

P425/2
APPLIED
MATHEMATIC
PAPER 2
JULY/AUG 2024
3 hours



ASK INTEGRATED TEACHER'S MOCK
EXAMINATIONS BUREAU

AITEL JOINT 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) answered will **not** be marked.

All necessary working **must** be shown clearly

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

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

Graph paper is provided

SECTION A (40 Marks)

(Attempt **all** questions in this section)

- Two events A and B are such that $P(A) = \frac{5}{12}$, $P(A/B') = \frac{7}{12}$, $P(A \cap B) = \frac{1}{8}$, find;
(i) $P(A \cup B)$ (03 marks)
(ii) $P(B/A')$ (02 marks)
- A train being brought to rest with uniform retardation travels 30m in 2 seconds and then a further 30m in 4 seconds. Find the retardation of the train. (05 marks)
- The tables of the normal probability distribution give $f(1.36) = 0.9131$, $f(1.37) = 0.9147$. Find by linear extrapolation the value of x when $f(x) = 0.9129$ correct to three decimal places. (05 marks)
- The table below shows the age groups of a random sample of 200 people that attend a music festival.

Age (years)	15 - < 20	< 25	< 30	< 35	< 40	< 50
No. of people	22	42	70	38	16	12

Construct a histogram and use it to estimate the mode. (05 marks)

- A body of mass 8kg in contact with a rough plane inclined at 50° to the horizontal is just prevented from sliding down the plane by a horizontal force P. if the angle of friction between the plane and the body is 25° , calculate the magnitude of P. (05 marks)
- Use the trapezium rule with 7 ordinates to estimate $\int_1^6 x \ln x \, dx$ giving your answer correct to 3 decimal places. (05 marks)
- A coin is biased so that it is twice as likely to show a head as a tail. If it is tossed 5 times, find the probability that at least 4 tails show up. (05 marks)
- A piston moves with simple harmonic motion performing 3 oscillations per minute. Given that the maximum speed of the piston is 0.5ms^{-1} , find the
(i) amplitude of the motion. (03 marks)
(ii) maximum acceleration. (02 marks)

SECTION B. (60 MARKS)

(Attempt any **five** questions from this section. **All** questions carry equal marks)

9. A random variable x has probability density function $f(x)$ given by

$$f(x) = \begin{cases} ax^2(d-x), & 0 \leq x \leq 1 \\ 0, & \text{elsewhere.} \end{cases}$$

Given that the mean of x is 0.6, determine;

(i) the value of a and d .

(ii) $P(0.9 \leq x \leq 1)$

(iii) the cumulative distribution of x . (12 marks)

10. Two particles of mass 2kg and 3kg are connected by a light inextensible string passing over a fixed smooth pulley. Initially, the system is at rest with the string taut and vertical with both particles at a height of 2m above the ground. When the system is released, find the;

(i) time that elapses before the 3kg mass hits the ground.

(ii) maximum height reached by the 2kg mass. (12 marks)

11. Given the equation $e^x + 1 = -2x$;

(a) Show graphically that the equation has a root between 0 and -1.

(b)(i) Show that the Newton Raphson formula for approximating the root of the

$$\text{equation is given by } x_{n+1} = \frac{x_n e^{x_n} - e^{x_n} - 1}{e^{x_n+2}}$$

(ii) Use the formula in b(i) above and the initial approximation x_0 in (a) above to find the root of the given equation to two decimal places. (12 marks)

12. The weights of a certain type of cows are normally distributed. Out of 8000 cows selected at random, 440 weigh below 130kg while 340 weigh above 200kg. find the;

(i) mean weight and standard deviation. (08 marks)

(ii) probability that a cow chosen at random weighs at least 120kg. (04 marks)

13. A ship A moving with a constant velocity $(4\mathbf{i} + 3\mathbf{j})$ passes through a point with position vector $(3\mathbf{i} + 2\mathbf{j})$. At the same instant, a ship B passes through the point with position vector $(3\mathbf{i} + 4\mathbf{j})$ moving with a constant velocity of $(\mathbf{i} - 2\mathbf{j})$.

Find the (i) position vector of A relative to B at any time t .

(ii) Shortest distance between P and Q in the subsequent motion.

(iii) time that elapses before the particles are nearest to one another.

(iv) the position vector of ship A after 3 hours. (12 marks)

14. Two numbers X and Y are approximated by x and y with errors e_1 and e_2 respectively.

(a) Show that the maximum relative error in x^2y is given by $2\left|\frac{e_1}{x}\right| + \left|\frac{e_2}{y}\right|$ (05 marks)

(b) If $x = 2.23$ and $y = 2.013$ are each rounded off to the given number of decimal places, calculate the;

(i) percentage error in xy .

(ii) limits within which xy is expected to lie. Given your answer correct to 3 decimal places. (07 marks)

15. Two adjudicators at a music competition award marks to 10 pianists as follows;

Adjudicator 1	78	66	73	73	84	66	89	87	67	77
Adjudicator 2	81	68	81	75	80	67	85	63	66	78

(a) (i) Draw a scatter diagram to show the awards of the two adjudicators.

(ii) Draw a line of best fit on the scatter diagram and estimate a mark adjudicator 2 would give if adjudicator 1 gave 75 marks.

(b) Calculate the rank correlation coefficient and comment on your result.

(12 marks)

16. A non-uniform beam AB of length 4m rests in a horizontal position on vertical support at A and B. The centre of gravity is at a point 1.5m from A. If the reaction at B is 37.5N,

(a) Find the; (i) weight of the beam.

(ii) reaction at A.

(b) The beam is made to lean against a smooth vertical wall with A on a rough horizontal ground. Find the coefficient of friction necessary to maintain the beam inclined at 30° to the horizontal. (12 marks)

END