A LEVEL MATHEMATICS SEMINAR 2025.
TAIBAH INTERNATIONAL SCHOOL
Saturday 21^{st} June 2025 (9:00 a.m)

EXAMINATION PAPER FORMAT :

<table>
<tr><th>P425/1</th><th>P425/2</th></tr>
<tr><td>
1. Analysis (6 questions)
 (a) Differentiation
 (b) Integration
 (c) Differential equations
2. Vectors (2 questions)
 (a) Vectors in 2-D
 (b) Vectors in 3-D
 (c) Ratio theorem
 (d) Lines and their properties
 (e) Planes and their properties
3. Trigonometry (2 questions)
4. Geometry (2 questions)
 (a) Coordinate geometry of lines and triangles
 (b) Locus and circles
 (c) Parabola,ellipse ,hyperbola
5. Algebra (4 questions)
 (a) Surds,indices and logarithms
 (b) Quadratics
 (c) Polynomials
 (d) Simultaneous equations
 (e) Inequalities
 (f) Partial fractions
 (g) Complex numbers
 (h) Permutation and combinations
</td><td>
1. Mechanics (6 questions)
 (a) Kinematics
 (b) Dynamics
 (c) Statics
2. Numerical analysis (4 questions)
 (a) Location of the roots of an equation
 (b) Trapezium rule of numerical integration
 (c) Newton Raphson method
 (d) Errors
 (e) Flow charts
3. Statistics and probability(6 questions)
 (a) Mean ,mode,median
 (b) Index numbers
 (c) Correlation coefficient
 (d) Scatter diagram
 (e) Discrete probability distributions
 (f) Continuous probability distributions
 (g) Distributions
  i. Uniform distribution
  ii. Normal distribution
  iii. Binomial distribution
  iv. Normal approximation to binomial distribution
 (h) Estimations
</td></tr>
</table>

PURE MATHEMATICS (P425/1)

TOPICS	SECTION A	SECTION B
ALGEBRA	2	2
ANALYSIS	3	3
TRIGONOMETRY	1	1
VECTORS	1	1
GEOMETRY	1	1

ALGEBRA

1. (a) Given that $\log_x 16 + \log_{16} x = 2.5$,determine the value of x.

   (b) Solve simultaneously :

$$2^p + 2^q = 320$$
$$p + q = 14$$

2. (a) Given that x and y are real numbers ,find the values of x and the values of y

$$(x+iy)^2 = 7 - (6\sqrt{2})i$$

   (b) i. Show that $z-3$ is a factor of $2z^3 - 4z^2 - 5z - 3$

   ii. Solve $2z^3 - 4z^2 - 5z - 3 = 0$

3. (a) A student deposits UGX 50,000 with a bank every start of a three month period.Their understanding is that the bank gives her a compound interest of 3% every three month period. How long will it take her to accumulate UGX 3 million if there is no withdrawal.

   (b) Show that

$$\sqrt[3]{\frac{1-x}{1+x}} \approx 1 - \frac{2}{3}x + \frac{2}{9}x^2$$

4. (a) Prove by induction that $3^{2n} + 5^n - 2$ is always a multiple of 4 for all integers ,$n \geq 1$.

   (b) Given that $\sum_1^n r^3 = \frac{1}{4}n^2(n+1)^2$,find the series sum $1^3 + 3^3 + 5^3 + \cdots + (2n-1)^3$.

5. The polynomials $P(x)$ and $Q(x)$ are defined as:

$$P(x) = x^3 + ax^2 + b \quad \text{and} \quad Q(x) = x^3 + bx^2 + a$$

It is given that $(x-2)$ is a factor of $P(x)$ and that when $Q(x)$ is divided by $(x+1)$ the remainder is -15

   (a) Find the value of **a** and the value of **b**

   (b) When **a** and **b** take these values, find the least possible value of $P(x) - Q(x)$ as x varies

6. (a) Express $\frac{6x^2-24x+15}{(x+1)(x-2)^2}$ in partial fractions.

   (b) Hence obtain the expansion of $\frac{6x^2-24x+15}{(x+1)(x-2)^2}$ in ascending powers of x ,up to and including the term in x^2

7. (a) Solve the equation $\sqrt{x+7}-\sqrt{x-1}=2$

   (b) Express $\frac{z+1}{z-i}$ in the form $a+bi$ where a and b are the real and imaginary variables respectively. Hence if $Arg(a+bi)=-\frac{\pi}{4}$,show that the locus of z is a circle

8. (a) Solve for n in $nC_3+nC_2=4n$

   (b) Solve the simultaneous equation

$$e^{3x+4y}=2e^{2x-y}$$
$$e^{2x+y}=8e^{x+6y}$$

   (c) Solve the equation for x if

      i.
$$-x-3<|2x+9|$$

      ii.
$$7(4^x-2^{x+1})=8(8^{x-1}-1)$$

9. (a) The function $f(x)=x^3+px^2-5x+q$ has a factor $(x-2)$ and has a value of 5 when $x=-3$.Find p and q

   (b) The roots of the equation $ax^2+bx+c=0$ are α and β.Form the equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$

   (c) A geometric progression has first term **a** and common ratio **r** .The sum of the first three terms is 3.92 and the sum to infinity is 5 .Find the value of **a** and the value of **r**.

TRIGONOMETRY

10. (a) If $3\sin(A-\alpha)=\cos(A+\alpha)$, show that $\cot A=\frac{3\cot\alpha+1}{3+\cot\alpha}$ .Hence determine $\tan(A+\alpha)$ when $\cot\alpha=-\frac{1}{2}$

   (b) Solve $\cos x=\sin\frac{x}{2}$ for $0^0\leq\frac{x}{2}\leq 90^0$

11. (a) Using $t=\tan A$ or otherwise ,solve $\sin 4A=\sin 2A$ for $0^0<A<360^0$.

   (b) Given that $\theta=\sin\alpha+\cos\beta$ and $\phi=\cos\alpha-\sin\beta$,show that

$$\frac{\theta^2-\phi^2}{2\theta\phi}=\tan(\alpha+\beta)$$

12. (a) In triangle ABC,show that

$$\tan\left(\tfrac{A-B}{2}\right)=\frac{a-b}{a+b}\cot\frac{c}{2}.$$

   (b) Hence if $a=4$cm,$b=6$cm and $C=127.2^0$,solve this triangle

13. (a) Express $4\sin\theta-6\cos\theta$ in the form $R\sin(\theta-\alpha)$,where $R>0$ and $0^0<\alpha<180^0$.Give the exact value of R and the value of α to 2 d.ps.

(b) Hence;

i. Solve the equation $4\sin\theta - 6\cos\theta = 3$ for $0^0 < \theta < 180^0$

ii. Find the greatest and least values of $(4\sin\theta - 6\cos\theta)^2 - 3$ as θ varies

VECTORS

14. (a) A plane is given by $r = \begin{pmatrix} 3 \\ 1 \\ -2 \end{pmatrix} + \alpha \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix} + \beta \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix}$ for scalars α and β.Determine its cartesian equation

(b) Find the coordinates of the foot of the perpendicular dropped from $(-5, -7, 25)$ to this plane.

15. The lines π and ϕ are given by $3\lambda i + (1 - 2\lambda)j + (3 + \lambda)k$ and KL respectively,where $K(-1, -6, 6)$ and $L(7, 4, 2)$.

(a) Find the vector equation of ϕ

(b) Show that π and ϕ intersect at right angles

(c) Determine the equation of the line that perpendicularly cuts both lines

16. (a) Calculate the angle between the line $r = (4 - 2\alpha)i + (1 - \alpha)j - 3\alpha k$ and the plane $\mathbf{p}.\begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} = -12$

(b) Calculate the area of the triangle with vertices P$(2, -1, 3)$,Q$(-3, 2, 1)$, and R$(1, 3, -2)$

17. (a) Given the vectors $8i - 2j + 5k$ and $i + 2j + pk$ are perpendicular,find the value of the constant p.

(b) The line L_1 passes through the point $(-3, 1, 5)$ and is parallel to the vector $7i - j - k$.

i. Write down a vector equation of the line L_1

ii. The line L_2 has vector equation $r = i - 2j + 2k + \mu(i + 8j - 3k)$.Show that L_1 and L_2 do not intersect

18. The origin **O** and the points A,B and C are such that **OABC** is a rectangle. With respect to **O** ,the position vectors of the points A and B are $-4i + pj - 6k$ and $-10i - 2j - 10k$.

(a) Find the value of the positive constant p

(b) Find a vector equation of the line **AC**

(c) Show that the line AC and the line ,L, with vector equation

$$r = 3i + 7j + k + \mu(-4i - 4j - 3k)$$

intersect and find the position vector of the point of intersection.

(d) Find the acute angle between the lines AC and L

GEOMETRY

19. The circles with equations $x^2 + (y-4)^2 = 16$ have $(x-4)^2 + (y-1)^2 = 1$ have centres at A and B respectively.

    (a) Show that these circles touch each other externally

    (b) Find the equation of the common tangent at their point of touch

    (c) The two circles also touch the x- axis at the origin ,**O** and point $P(4,0)$ respectively .Calculate the area of the shape 0ABP

20. (a) The line $y = mx+c$ meets the curve $x^2+y^2 = r^2$ at only point.Show that $c^2 = r^2(1+m^2)$.

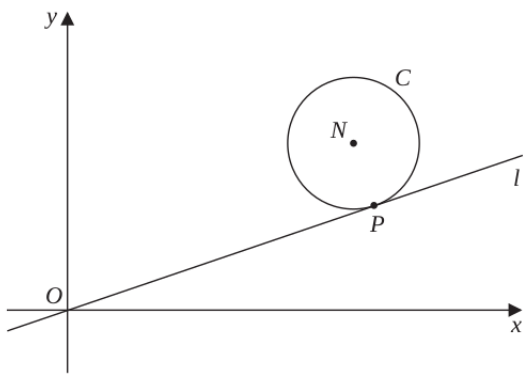
    (b) Find the possible equations of the lines drawn from $(-1, 13)$ and touching the curve $x^2 + y^2 = 10$

21. The equation of the chord PQ of a curve is $pqy + x = 2(p+q)$ for parameters **p** and **q** at points **P** and **Q** respectively.

    (a) Deduce the equation of the tangent to this curve at a point with parameter ,t.

    (b) The normal at $T(2t, \frac{2}{t})$ meets the curve again at point R.Find the coordinates of R in terms of parameter ,t.

22. The figure below shows a sketch of a circle C with centre N(7, 4) The line l with equation $y = \frac{1}{3}x$ is a tangent to C at the point P.



Find

(a) the equation of line PN in the form y = mx + c, where m and c are constants,

(b) an equation for C.

(c) The line with equation$y = \frac{1}{3}x + k$, where k is a non-zero constant, is also a tangent to C. Find the value of k.

ANALYSIS

23. (a) On the same axes,sketch the curves $f(x) = 2x^2 + 4x - 6$ and $g(x) = \frac{1}{2x^2+4x-6}$.

    (b) Find the volume of the solid generated when the region between the curve $f(x) = 2x^2 + 4x - 6$,lines $x = -1, x = 0$ and $y = 0$ is rotated through 360^0 about the line $y = 0$

24. (a) A cone with a semi-vertical angle of 30^0 collects very soft ice-cream from a vendor's machine at a rate of 9 cm^3 per second. Calculate the rate at which the surface area of the ice-cream increases when the ice cream reaches a depth of 10 cm.

    (b) A cylinder is inscribed in a hemisphere of radius ,R .Its length lies along the diameter of the hemisphere .Show that the maximum volume of this cylinder is $\frac{\sqrt{3}}{9}\pi R^3$

25. In a community of 1000 people, a rumour spreads at a rate proportional to the product of the population that has heard the rumour and the population that has not yet heard the rumour. Initially, at 8:00 a.m., 100 people had heard the rumour. By this time, 10 people per hour had heard the rumour.

    (a) Write a differential equation for this scenario.

    (b) i. Determine how many people will have heard the rumour by 8:00 a.m. the next day.

        ii. When will 900 people have heard the rumour?

26. (a) Find $\int \cos^2 3y \sin y$ dy

    (b) Using the substitution $2x = \sin u$, evaluate

$$\int_0^{\frac{1}{4}} \sqrt{\frac{1-2x}{1+2x}}dx$$

    (c)

$$\int_0^1 \frac{\tan^{-1} x}{1-x^2}dx$$

27. (a) Differentiate $\sec x$ with respect to x from first principles.

    (b) Given that $\frac{(2y-x)e^x}{y+2x} = 1$, find $\frac{dy}{dx}$ in terms of x

28. The parametric equations of a curve are $x = t + 4\text{In}t$, $y = t + \frac{9}{t}$,for $t > 0$.

    (a) Show that

$$\frac{dy}{dx} = \frac{t^2 - 9}{t^2 + 4t}$$

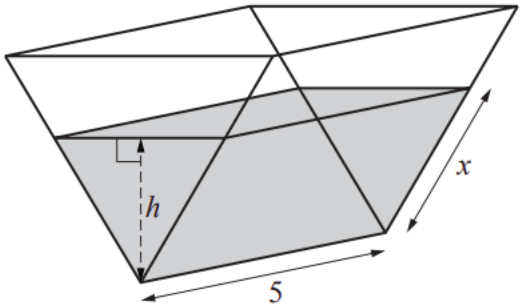
    (b) The curve has one stationary point.Find the y - coordinate of this point and determine whether it is a maximum or a minimum point.

29. (a) Differentiate e^{kx} from first principles

    (b) Use small changes to show that $(16.02)^{\frac{1}{4}} = 2\frac{1}{1600}$

(c) Differentiate $\frac{e^{5x}\cos 2x}{\ln(1-x)}$ with respect to x

30. The diagram shows a water container in the shape of a triangular prism. The depth of water in the container is h. The container has length 5. The water in the container forms a prism with a uniform cross-section that is an equilateral triangle of side x.In this question all lengths are in metres.



(a) Show that the volume ,V ,of the water is given by

$$V = \frac{5\sqrt{3}h^2}{3}$$

(b) Water is pumped into the container at a rate of $0.5m^3$ per minute. Find the rate at which the depth of the water is increasing when the depth of the water is 0.1m.

31. Show that

(a)

$$\int \frac{1}{1+2\sin^2 x}dx = \frac{1}{\sqrt{3}}\tan^{-1}(\sqrt{3}\tan x) + c$$

[redacted]

[redacted]

(c)

$$\int_0^{\frac{\pi}{2}} \frac{\sin x}{3\sin x + 4\cos x}dx = \frac{3\pi}{50} + \frac{4}{25}In\left(\frac{4}{3}\right)$$

(d)

$$\int_0^{36} \frac{1}{\sqrt{x}(\sqrt{x}+2)}dx = In|16|$$

(e)

$$\int \frac{1}{\text{cosec}2x - \cot 2x}dx = In|\sin x| + c$$

APPLIED MATHEMATICS P425/2

TOPICS	SECTION A	SECTION B
NUMERICAL ANALYSIS	2	2
STATISTICS AND PROBABILITY	3	3
STATIC MECHANICS	1	1
DYNAMIC MECHANICS	1	1
KINEMATIC MECHANICS	1	1

Mechanics

1. A particle moves a long a horizontal line. The particle's displacement ,in metres ,from an origin O at time t seconds is given by $r(t) = 4 - 2\sin 2t$.

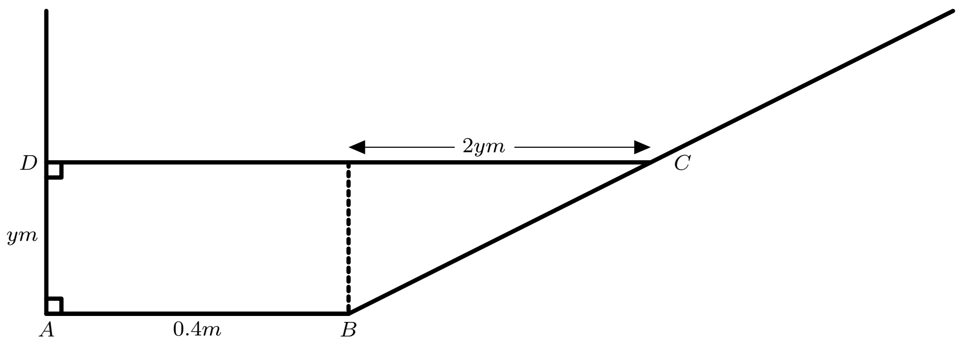
   (a) Find the particle's velocity and acceleration at any time t.

   (b) Find the particle's initial displacement,velocity and acceleration

   (c) Find when the particle is at rest,moving to the right and moving to the left during the time $0 \leq t \leq \pi$

   (d) Find the displacement of the particle after πseconds

2. A light container has a vertical cross-section in the form of a trapezium. The container rests on a horizontal surface.



   Grain is poured into the container to a depth of y m. As shown in the diagram, the cross-section ABCD of the grain is such that $AB = 0.4m$ and $DC = (0.4 + 2y)m$

   (a) When $y = 0.3m$, find the vertical height of the centre of mass of the grain above the base of the container.

   (b) Find the value of y for which the container is about to topple.

3. An object of mass $4kg$ is initially at rest at a point whose position vector is $(-4i + 2j)m$.If its acted upon by a force $F = (14i + 21j + 24k)N$. Find

   (i) acceleration of the object

   (ii) its velocity and speed after 2seconds

   (iii) its distance from the origin after 4seconds

4. A particle is projected from a point on level ground such that its initial velocity is $60ms^{-1}$ at an angle of elevation 30^0 and taking $g = 10ms^{-2}$,find

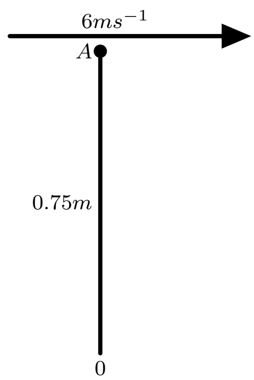
(a) the time taken for the particle to reach its maximum height

(b) the maximum height

(c) the time of flight

(d) the horizontal range of the particle

5. One end of a light inextensible string of length $0.75m$ is attached to a particle A of mass 2.8 kg. The other end of the string is attached to a fixed point O. A is projected horizontally with speed 6 ms^{-1} from a point 0.75 m vertically above O (see Fig below). When OA makes an angle θ with the upward vertical ,the speed of A is vms^{-1} .



(a) Show that $v^2 = 50.7 - 14.7\cos\theta$.

(b) Given that the string breaks when the tension in it reaches 200 N, find the angle that OA turns through between the instant that A is projected and the instant that the string breaks.

6. Forces of magnitude $2N, 2N, 3N, 4N, 2\sqrt{2}N$ and $\sqrt{2}N$ act along sides **AB,BC,DC,AD,AC** and **DB** respectively. Where the square is of side $2m$.Find the ;

(a) Resultant force

(b) Equation of the line of atcion of the resultant force and where it cuts the $x-$ axis

7. At time $t = 0$,the position vector **r** and velocity **v** of two trains A and B are as follows.

Trains	Velocity vector	Position vector
A	$V_A = (-6i + k)ms^{-1}$	$r_A = (i + 2j + 3k)m$
B	$V_B = (-5i + j + 7k)ms^{-1}$	$r_B = (4i - 14j + k)m$

If the trains maintain these velocities,find the :

(a) Position of B relative to A at time t

(b) time that elapses before the trains are closest to each other

(c) least distance between the trains in the subsequent motion

8. A horizontal turn table rotates with constant angular speed $\omega rads^{-1}$ about its centre O. A particle P of mass $0.08kg$ is placed on the turntable. The particle moves with the turntable and no sliding takes place.

(a) It is given that $\omega = 3$ and that the particle is about to slide on the turntable when $OP = 0.5m$. Find the coefficient of friction between the particle and the turntable.

(b) Given instead that the particle is about to slide when its speed is $1.2ms^{-1}$, find ω.

9. A car of mass 1000kg is moving on a straight horizontal road. The driving force of the car is $\frac{28000}{v}$N and the resistance to motion is $4v$N, where vms^{-1} is the speed of the car t seconds after it passes a fixed point on the road.

   (a) Show that

$$\frac{dv}{dt} = \frac{7000 - v^2}{250v}$$

   (b) The car passes points A and B with speeds $10ms^{-1}$ and $40ms^{-1}$ respectively. Find the time taken for the car to travel from A to B.

Statistics and Probability

10. The continuous random variable X has probability density function

$$f(x) = \begin{cases} \frac{1}{36}(9 - x^2) & ; -3 \leq x \leq 3 \\ 0 & ; \text{otherwise} \end{cases}$$

   (a) Find the mean and variance of X.

   (b) Calculate

      i. $P(X > 2)$

      ii. $P(|X| > \sigma)$,where σ is the standard deviation of X

11. The random variable X denotes the number of hours of cloud cover per day at a weather forecasting center.The probability density function of X is given by

$$f(x) = \begin{cases} \frac{(x-18)^2}{k} & ; 0 \leq x \leq 24 \\ 0 & ; \text{otherwise} \end{cases}$$

   where k is a constant

   (a) Show that $k = 2016$

   (b) On how many days in a year of 365 days can the centre expect to have less than 2 hours of cloud cover

   (c) Find the mean number of hours of cloud cover per day.

12. The continuous random variable T represents the time in hours that students spend on homework. The cumulative distribution function of T is

$$F(t) = \begin{cases} 0 & ; t < 0 \\ k(2t^3 - t^4) & ; 0 \leq t \leq 1.5 \\ 1 & ; t > 1.5 \end{cases}$$

   where k is a positive constant.

(a) Show that $k = \frac{16}{27}$

(b) Find the proportion of students who spend more than 1 hour on homework.

(c) Find the probability density function, $f(t)$ of T.

(d) Show that $E(T) = 0.9$.

13. A box contains 1 red bead and I white bead. When a bead is drawn from the box, it is returned together with a bead of the other colour. If three such random draws are made,

    (a) Find the probability that the second and third beads drawn are of the same colour.

    (b) i. Construct a probability distribution for the number of red beads in the box after the experiment.

       ii. Find the expected number of red sweets in the box after the draws.

14. Bottles of wine are stacked in racks of 12 . The weights of these bottles are normally distributed with mean $1.3kg$ and standard deviation of 0.06kg.The weights of the empty racks are normally distributed with mean $2kg$ and standard deviation of $0.3kg$.

    (a) Find the probability that the total weight of a full rack of 12 bottles of wine is between 17kg and 18kg.

    (b) Two bottles of wine are chosen at random .Find the probability that they differ in weight by morethan $0.05kg$

15. Jacob has four coins. One of the coins is biased such that when it is thrown the probability of obtaining a head is $\frac{7}{10}$. The other three coins are fair. Jacob throws all the four coins at once. The number of heads he obtains is denoted by a random variable X. The probability distribution table for X is as follows.

x	0	1	2	3	4
$P(X = X)$	$\frac{3}{80}$	a	b	c	$\frac{7}{80}$

    (a) Show that $a = \frac{1}{5}$ and find b and c.

    (b) Find $E(X)$

    (c) Jacob throws all four coins together 10 times

       i. Find the probability that he obtains exactly one head on fewer than 3 occasions.

       ii. Find the probability that Jacob obtains exactly one head for the first time on the 7th or 8th time that he throws the four coins.

16. There are three sets of traffic lights on Masandugu's journey to work. The independent probabilities that Masandugu has to stop at the first, second, and third set of lights are $0.4, 0.8$, and 0.3 respectively.

    (a) Draw a tree diagram to show this information.

    (b) Find the probability that Masandugu has to stop at each of the first two sets of lights but does not have to stop at the third set.

(c) Find the probability that Masandugu has to stop at exactly two of the three sets of lights.

(d) Find the probability that Masandugu has to stop at the first set of lights, given that she has to stop at exactly two sets of lights.

17. The weight of male leopards in a particular region are normally distributed with mean 55kg and standard deviation 6kg.

 (a) Find the probability that a randomly chosen leopard from this region weighs between 46kg and 62kg

 (b) The weight of female leopards in this region are normally distributed with mean 42kg and standard deviation σ kg. it is known that 25% of female leopards in the region weigh less than 36kg. Find the value of σ .

18. The lengths , in cm, of the leaves of a particular type are modelled by the distribution $N(5.2, 1.5^2)$.

 (a) Find the probability that a randomly chosen leaf of this type has length less than 6cm

 (b) The length of leaves of another type are also modelled by a normal distribution. A scientist measures the lengths of a random sample of 500 leaves of this type and finds that 46 are less than 3cm long and 95 are more than 8cm long. Find estimates for the mean and standard deviation of the length of leaves of this type.

19. The weights in kg of 25 boys were as follows.

Weights,x(kg)	Frequency
20 – 24	3
25 – 29	5
30	2
31 – 34	6
35 – 49	9

 (a) Calculate the

  i. Mean weight

  ii. number of boys weighing between 26.5kg and 32.5kg

 (b) i. Draw a histogram for the data

  ii. Use your histogram to estimate the modal weight

20. (a) The table below shows the marks of mathematics (x) and SST (y) obtained by certain students

Math(x)	35	65	55	25	45	75	20	90	51	60
SST(y)	86	70	84	92	79	68	96	58	86	77

i. Plot a scatter diagram for the data, draw a line of best fit and comment on the relationship between the scores in the two tests.

ii. Estimate mathematics mark (x) when SST mark (y) is 84

(b) Calculate the rank correlation coefficient and comment at 5% level of significance

21. The lifetime in hours of 80 solar bulbs were as follows

Lifetime(Hours)	Number of bulbs
Below 10	14
10 and under 20	19
20 and under 30	15
30 and under 40	20
40 and under 50	12

(a) Calculate the mean life time and variance

(b) i. Draw an Ogive for the data .

ii. Use it to estimate the lifetime exceeded by 75% of the bulbs

22. The table below shows the prices and price indices for three items in the years 2023 and 2024 respectively.

Item (kg)	Price in 2023	Price indices in 2024 using 2023 as base
X	3200	125
Y	4000	105
Z	4500	120

(a) Calculate the price of each item in 2024

(b) Taking Y as the base item ,calculate the price indices for 2023

(c) Using weights 3,5 and 2 for items X,Y and Z respectively .Calculate the:

i. Composite price index for the items in 2024

ii. Weighted aggregate price index of the items in 2024

23. Given that $P(AUB) = \frac{9}{10}, P(A/B) = \frac{1}{3}$ and $P(B/A) = \frac{2}{5}$,find :

(a) P(A)

(b) $P(A^1/B^1)$

(c) P(A or B but not both A and B)

Numerical Analysis

24. (a) Use the trapezium rule with 7 ordinates to estimate $\int_0^6 xe^{-x}dx$ correct to 3 significant figures

(b) Find the percentage error made in your estimation ,giving your answer to 2 deciml places .Suggest how this error may be reduced.

25. The table values of $\tan\Theta$ have been extracted from four figure tables

Θ	75	76	77	78	79
$\tan\Theta$	3.7321	4.0108	4.3315	4.7046	5.1446

Estimate

(i) $\tan^{-1}(4.6500)$

(ii) $\tan 79^0 36'$

26. (a) Use Newton Raphson's formula to show that the sixth root of a number N is given by

$$x_{n+1} = \frac{5}{6}\left[x_n + \frac{N}{5x_n^5}\right]$$

(b) Draw a flow chart that:

(i) Reads N and the initial approximation x_0

(ii) Computes and prints the roots to 3 d.p

(iii) Print N and the root

(c) Taking N=30.5 and $x_0 = 1.2$ perform a dry run for the flow chart.

27. The numbers $M = 5.83$ and $N = -2.456$ were rounded off to the given number of decimal places.

(a) State the maximum possible errors in M and N

(b) Find the range in which $\frac{M}{N-M}$ lies.

28. The radius r ,heigh h of a cone are measured with errors Δr and Δh respectively.

(a) Show that the maximum relative error in its volume is

$$2\left|\frac{\delta r}{r}\right| + \left|\frac{\Delta h}{h}\right|$$

(b) If $r = 3.55$ and $h = 12.4cm$.Find the percentage error in its volume.

29. (a) Use the graphical approach method to estimate the root of the equation $2\sin x - Inx = 0$ in the interval $2 \leq x \leq 3$.

(b) Use Newton Rahson method ,find the root of the equation $2\sin x - Inx = 0$ taking the approximate root obtained in (a) as the initial value of x_o.Give your answer to 3 decimal places.

30. The charges of sending parcels by JEFF distributing company depends on the weights of the parcels. For the parcels of weight 500g, 1kg, 1.5kg, and 2kg the charges are 1000/=, 2000/=, 3500/=, 4000/= respectively. Estimate

(a) What the distributor would charge for a parcel of weight 450g

(b) What the distributor would charge for a parcel of weight 1.8kg

(c) If the sender pays 6200/= what is the weight of his parcel