P425/2
APPLIED
MATHEMATICS
Paper 2
2 August 2023
3 hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

Answer **all** *the* **eight** *questions in* Section **A** *and* **only five** from Section B.

All *the necessary working* **must** *be shown clearly.*

Begin each question on a fresh page.

Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

In numerical work, take g to be 9.8 ms^{-2}.

SECTION A: 40 Marks

Answer all questions in this Section.

1. Two events A and B are such that $P(B/A) = \frac{1}{3}$, $P(B) = \frac{1}{8}$ and $P(A \cap B) = \frac{1}{10}$. Find ;

   (i) $P(A)$

   (ii) $P(A \cup B')$ *(05 marks)*

2. A particle is project vertically upwards with a speed of $80ms^{-1}$ from a point $15m$ above the ground. Determine the;

   (i) time taken to hit the ground.

   (ii) velocity with which it hits the ground. *(05 marks)*

3. Given that $x = 14.2, y = 8.28$ and $z = 5.332$ are all rounded off to the given number of d.p. find the interval within which $xy + \frac{y}{z}$ lies. *(05 marks)*

4. A pendulum consists of a light string AB of length $60cm$ with end A fixed and a bob of mass $3kg$ attached to end B. Find a horizontal force that must be applied to the down wards vertical. *(05 marks)*

5. Show that the equation $3x^3 + x - 5 = 0$ has a root between 1 and 2. Hence use linear interpolation to obtain the approximate root to 2dp. *(05 marks)*

6. A bag contains pens of which 40% are blue and the rest are red. A random sample of 8 pens is taken at random. What is probability that;

   (i) exactly 5 are blue

   (ii) more than 6 are blue. *(05 marks)*

7. A body of mass 2kg lies on a rough plane which is inclined at an angle of $Sin^{-1}\frac{5}{13}$ to the horizontal. A force of 20N applied to and up the plane produces an acceleration of $1.5ms^{-2}$, find the coefficient of friction between the body and the plane. *(05 marks)*

8. The table below represents grades of 9 students in a certain school.

MTC	C	D	E	C	C	B	A	E	D
BIO	A	E	C	A	B	B	C	D	E

Calculate the rank correlation coefficient between MTC and BIO. Comment on significance at 5%. *(05 marks)*

SECTION B (60 MARKS)

*Attempt **five** questions from this Section*

9. The marks in an examination were found to be normally distributed with mean μ and standard deviation δ. 10% of the candidates scored about 70% and 20% scored below 40%;

(i) Find the value of μ and δ.

(ii) Determine the percentage of students of students in class who scored above 50%. *(12 marks)*

10. At 8:00Am particles A and B have velocity and position vectors below;

$$\sqrt{}_A = (2i + j - 15k)km$$
$$V_A = (\lambda i + 3j + 30k)kmh^{-1}$$
$$\sqrt{}_B = (-i + 4j + 12k)$$
$$V_B = (4i + 2j - 15k)kmh^{-1}$$

If their velocities remain constant, and given that the particles collides, find;

(i) value of λ.
(ii) time when collision occurs.
(iii) position vector of the point collision. *(12 marks)*

11. (a) Using trapezium rule with ~~fine~~ five stripes find $\int_1^2 \frac{x}{2x^2+4}dx$ correct to decimal places. 4 decimal places *(06 marks)*

(b) Find the error made in estimating the above integral.

(c) Suggest how the error can be reduced. *(06 marks)*

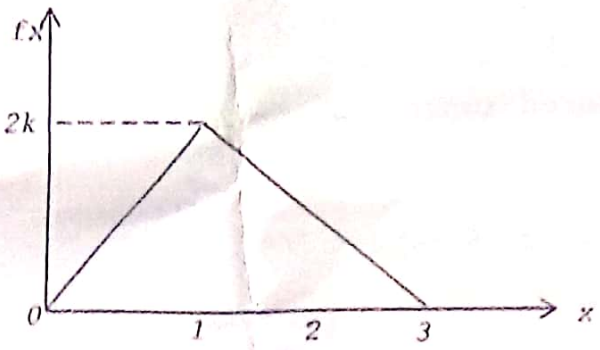
12. (a) Four particles of mass $3kg, 5kg, 2kg$ and $4kg$ are at point $(1,6)(-1,5)(2,-3)$ and $(-1,-4)$ respectively. Find the coordinate of the center of gravity. *(06 marks)*

(b) $ABCD$ is a uniform rectangular lamina where $AB = 6cm$ and $AD = 4cm$. E is a point on BC and F a point on DC such that $CE = CF = 1cm$. A square FCEH is removed from the lamina. Find the coordinate of the center of gravity of the remaining lamina. *(06 marks)*

$a \cdot b = |a||b|\cos\theta$

13. The probability function (p.d.f) of a continuous random variable x is represented by figure below.

Fig 1



(a) Find the;
(i) Value of k.
(ii) Expression for the p.d.f $f(x)$

(b) Calculate the;
(i) Median
(ii) $P(x < 2)$ *(12 marks)*

14. The marks of students in a mathematics test were recorded as follow;

Marks	40–<50	50–<60	60–<65	65–<70	70–<75	75–<85	85–<100
No of students	4	8	11	14	8	10	5

(a) Calculate the mean mark.
(b) Construct a histogram and use it to estimate he mode. *(12 marks)*

15. (a) Show that the Newton - Raphson formula to approximate the root of the equation. $x = ln(8 - x)$ is given by

$$x_{n+1} = \frac{e^{x_n}(x_n - 1) + 8}{e^{x_n} + 1}$$

(b) Draw a flow chart that;
(i) Reads the initial approximation x_0 of the root.
(ii) Computes and prints the root correct to three decimal places.

(c) Taking $x_0 = 1.8$, perform a dry run of your chart to find the root of the equation. *(12 marks)*

16. A car of mass $4500kg$ tows another car of mass $1000kg$ uphill of 1 in 10. The resistance to the motion of the cars is $0.5N$ per kg. Find the tension in the tow bar and the acceleration of the cars when the speed is $10ms^{-1}$ and the engine works at a rate of $450KW$. *(12 marks)*

END