

P425/2
APPLIED MATHEMATICS
Paper 2
July/August 2024
3 hours



**NAMIREMBE DIOCESE COUHEIA SECONDARY
MOCK EXAMINATIONS 2024**

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

PAPER 2

3 hours

INSTRUCTIONS TO CANDIDATES

Answer all the eight questions in section A and any five questions from section B

Any additional question(s) shall **not** be marked.

All necessary working must be shown clearly.

Begin each answer on a fresh page.

Graph paper is provided.

In numerical work, take the acceleration due to gravity g , to be 9.8ms^{-2}

Restoring the church in Education

Turn Over

SECTION A (40 marks)

1. A fair six-sided die is rolled. The random variable Y represents the score on the uppermost face.
 - a) Write down the probability of function of Y
 - b) State the name of the distribution of Y
 - c) Find the value of $E(6Y+2)$ (5 marks)
2. A car of mass 5 tonnes descends a slope of 1 in 10 with an acceleration of 1.5ms^{-2} . At speed of 15Kmh^{-1} , the power developed is 45KW. Find the total resistance of the motion of the car (5 marks)
3. Given that $\Theta = 36.7^\circ$, find the relative error made in $y = 4\sin\Theta - 5\cos\Theta$ (5 marks)
4. A candidate takes three examination papers 1, 2 and 3 in chemistry. Her marks are to be averaged so that the first paper is worth twice the second paper and the second paper is worth the three times the third. If the marks are 56, 73 and 80 respectively, for paper 1, and 3, calculate her average marks (5 marks)
5. A straight wire AB of negligible mass has three masses fixed on it. 5Kg at A, 2Kg at a distance of 24cm from A and 10 Kg at 40cm from A. find its centre of gravity (5marks)
6. A particle initially at a point with position vector $(12\mathbf{i} + 8\mathbf{j} - 5\mathbf{k})\text{m}$ moves with a constant speed of 9ms^{-1} in a direction $(2\mathbf{i} - \mathbf{j} - 2\mathbf{k})$. Find its distance from the origin after 4 seconds (5 marks)
7. Three girls Claire, Debbie and Emily have independent probabilities of $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ respectively of solving a problem. Find the probability that
 - a) Just one of the three solves the problem
 - b) They will fail to solve the problem(5 marks)
8. Show that the root of the equation $e^x - 4\sin x = 0$ lies between $x = 0$ and $x = 0.4$ use linear interpolation to find the root to two significant figures. (5marks)

SECTION B (60 marks)

Attempt any five questions

9. A particle is projected from O with the velocity $\mathbf{u} = (4\mathbf{i} + 3\mathbf{j}) \text{ ms}^{-1}$. If the particle moves with constant acceleration of $-g\mathbf{j} \text{ ms}^{-2}$, show that the position vector \mathbf{r} of the particle t seconds is given by $\mathbf{r} = 4t\mathbf{i} + (3t - \frac{1}{2}gt^2)\mathbf{j}$. if $\mathbf{r} = x\mathbf{i} + y\mathbf{j}$, Show that $y = \frac{3}{4}x - \frac{gx^2}{32}$. hence determine in terms of g
- The horizontal range travelled
 - The maximum height reached by the particle
- (12 marks)

10. A random variable X has its probability function defined by

$$f(x) = \begin{cases} kx & ; 0 \leq x \leq 1 \\ \frac{k}{2}(3-x) & ; 1 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

- Sketch the graph $f(x)$ and use it to find the value of K
 - Compute $P(|x - 1| < \frac{1}{2})$
 - Derive the distribution function of X and hence find the median of X
- (12 marks)

11. Show that Newton Raphson method for finding the natural logarithm of a number given by

$$X_{n+1} = \frac{(x_n - 1)e^{x_n} + N}{e^{x_n}} \quad n = 0, 1, \dots$$

- b) Draw a flow chart that
- Reads the initial approximation X_0 and N
 - Computes and prints its logarithm after 4 iterations and gives the logarithm correct to 3dps
- c) Perform the dry run for $N = 15$, $X_0 = 2.8$
- (12 marks)

12. The marks obtained by 25 students in a mock mathematics paper were normally distributed with mean 50 and standard deviation 16

- Find the probability that the mean mark exceeds 56

- ii. Given that 8.5% failed the paper and 12.8% got distinctions, calculate pass mark and the lowest mark for the distinction (12 marks)

13. A particle of mass m_1 is drawn up a smooth inclined plane of height h and length c by a string passing over the top of the plane and supporting at the other end a mass m_2 . If m_1 starts from rest at the bottom of the plane and m_2 is detached after m_1 has moved a distance x , show that m_1 will just reach the top of the plane if $x = \frac{(m_1 + m_2)Ch}{m_2(C + h)}$

(12marks)

14. A particle travelling in a straight line is subject to retardation of $(V^2 + 25)$ in ms^{-2} where $V \text{ ms}^{-1}$ is its speed at time t seconds. If its initial speed is 12 ms^{-1} , show that it travels a distance $\log_e(13/5)$ metres before coming to rest.

b) A particle moving with S.H.M oscillates between point A and B which are 10m apart. When it is 1m from A, its speed is 16 ms^{-1} . Find the

- Periodic time
 - Maximum speed it attains
- iii. Smallest time it takes to travel from A to C, where $AC = \frac{1}{4}AB$ (12marks)

15.a) Find the exact values of $\int_1^{1.8} \tan \frac{x}{2} dx$ correct to 3dp

b) Use the trapezium rule with 8 sub intervals to evaluate $\int_1^{1.8} \tan \frac{x}{2} dx$ correct to 3dp

c) Calculate the absolute error in your (b) above and suggest two ways of reducing its errors

(12marks)

16. The cumulative frequency table below shows the number of absentees for of a class of 32 children during the term

Times absent	0	≤ 1	≤ 2	≤ 3	≤ 4	≤ 5	≤ 6	≤ 7
Cumulative frequency	5	10	20	23	27	28	31	32

- Find the median number of absentees
- Represent the data on a histogram and use it to find the modal number of absentees
- Find the range of the middle 50% of the observations
- Calculate the standard deviation

(12marks)

END