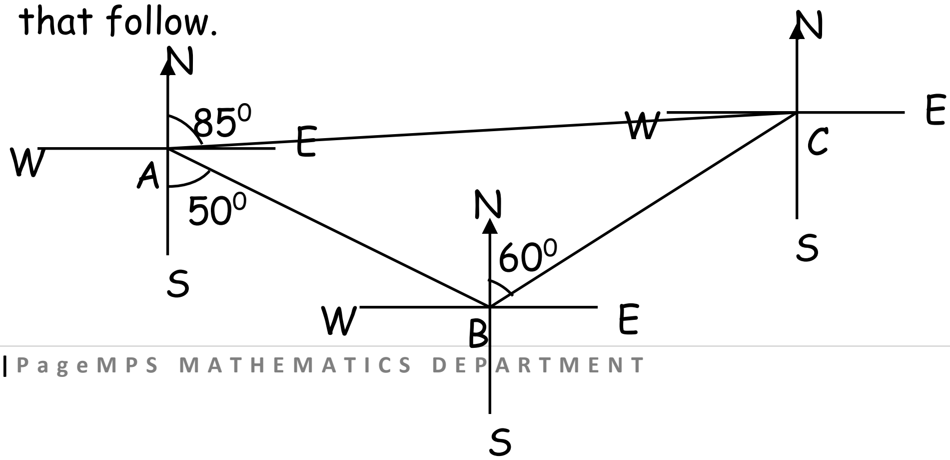
d) B from C
$= 180^0 + 50^0$
$= 230^0$
OR
$360^0 - 130^0$
$= 230^0$

e) C from B
$= 050^0$

f) C from A
$= 080^0$

Activity

1. Study the diagram below carefully and use it to answer questions that follow.



i) Find the direction of;

a) A from B c) B from A e) C from B

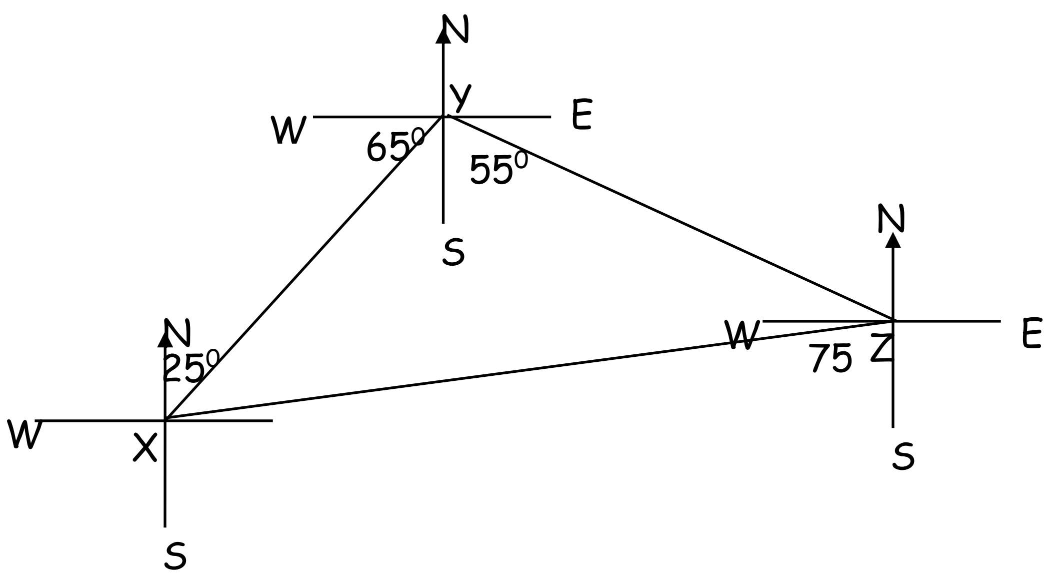
b) B from A d) B from C f) C from A

ii) What the bearing of;

a) A from B c) B from A e) C from B

b) B from A d) B from C f) C from A

2. Use the diagram below to answer the questions that follow



a) Find the direction of;

i) Y from X c) Y from Z c) X from Z

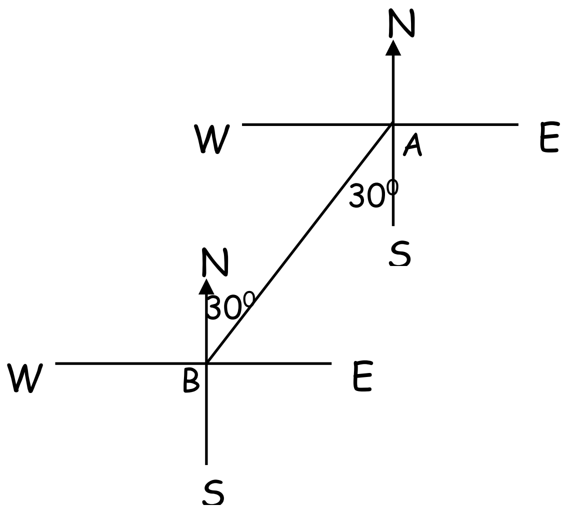
ii) X from d) Z from Y d) Z from X

OPPOSITE BEARING

- If the given bearing is less than 180^0, the opposite bearing will be 180^0 plus the given bearing.
- When the given bearing is greater than 180^0, the opposite bearing will be the given bearing minus 180^0.

Examples

1. The bearing of town A from town B is 030^0. Find the bearing of town B from town A.

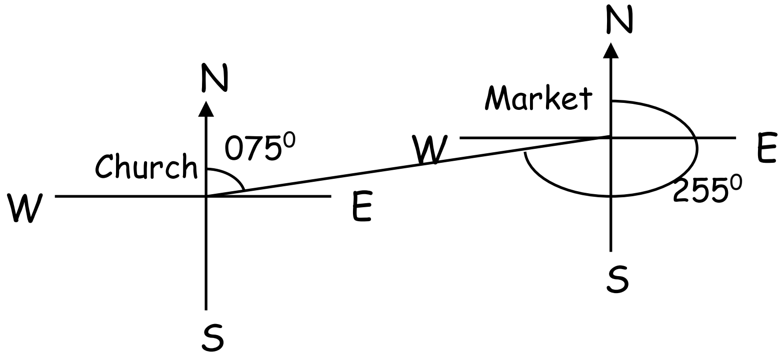


Bearing of town B from town A

$= 180^0 + 30^0$

$= 210^0$

2. The bearing of the church from the market is 255^0. What is the bearing of the market from the church?



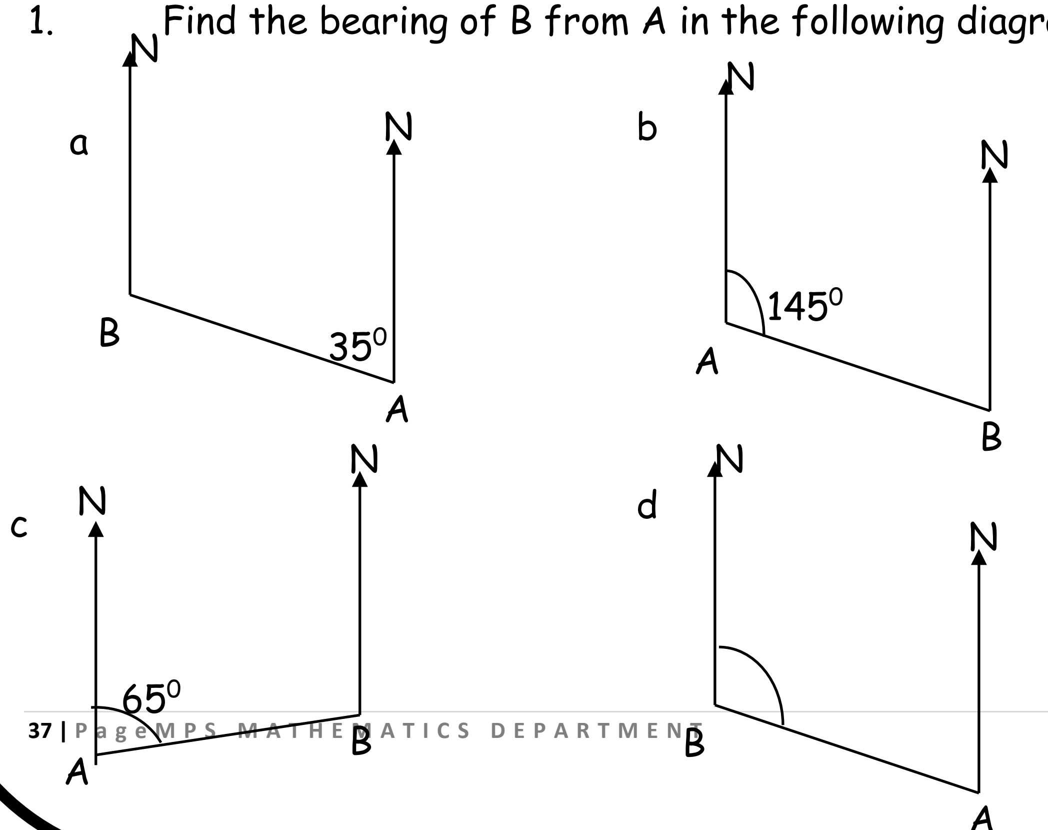
Bearing of the market from the church

$= 255^0 + 180^0$

$= 075^0$

Activity

1. Find the bearing of B from A in the following diagrams



1. The bearing of town X from town Y is 290^0. What is the bearing of town Y from town X?

2. The bearing of town R from town T is 050^0. Find the bearing of town T from town R.

3. Find the bearing of H from G if the bearing of G from H IS 330^0

The bearing of Q from P is 080^0. What is the bearing of P from Q?

Scale drawing

There are three types of scales

- Linear scale/ bar scale.
- Statement scale
- Ratio scale

Examples

1. If 1cm on a map represents 10km on land, what will be the actual distance of;

a) 5cm

$5 \times 10km$

$= 50km$

b) 2.5cm

$\frac{25}{10} \times 10km$

$= 25km$

c) 2.5cm

$\frac{25}{10} \times 10km$

$= 25km$

2. If 1cm represents 10km, what will be the distance on the map that represents the following actual distance?

a) 80km

$\frac{80}{10}$

$= 8cm$

b) 150km

$\frac{150}{10} \times 10km$

$= 15cm$

b) 1100km

$\frac{1100}{10} \times 10km$

$= 110cm$

3. Given that the scale on a map is 1:480,000. Find the actual distance on the ground in km represented by 5cm on a map.

1cm on the map represents 480,000cm on land.

5cm represents (480000 x 5)

$= 2,400,000cm$

But 100000cm = 1km

$$2,400,000cm = \frac{2,400,000}{100000}$$

$= 24km$

Activity

1. What will be the actual length on the ground that is represented by the following length on the map?
   a) 4cm
   b) 7.5cm
   c) 13cm
2. What will be the actual length on the ground that represents the following length on the map?
   a) 90km
   b) 120km
   c) 145km
3. Given that the scale on the map is 1:1,200,000. Find the actual distance on the ground in km represented by;
   a) 4 cm
   b) 6cm
   c) 7.5cm

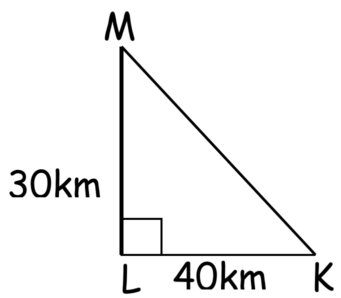
Scale drawing

Examples

1. Town K is 40km east of town L and town M is 30km north of town L.
   a) using a scale of 1cm to represent 10 km, draw an accurate diagram to show the three towns.

b) What is the shortest distance between towns K and L?

Sketch



b) 40km

$\frac{40}{10}$

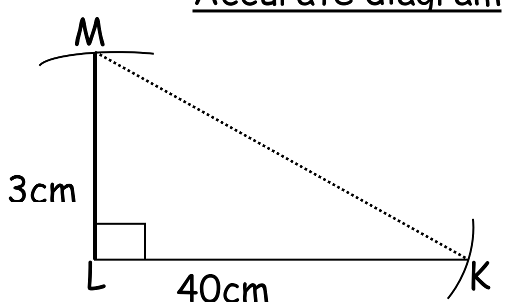
= 4cm

b) 30km

$\frac{30}{10}$

= 3cm

Accurate diagram



Shortest distance

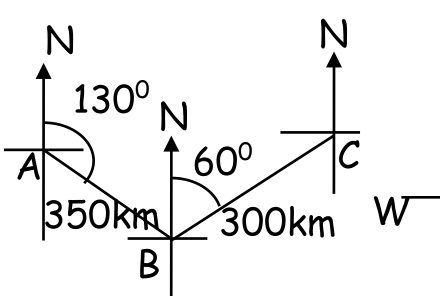
= 5cm

= 5 x 10km

= 50km

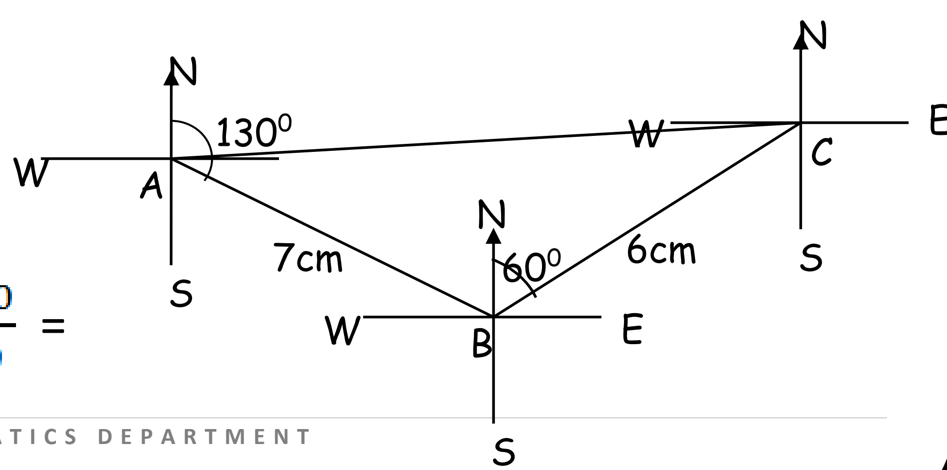
2. Town b is 350km away from town a on a bearing of 130^0 and town c is 300km away from town b on a bearing of 060^0
   a) Using a scale of 1cm to represent 50km, draw an accurate diagram showing the three towns.
   b) Find the shortest distance between towns A and C

Sketch



$\frac{350}{50}$ = 7cm $\frac{300}{50}$ =

Accurate diagram



Activity

1. A plane moved 40km southwards from town P to town K. Iit then left town K and flew eastwards for 30km to town Q.
    a) Draw the sketch to show the above flight.
    b) Using a scale of 1cm to represent 5km, draw an accurate diagram to show the above flight.
    c) What is the shortest distance in km between P and Q.
    d) Find the bearing of P from Q.
2. An Air craft left town K and flew westwards to town P which is 63 km away. It then left town P and flew northwards for 53km to town Z.
    a) Using a scale of 1km to represent 9km, draw an accurate diagram to show the above flight.
    b) Find the shortest distance between towns K and Z

3. A school library is 800m west of the dinning hole and the staff room is 600m south of the school library.

a) Draw a sketch diagram showing the location of the three places.

b) Using a scale of 1cm to represent 100kn, draw an accurate diagram showing the location of the three places.

4. A military plane leaves base K and flies 60km westwards to base B. It then flies 80km northwards to base C.

a) Draw a sketch to show the rout taken by the plane.

b) Using a scale of 1cm to represent 10km, construct an accurate diagram to show the above flight.

c) Find the shortest distance in km from base K to base C.