P425/2
APPLIED MATHEMATICS
NOVEMBER-2025
FINAL RECAP

Uganda Advanced Certificate of Education
PRE-UNEB Revision
APPLIED MATHEMATICS

#UACE 2025
Mathematics Department

The number of cows owned by residents in a village is assumed to be normally distributed. 15% of the residents have less than 60 cows. 5% of the residents have over 90 cows.

(a). Determine the values of the mean and standard deviation of the cows. [8]

(b). If there are 200 residents, find how many have more than 80 cows. [4]

By plotting graphs of $y = x$ and $y = 4\sin x$ on the same axes, show that the root of the equation $x - 4\sin x = 0$ lies between 2 and 3.
Hence use Newton Raphson's method to find the root of the equation correct to **3** decimal places. [12]

The times taken for S5 students to have their lunch to the nearest minute are given in the table below.

Time (minutes)	3 – 4	5 – 9	10 – 19	20 – 29	30 – 44
Number of students	2	7	16	21	9

(a). Calculate the mean time for the students to have lunch. [4]

(b). (i). Draw a histogram for the given data.

(ii). Use your histogram to estimate the modal time for the students to have their lunch. [8]

A student used the trapezium rule with five sub-intervals to estimate $\int_2^3 \frac{x}{(x^2-3)}\,dx$ correct to **three** decimal places.

Determine:

(a). the value the student obtained. [6]

(b). the actual value of the integral. [3]

(c). (i). the error the student made in the estimate.

(ii). How the student can reduce the error. [3]

A particle of mass 3 kg is acted upon by a force $\boldsymbol{F} = 6\underset{\sim}{\boldsymbol{i}} - 36t^2\underset{\sim}{\boldsymbol{j}} + 54t\underset{\sim}{\boldsymbol{k}}$ Newtons at time t. At time $t = 0$, the particle is at the position vector $\underset{\sim}{\boldsymbol{i}} - 5\underset{\sim}{\boldsymbol{j}} - \underset{\sim}{\boldsymbol{k}}$and its velocity is $3\underset{\sim}{\boldsymbol{i}} + 3\underset{\sim}{\boldsymbol{j}}\,\mathrm{m\,s^{-1}}$. Determine the:

(a). position vector of the particle at time $t = 1$ second. [9]

(b). distance of the particle from the origin at time $t = 1$ second. [3]

A discrete random variable X has a probability distribution given by

$$P(X = x) = \begin{cases} kx & ; \quad x = 1, 2, 3, 4, 5, \\ 0 & ; \quad \text{otherwise.} \end{cases}$$

where$k$ is a constant.

Determine:

(a). the value of k. [3]

(b). $P(2 < X < 5)$. [2]

(c). Expectation, $E(X)$. [3]

(d). Variance, $Var(X)$. [4]

Qn 7: The table below shows the retail prices (shs) and ammount of each item bought weekly by a restaurant in 2002 and 2003.

Item	Price (Shs)		Ammount bought
	2002	2003	
Milk (per litre)	400	500	200
Eggs (per tray)	2,500	3,000	18
Cooking oil (per litre)	2,400	2,100	2
Baking flour (per packet)	2,000	2,200	15

(a). Taking 2002 as the base year, calculate the weighted aggregate price index. [3]

(b). In 2003, the restaurant spent shs. 450,000 on buying these items. Using the weighted aggregate price index obtained in (a), calculate what the restaurant could have spent in 2002. [2]

In a square ABCD, three forces of magnitudes 4 N, 10 N and 7 N act along AB, AD and CA respectively. Their directions are in the order of the letters. Find the magnitude of the resultant force. [5]

A box A contains 1 white ball and 1 blue ball. Box B contains only 2 white balls. If a ball is picked at random, find the probability that it is:

(a). white. [3]

(b). from box A given that it is white. [2]

Given that $y = \frac{1}{x} + x$ and $x = 2.4$ correct to **one** decimal place, find the limits within which y lies. [5]

The probability that a patient suffering from a certain disease recovers is 0.4. If 15 people contracted the disease, find the probability that:

(a). more than 9 will recover. [2]

(b). between five and eight will recover. [3]

(a). Draw on the same axes the graphs of the curves $y = 2 - e^{-x}$ and $y = \sqrt{x}$ for $2 \leq x \leq 5$. [5]

(b). Determine from your graphs the interval within which the root of the equation $e^{-x} + \sqrt{x} - 2 = 0$ lies. Hence, use Newton Raphson's method to find the root of the equation correct to **3** decimal places.

[7]

The table below shows the number of red and green balls put in three identical boxes A, B and C.

Boxes	A	B	C
Red balls	4	6	3
Green balls	2	7	5

A box is chosen at random and two balls are then drawn from it successively without replacement. If the random variable X is "the number of green balls drawn",

(a). draw a probability distribution table for X. [6]

(b). calculate the mean and variance of X. [6]

(a). Use trapezium rule with 6-ordinates to estimate the value of $\int_0^{\frac{\pi}{2}}(x + \sin x)\, dx$, correct to **three** decimal places. [6]

(b). (i). Evaluate $\int_0^{\frac{\pi}{2}}(x + \sin x)\, dx$, correct to **three** decimal places. [3]

(ii). Calculate the error in your estimation in (a) above. [2]

(iii). Suggest how the error may be reduced. [1]

A particle of mass 4 kg starts from rest at a point $\left(2\underset{\sim}{\boldsymbol{i}} - 3\underset{\sim}{\boldsymbol{j}} + \underset{\sim}{\boldsymbol{k}}\right)$ m. It moves with acceleration $\underset{\sim}{\boldsymbol{a}} = \left(4\underset{\sim}{\boldsymbol{i}} + 2\underset{\sim}{\boldsymbol{j}} - 3\underset{\sim}{\boldsymbol{k}}\right)$ m s^{-2} when a constant force, $\underset{\sim}{\boldsymbol{F}}$, acts on it. Find the:

(a). force $\underset{\sim}{\boldsymbol{F}}$. [2]

(b). velocity at any time t. [4]

(c). work done by the force $\underset{\sim}{\boldsymbol{F}}$after 6 seconds. [6]

The frequency distribution below shows the ages of 240 students admitted to a certain University.

Age (years)	Number of students
$18-<19$	24
$19-<20$	70
$20-<24$	76
$24-<26$	48
$26-<30$	16
$30-<32$	6

(a). Calculate the mean age of the students. [4]

(b). (i). Draw the histogram for the given data.

(ii). Use the histogram to estimate the modal age. [8]

A random variable X has a normal distribution where $P(X > 9) = 0.9192$ and $P(X < 11) = 0.7580$. Find:

(a). the values of the mean and standard deviation. [8]

(b). $P(X > 10)$. [4]

: A particle of mass 15 kg is pulled up a smooth slope by a light inextensible string parallel to a slope . The slope is 10.5 m long inclined at $\sin^{-1}\left(\frac{4}{7}\right)$ to the horizontal. The acceleration of the particle is 0.98 m s^{-2}. Determine the:

(a). tension in the string. [3]

(b). work done against gravity when the particle reaches the end of the slope. [2]

: The price index of an article in 2000 based on 1998 was 130. The price index of the article in 2005 based on 2000 was 80. Calculate the:

(a). price index of the article in 2005 based on 1998. [3]

(b). price of the article in 1998 if the article was 45,000 in 2005. [2]

: Two numbers A and B have maximum possible errors e_a and e_b respectively.

(a). Write an expression for the maximum possible error in their sum.

(b). If $A = 2.03$ and $B = 1.547$, find the maximum possible error in $A + B$. [5]

: In an equilateral triangle PQR, three forces of magnitude 5 N, 10 N and 8 N act along the sides PQ, QR and PR respectively. Their forces are in the order of the letters. Find the magnitude of the resultant force. [5]

: A biased coin is such that a head is three times as likely to occur as a tail. The coin is tossed 5 times. Find the probability that at most two tails occur. [5]

: Two events A and B are such that $P(A/B) = \frac{2}{5}$, $P(B) = \frac{1}{4}$ and $P(A) = \frac{1}{5}$.

Find:

(a). $P(A \cap B)$. [2]

(b). $P(A \cup B)$. [3]

The table below shows height in centimetres of 25 students in a certain school.

Height (cm)	< 10	< 20	< 25	< 30	< 50	<55	< 65
Number of students	0	3	7	15	17	23	25

Calculate
(i). Mean height
(ii). Variance
(iii). Mode
(iv). Middle 70% of the height. [12]

(a). Construct a flow chart that computes and prints the average of the squares of the first six counting numbers. Perform a dry run for your flow chart.
(b). Locate graphically the positive root of the equation $e^{-x} = 4 - 3x$ and hence, use linear interpolation to find the root of the equation to 2 decimal places. [12]

Annet stays in Kenya and Bob stays in Uganda. The probability that Annet will go to china in December this year is $\frac{3}{5}$ and that of Bob is $\frac{3}{8}$.
(a). Find the probability that they are likely to be in different countries next year.
(b). The probability that patience passes Biology, Chemistry and Mathematics is 0.7, 0.8 and 0.65 respectively.
 (i). Find the probability that she passes at most one subject.
 (ii). If we know that she passed atmost one subject. What is the probability that she passed Mathematics. [12]

A random variable X has its p.d.f given by

$$P(x = x) = \begin{cases} \frac{k}{x} & ; \quad x = 1, 2, 3, \\ 0 & ; \quad \text{elsewhere.} \end{cases}$$

Find:
(i). the value of Constant k,
(ii). $E(X + 1)^2$,
(iii). Median,
(iv). 3rd decile. [12]

(a). Use the trapezoidal rule with five ordinates to evaluate $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}}\,dx$ to 3 decimal places.

(b). Find the exact value of $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}}\,dx$ to 3 decimal places.

(c). Find the absolute error in the function and state one way how this error can be reduced. [12]

: A Continuous random variable has accumulative probability function given by

$$F(x) = \begin{cases} \log_2(x^k) & ; \quad 0 \le x \le e, \\ 1 & ; \quad x \ge e. \end{cases}$$

(i). Show that $k = \ln 2$.

(ii). Obtain the p.d.f of X. [5]

: A stone is projected from the top a cliff of height 25 m with an initial speed of 12 m s^{-1} at an angle of 60° to the vertical. Find the time it takes the stone to hit the sea-level. [5]

Ingredients	**Cost**	
	2015	**2017**
Salt	200	350
Baking flour	3800	4600
Cooking oil	1500	1800

By taking 2015 as a base year, calculate the price relative for each ingredient and hence, obtain the average index number. [5]

: A random variable X is such that $X \sim N(102, 16)$.
Find $P(|x - 100| < 7.2)$. [5]

The cumulative distribution of the ages (in years) of the employees of a company is given in the table below:

Age	<15	<20	<30	<40	<50	<60	<65	<100
Cumulative frequency	0	17	39	69	87	92	98	98

(a). Find the:

(i). Mean and median age.

(ii). Middle 70% age range.

(b). Represent the above information on a histogram and use it to estimate the modal age. [12]

(a). Use the trapezium rule to estimate the area of 5^{2x} between the x-axis, $x = 0$ and $x = 1$, using 5 sub-intervals. Give your answer correct to 3 decimal places.

(b). Find the exact value of $\int_0^1 5^{2x}\, dx$.

(c). Determine the percentage error in the two calculations in (a) and (b) above. [12]

Show that the iterative formula for finding the 4th root of a number N is given by:

$$x_{n+1} = \frac{3}{4}\left(x_n + \frac{N}{3{x_n}^3}\right), \qquad \text{for } n = 0, 1, 2, 3, \dots$$

Draw a flow chart that:

(i). reads the number N and the initial approximation, x_0,

(ii). computes and prints N the its fourth root after 3 iterations and give the root correct to 3d.p.

Perform a dry run for $N = 54$ and $x_0 = 2.5$. [12]

The speeds of cars passing a certain point on a motorway can be taken to be normally distributed. Observations show that of cars passing the point, 95%are travelling at less than 85 km h^{-1} and 10% are travelling at less than 55 km h^{-1}.

(a). Find the average and standard deviation of the speeds of the cars passing a certain point. [6]

(b). If a random sample of 25 cars is selected, find the:

(i). probability that their mean speed is not more than 70 km h^{-1}.

(ii). 95% confidence interval for the mean speed. [3]

: The discrete random variable X can take values 0, 1, 2 and 3 only. Given $P(X \leq 2) = 0.9$, $P(X \leq 1) = 0.5$ and $E(X) = 1.4$, find:

(a). $P(X = 1)$,

(b). $P(X = 0)$. [5]

The random variable X has probability density function

$$f(x) = \begin{cases} 3x^k & ; \quad 0 \leq x \leq 1, \\ 0 & ; \quad \text{otherwise} \end{cases}$$

where k is a positive integer. Find:

(a). The value of k,

(b). The mean of X,

(c). The value of m such that $P(X \leq m) = 0.5$. [12]

.: Two events A and B are such that $P(A) = \frac{8}{15}$, $P(B) = \frac{1}{3}$ and $P(A/B) = \frac{1}{5}$.

Calculate the probabilities that:

(a). Both events occur.

(b). Only one of the two events occurs.

(c). Neither events occurs. [5]

Two tetrahedral dice, with faces labeled 1, 2, 3 and 4 are thrown and the number on which each lands is noted. The score is the sum of the two numbers. Find the probability that:

(a). the score is even, given that at least one die lands on three.

(b). at least one die lands on three given that the score is even. [12]

Show graphically that the equation $x^3 + 5x^2 - 3x - 4 = 0$ has roots between 0 and -1. Hence use Newton Raphson's method to find the root of the equation, correct to **2** decimal places. [12]

The table below shows the percentage of sand, y, in the soil at different depths, x (in cm).

Soil depth (x)	35	65	55	25	45	75	20	90	51	60
Percentage of sand (y)	86	70	84	92	79	68	96	58	86	77

(a). (i). Calculate the rank correlation coefficient between the two variables.

(ii). Comment on the significance at 5% level. [5]

(b). (i). Draw a scatter diagram for the data and comment on our result.

(ii). Draw the line of best fit; hence estimate the:

- percentage of sand in the soil at a depth of 31 cm.
- depth of the soil with 54% sand. [7]

(a). If $x = 4.95$ and $y = 2.013$ are each rounded off to the given number of decimal places, calculate the maximum possible error in $\frac{x}{x-y}$. [6]

(b). The height and radius of a cylinder are measured as h and r with maximum possible errors Δ_1 and Δ_2 respectively. Show that the maximum percentage error made in calculating the volume is

$$\left(\left|\frac{\Delta_1}{h}\right| + 2\left|\frac{\Delta_2}{r}\right|\right) \times 100$$

[6]

The number of cows owned by residents in a village is assumed to be normally distributed. 15% of the residents have less than 60 cows, 5% of the residents have over 90 cows.

(a). Determine the values of the mean and standard deviation of the cows. [8]

(b). If there are 200 residents, find how many have more than 80 cows. [4]

: Given that $g(0.9) = 0.2661$, $g(1.0) = 0.2420$ and $g(1.1) = 0.2179$. Use linear interpolation or extrapolation to estimate:

(a). $g(0.96)$, [3]

(b). $g^{-1}(0.2372)$. [2]

: The probability that a fisherman catches fish on a clear day is $\frac{2}{5}$ and on cloudy day is $\frac{7}{10}$. If the probability that the day is cloudy is $\frac{3}{5}$, find the probability that the day is cloudy given that the fisherman does not catch fish. [5]

5: The marks of **40** students in a test were as follows:

Marks	30 –	40 –	50 –	70 –	80 –	90 –
Number of students	8	5	12	9	6	0

Calculate the standard deviation of the marks. [5]

: At the same instant, two children who are standing 24 m apart begin to cycle directly towards each other. James starts from rest at a point A riding with a constant acceleration of $2\ \text{m s}^{-2}$ and William rides with a constant speed of $2\ \text{m s}^{-1}$. Find how long it is before they meet. [5]

2: Given that $X \sim B(15, 0.2)$, find:

(a). $P(X > 8)$, [2]

(b). the mode of X. [3]

3: Use the trapezium rule with 5 strips to estimate

$$\int_{-1}^{1} (3 + 2x)^5 \, dx$$

correct to **three** decimal places. [5]

4: ABC is an equilateral triangle. Forces of 7 N, $8\sqrt{3}$ N and $8\sqrt{3}$ N act along BA, CA and CB respectively in the direction indicated by the order of the letters. Find the resultant force. [5]

A box contains 4 pink counters, 3 green counters and 3 yellow counters. Three counters are drawn at random one after the other without replacement.

(a). Find the probability that the third counter drawn is green and the first two are of the same colour. [4]

(b). Find the expected number of pink counters drawn. [8]

The numbers x and y are approximated by X and Y with errors Δx and Δy respectively.

(a). Show that the maximum relative error in $\frac{y^2}{x}$ is given by

$$\left|\frac{\Delta x}{X}\right| + 2\left|\frac{\Delta y}{Y}\right|$$

[5]

(b). If $x = 4.95$ and $y = 2.013$ are each rounded off to the given number of decimal places, calculate the:

(i). percentage error in $\frac{y^2}{x}$,

(ii). limits within which $\frac{y^2}{y-x}$ is expected to lie. Give your answer to **three** decimal places. [7]

The events A and B are such that $P(A/B) = 0.4$, $P(B/A) = 0.25$, $P(A \cap B) = 0.12$. Find $P(A \cup B')$. [5]

Given below are values of $f(x)$ for given values of x.
$f(0.4) = -0.9613$, $f(0.6) = -0.5108$ and $f(0.8) = -0.2231$.
Use linear interpolation to determine $f^{-1}(-0.4308)$ correct to **2** decimal places. [4]

The drying time of a newly manufactured paint is normally distributed with mean 110.5 minutes and standard deviation 12 minutes.

(a). Find the probability that the paint dries for less than 104 minutes. [3]

(b). If random sample of 20 tins of the paint was taken, find the probability that the mean drying time of the sample is more than 112 minutes. [4]

(c). A random sample of 16 tins taken from a different type pf paint of standard deviation 15 minutes is found to have a mean time of 105.5 minutes, determine the 90% confidence limits the mean of time of this type of paint. [5]

Given the equation $x^3 - 6x^2 + 9x + 2 = 0$;

(a). Find graphically the root of the equation which lies between -1 and 0. [5]

(b). (i). Show that Newton Raphson formula for approximating the root of the equation is given by

$$x_{n+1} = \frac{2}{3}\left[\frac{x_n{}^3 - 3x_n{}^2 - 1}{x_n{}^2 - 4x_n + 3}\right], \qquad \text{where } n = 0, 1, 2, \dots \dots$$

[3]

(ii). Use the formula in (b)(i) above, with an initial approximation in (a) above to find the root of the given equation correct to **two** decimal places. [4]

The displacement of a particle of mass 2 kg is given by:

$$\underset{\sim}{s} = \begin{pmatrix} t^3 - 4 \\ t^2 - t \\ 2\sin t + \cos 2t \end{pmatrix} \text{ metres.}$$

Find the:

(a). average velocity between $t = 1$ s and $t = 3$ s. [3]

(b). magnitude of the forced when $t = 4$ s. [6]

(c). kinetic energy when $t = 2$ s. [3]

The table below shows the expenditure of restaurant for the years 2014 and 2016.

Item	**Price (shs)**		**Weight**
	2014	**2016**	
Milk (per litre)	1,000	1,300	0.5
Eggs (per tray)	6,500	8,300	1
Sugar (per kg)	3,000	3,800	2
Blue band	7,000	9,000	1

Taking 2014 as the base year, calculate for 2016 the:

(a). Price relative for each item.

(b). Simple aggregate price index.

(c). Weighted aggregate price index and comment on your result.

(d). In 2016, the restaurant spent shs 45,000 on buying these items. Using the index obtained in (c), find how much money the restaurant could have spent in 2014. [12]

(a). Three forces $\left(-2\underset{\sim}{\boldsymbol{i}} - 3\underset{\sim}{\boldsymbol{j}}\right)$ N, $\left(3\underset{\sim}{\boldsymbol{i}} + 4\underset{\sim}{\boldsymbol{j}}\right)$ N and $\left(-\underset{\sim}{\boldsymbol{i}} - \underset{\sim}{\boldsymbol{j}}\right)$ N act at the points $(2, 0)$, $(0, 3)$ and $(1, 1)$ respectively. Show that these forces reduce to a couple. [5]

(b). $ABCD$ is a rectangle with $\overline{AB} = 3$ m and $C\hat{A}B = 30°$. Forces of 10 N, 20 N and 20 N act along AC, AD and DB respectively. Calculate the magnitude and direction of the resultant force hence find where its line of action cuts AB. [7]

: A body of mass 4 kg is moving with an initial velocity of 5 m s^{-1} on a plane experiences a resistance of 0.4 N in a distance of 40 m. Find the loss in kinetic energy. [5]

: The events A and B are such that $P(A/B) = 0.4$, $P(B/A) = 0.25$, $P(A \cap B) = 0.12$. Find $P(A \cup B')$. [5]

: Given below are values of $f(x)$ for given values of x.
$f(0.4) = -0.9613$, $f(0.6) = -0.5108$ and $f(0.8) = -0.2231$.
Use linear interpolation to determine $f^{-1}(-0.4308)$ correct to **2** decimal places. [4]

: Use trapezium rule with 4 sub-intervals to estimate

$$\int_0^{\frac{\pi}{2}} \cos x \, dx$$

correct to **three** decimal places. [5]

: A continuous random variable X has a cumulative distribution function;

$$P(X \leq x) = \begin{cases} \dfrac{1}{64}x^3 & ; \quad 0 \leq x \leq \beta, \\ 1 & ; \quad x \geq \beta. \end{cases}$$

Find the:

(a). value of the constant β. [2]

(b). probability density function. [3]

A ball is projected vertically upwards and when it is at a height of 10 m, it takes 8 seconds to return to its point of projection. Find the speed with which the ball was projected. [5]

(a). The marks of a certain electric light bulb is known to be normally distributed with a mean life of 2000 hours and a standard deviation of 120 hours. Estimate the probability that the life of such bulb will be:

(i). greater than 2015 hours,

(ii). Between 1850 hours and 2090 hours. [8]

(b). Wavah industry manufactures light bulbs that have a length of life time that are approximately normally distributed with a standard deviation of 40 hours. If a random sample of 36 bulbs have an average life of 780 hours, find the 99.9% confidence interval for the mean of the entire bulbs. [4]

The numbers $\boldsymbol{A}$ and $\boldsymbol{B}$ are rounded off to $\boldsymbol{a}$ and $\boldsymbol{b}$ with errors $\boldsymbol{e_1}$ and $\boldsymbol{e_2}$ respectively.

(a). Show that the absolute relative error in the product $\boldsymbol{AB}$ is given by:

$$\frac{|\boldsymbol{a}||\boldsymbol{e_2}| + |\boldsymbol{b}||\boldsymbol{e_1}|}{\boldsymbol{ab}}.$$

[5]

(b). Given that $\boldsymbol{A} = 6.43$ and $\boldsymbol{B} = 37.2$ are rounded off to the given number of decimal places indicated;

(i). State the maximum possible errors in $\boldsymbol{A}$ and $\boldsymbol{B}$. [2]

(ii). Determine the absolute error in $\boldsymbol{AB}$. [2]

(iii). Find the limits within which the product $\boldsymbol{AB}$ lies. Give your answer to **4** decimal places. [3]

(a). At time, t, the position vector of a particle of mass 2 kg is $\left(\cos t\, \underset{\sim}{\boldsymbol{i}} + t^2 \underset{\sim}{\boldsymbol{j}}\right)$ m. Show that the force acting on the particle when $t = \pi$ seconds is of magnitude $2\sqrt{5}$ N. [7]

(b). A particle is moving so that at any instant, its velocity vector, $\underset{\sim}{\boldsymbol{v}}$, is given by $\underset{\sim}{\boldsymbol{v}} = \left(3t\underset{\sim}{\boldsymbol{i}} + 4\underset{\sim}{\boldsymbol{j}} + t^2\underset{\sim}{\boldsymbol{k}}\right)$ m s^{-1}. When $t = 0$, it is at the point $(1, 0, 1)$. Show that the magnitude of its acceleration at $t = 2$ seconds is 5 m s^{-2}.

[5]

Eight candidates seeking admission to a university course sat for a written and oral test. The scores were as shown in the table below:

Written (X)	55	54	35	62	87	53	71	50
Oral (Y)	57	60	47	65	83	56	74	63

(a). (i). Draw a scatter diagram for this data. [3]
(ii). Draw a line of best fit on your scatter diagram. [1]
(b). Use the line of best fit to estimate the value of Y when $X = 70$. [2]
(c). Calculate the rank correlation coefficient. Comment on your result.[6]

Given the equation $3x^3 + x - 5 = 0$;
(a). (i). Show that the equation has a root between $x = 1$ and $x = 1.5$. [3]
(ii). Hence use linear interpolation to obtain an approximation of the root. [3]
(b). Use Newton Raphson's formula to find the root of the equation by performing two iterations, correct to two decimal places. [6]

X is a random variable such that:

$$f(x) = \begin{cases} \beta(1-2x) & ; \quad -1 \le x \le 0, \\ \beta(1+2x) & ; \quad 0 \le x \le 2, \\ 0 & ; \quad \text{elsewhere.} \end{cases}$$

(a). (i). Sketch the p.d.f, $f(x)$. [3]
(ii). Determine the value of the constant, β. [3]
(b). Find the:
(i). Mean of X, [3]
(ii). 60th percentile. [3]

Qn 8: A discrete random variable X has the following probability distribution.

x	1	2	3
$P(X = x)$	0.1	0.6	0.3

Find:
(i). $E(5X + 3)$,
(ii). $Var(5X + 3)$. [5]

: $\boldsymbol{A}$, $\boldsymbol{B}$ and $\boldsymbol{C}$ are points on a straight road such that $\overline{\boldsymbol{AB}} = \overline{\boldsymbol{BC}} = 0.2$ m. a cyclist moving with uniform acceleration passes $\boldsymbol{A}$ and then notices that it takes him 10 s and 15 s to travel between $\boldsymbol{AB}$ and $\boldsymbol{BC}$ respectively. Find:

(i). his acceleration, [3]

(ii). The velocity with which he passes $\boldsymbol{A}$. [2]

: In Ndejje S.S.S, 15% of the students like posho. Find the probability that in a sample of 300 students in the school, over 50 students like posho. [5]

(i). Use the trapezium rule with equal strips of width $\frac{\pi}{6}$ to find an approximation for $\int_0^{\pi} x \sin x \, dx$. Give your answer to **4** significant figures. [4]

(ii). Comment on how you could obtain a better approximation to the value of the integral using the trapezium rule. [1]

: Forces $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ N, $\begin{pmatrix} 2 \\ 9 \end{pmatrix}$ N, and $\begin{pmatrix} 4 \\ -6 \end{pmatrix}$ N act on a body of mass 2 kg. Find the magnitude of the acceleration of the body. [5]

: The table below shows the times to the nearest second taken by 100 students to solve a problem.

Times (s)	30 – 49	50 – 64	65 – 69	70 – 74	75 – 79
No. of students	10	30	25	20	15

Calculate the mean time of the distribution, correct to **one** decimal place. [5]

(a). Use the trapezium rule with six ordinates to find the approximate value of $\int_2^5 xe^{-x} \, dx$ correct to 3 significant figures.

(b). Find the area bounded by the curve $y = xe^{-x}$ between $x = 2$ and $x = 5$.

(c). Find the percentage error in (a) and (b) above. [12]

The force, F, acting on a particle of mass 2 kg is given by $F = 5 + 4t$ N, where t is the time in seconds. Given that initially the particle is moving at a speed of 5 m s^{-1}, find the speed of the particle when $t = 2$. [5]

The mean life of a certain make of dry cells is 150 days and standard deviation 32 days. Their duration is normally distributed.

(a). Find the probability that the cells will last between 125 and 210 days.

(b). If there are 300 dry cells, calculate how many will need replacement after 225 days.

(c). After how many days will a quarter of the cells have expired? [12]

Two vehicles ***P*** and ***Q*** travel equal distance of 36 km in the same time of 36 minutes. Vehicle ***P*** moves at a constant speed for the first 14.4 km and is then brought to rest with a uniform retardation. Vehicle ***Q*** starts from rest and accelerates uniformly to a speed of 90 km h^{-1}; travels steadily at this speed; and is then brought to rest under a uniform retardation.

(a). Sketch the velocity-time graphs for each vehicle's motion. [2]

(b). Calculate the:

(i). Initial speed of ***P***, [3]

(ii). Retardation of ***P*** in m s^{-2}, [3]

(iii). Distance ***Q*** travels at a steady speed. [4]

(a). The numbers 2.6754, 4.802, 15.18 and 0.925 are rounded off to the given number of decimal places. Find the range within which the exact value of: $2.6754\left(4.802-\frac{15.18}{0.925}\right)$ can be expected to lie. [6]

(b). The numbers a, b, c and d are all rounded with errors e_1 , e_2 , e_3 and e_4 respectively. Show that the expression for the maximum absolute error, e_z in $z=\frac{ab}{c+d}$ is: $\frac{ab}{c+d}\left(\left|\frac{e_1}{a}\right|+\left|\frac{e_2}{b}\right|+\left|\frac{e_3+e_4}{c+d}\right|\right)$. [6]

: The temperatures (°C) of a cooling body measured every 10 minutes were recorded as 82, 70, 56, and 42. If the body's initial temperature is 93°C , find, using linear interpolation/extrapolation, the:

(i). time taken for the body to cool to 63°C.

(ii). temperature of the body after 45 minutes. [5]

: The force, F, acting on a particle of mass 2 kg is given by $F=5+4t$ N, where t is the time in seconds. Given that initially the particle is moving at a speed of 5 m s^{-1}, find the speed of the particle when $t=2$. [5]

: Two events A and B are such that $P(A'/B')=\frac{2}{7}$ and $P(B)=\frac{2}{3}$. Find the:

(i). $P(A\cup B)$,

(ii). $P(A\cap B')$. [5]

The heights (cm) of senior six candidates in a certain school were recorded as in the table below.

Height (cm)	Frequency
148 - < 152	5
152 - < 156	8
156 - < 160	12
160- < 164	15
164 - < 168	6
168 - < 172	4

(a). Calculate the:
(i). Mean,
(ii). Standard deviation. [7]

(b). Calculate the unbiased estimate of the variance and hence construct a 95% confidence interval for the mean height of all the senior six candidates. [5]

(a). A discrete random variable X has a function given by $P(X \leq x) = \frac{x^2}{9}$, for $x = 1, 2, 3$.
(i). Write out the probability distribution for X.
(ii). Find the mode.
(iii). Find $E(3X + 2)$. [6]

(b). A and B are two independent events with $P(A) > P(B)$ such that $P(A \cap B) = \frac{1}{3}$ and $P(A \cup B) = 0.9$. Find:
(i). $P(A)$.
(ii). $P(B)$. [6]

At 8:00 am, a bus initially parked at stage A, starts moving along a straight road with acceleration, $a = (4t)$ km h^{-2}, which acceleration continues until $t = 5$ hours, where upon it cease and the bus uniformly retards at 20 km h^{-2} to rest at stage B.

(a). Determine the:
(i). time when the bus reaches stage B. [5]
(ii). Distance between A and B. [5]

(b). Sketch a velocity-time graph to represent the above journey of the bus. [2]

The table below shows the frequency distribution of marks obtained in paper one of the mathematics contest by Ndejje SSS students.

Marks (%)	10 –	20 –	30 –	40 –	50 –	60 –	70 –	80 – 90
Frequency	18	34	58	42	24	10	6	8

(a). Calculate the:

(i). Mean mark. [2]

(ii). Standard deviation. [2]

(iii). Number of students who scored above 54%. [2]

(b). Draw a cumulative frequency curve and use it to estimate the:

(i). 5^{th} decile.

(ii). Number of students that would not qualify for paper two if the pass mark is fixed at 40%.

(iii). Least mark if the top 10% of the students are to be awarded. [6]

: A bag contains 15 white, 5 red and 5 blue balls. Three balls are drawn at random one at a time without replacement. Determine the probability that the first ball is blue and the third one is red. [5]

: Given that $y = \frac{1}{x} + x$ and $x = 2.4$ correct to **one** decimal place, find the limits within which y lies. [5]

: A particle initially moving with a constant velocity is acted upon by a retardation force. If after t seconds its position vector is $\underset{\sim}{\boldsymbol{r}} = \left(0.5t^2\left(\underset{\sim}{\boldsymbol{i}} + \underset{\sim}{\boldsymbol{j}}\right) + t\left(2\underset{\sim}{\boldsymbol{i}} + 5\underset{\sim}{\boldsymbol{j}}\right) + 6\underset{\sim}{\boldsymbol{i}} - 22\underset{\sim}{\boldsymbol{j}}\right)$ metres, find the time after which its speed will reduce to $15\ \text{m s}^{-1}$. [5]

Opio sits for four examinations in his class. If the probability of passing an examination in his class is 0.25, find the probability that he passes:

(i). Only two examinations.

(ii). Less than half of the examination. [5]

A car decelerated from a speed of 20 m s^{-1} to rest in 8 seconds, falling short of its parking slot by 20 m. By how much longer should the car have decelerated from the same speed so as to just reach the parking slot? [5]

Qn 3: The table below gives values of x and the corresponding values of $f(x)$.

x	0.1	0.2	0.3	0.4	0.5	0.7
$f(x)$	4.21	3.83	3.25	2.85	2.25	1.43

Use linear interpolation/extrapolation to find:

(a). $f(x)$ when $x = 0.6$. [3]

(b). the value of x when $f(x) = 0.75$. [2]

A particle is projected from a point $P(3, 4)$ with velocity $\left(\underset{\sim}{i} + 2\underset{\sim}{j}\right)$ m s^{-1} and it moves freely under gravity. Find its velocity and position vector 1.5 s later. [5]

$$f(x) = \begin{cases} \frac{2}{13}(x+1) & ; \quad 0 \le x \le 2, \\ \frac{2}{13}(5-x) & ; \quad 2 \le x \le 3, \\ 0 & ; \quad \text{elsewhere.} \end{cases}$$

(a). Calculate the:

(i). $P(X < 2.5)$, [3]

(ii). Mean of X. [3]

(b). Determine the cumulative distribution function, $F(x)$. [6]