

P 425/2

APPLIED MATHEMATICS

3 HOURS

UGANDA ADVANCED CERTIFICATE OF EDUCATION

APPLIED MATHEMATICS

PAPER TWO

3 HOURS

INSTRUCTIONS:

- ✓ ATTEMPT ANY EIGHT (8) QUESTIONS FROM SECTION A AND NOT MORE THAN FIVE FROM SECTION B.
- ✓ NON- PROGRAMABLE SILENT SCIENTIFIC CALCULATIONS MAY BE USED.
- ✓ MATHEMATICAL TABLES WITH LIST OF FORMULAE AND GRAPH PAPERS MAY BE PROVIDED
- ✓ IN NUMERICAL WORK TAKE $g = 9.8\text{ms}^{-2}$

SECTION A

- Events A and B are such that
 $P(A) = \frac{2}{3}$, $P(A/B) = \frac{2}{3}$, $P(B) = \frac{1}{4}$
 Find: (a) $p(B/A)$ (3marks)
 (b) $p(A \cap B)$ (2 marks)
- A uniform rod AB of weight W rests in equilibrium with the end A in contact with smooth vertical wall and the end B in contact with a smooth plane inclined at 45° to the wall. Find the reactions at A and B in terms of W. (5 marks)
- A box contains five beads each having the numbers 1, 2, 3, 4, 5. A bead is drawn from the box, its number noted, and then replaced. This was done 50 times in all and the table below shows the resulting frequency distribution.

Number	1	2	3	4	5
Frequency	x	11	y	8	9

If the mean is 2.7, determine the values of x and y. (5marks)

- A car travelling along a straight line with constant acceleration is observed to travel consecutive distances of 1km in times of 30s and 60s respectively. Find the initial velocity of the car. (5 marks)
- Four rods of lengths 1, 2, 3 and 4 units are placed in a bag from which one rod is selected at random. The probability of selecting a rod of length l is R/l .
 (a) Find the value of R, the constant. (2 marks)
 (b) Show that the expected value of X, the length of the rod is 3 units. (3 marks)
- Given that $x = 3.150$, $y = 2.7$.
 (a) State the possible errors in x and y. (2 marks)
 (b) Find the limits within which the value of $\frac{x-y}{x+y}$ is expected to lie. (3marks)
- Two particles of mass m and M, $M > m$, are connected by a light inelastic string which passes over a smooth fixed pulley. Find the acceleration of the system and the tension in their string. (5 marks)
- Calculate a weighted price index for the following for 2015 based on 2010.

	2000	2015	
Item	Price	Price	Weight
Food	235,000	250,000	4
Housing	180,000	210,000	3
Transport	65,000	85,000	1

SECTION B (60 MARKS)

9. The table below shows the time taken by students in a certain to make telephone calls.

Duration in minutes	number of calls
≤ 1	6
1-2	10
2-3	15
3-5	5
5-10	4
≥ 10	0

- (a) Obtain an estimate for the mean and standard deviation (6 marks)
 (b) Draw a histogram and use it to estimate the modal time. (6 marks)

10. A force P has magnitude 100N, acts in the direction $24i - 7j$ and passes through (1, 1). A second force Q is $2i + j$ and passes through (5,1).

- (a) Find the equation of the lines of action of P and Q. (4 marks)
 (b) Find the resultant of P and Q. (3 marks)
 (c) Find the equations of the line of action of the resultant force. (5 marks)

11. Two positive real numbers x and y are approximated by $\bar{x}$ and $\bar{y}$ and the error created respectively are δx and δy .

- (a) Show that the maximum relative ⁱⁿxy is given by $\frac{|\partial x|}{|\bar{x}|} + \frac{|\partial y|}{|\bar{y}|}$. (8 marks)

- (b) If $\bar{x} = 2.71$ and $\bar{y} = 1.5$, find the percentage error in the production xy. (4 marks)

* 12. In an inspection survey carried out by Uganda National bureau of standard, a sample of 20 items is selected at random from a large batch is rejected. If this number of defective item is 0.02, find the probability that:

- (a) the batch is accepted (7 marks)
 (b) the batch is accepted given that it has defective items. (5 marks)

13. The continuous random variable x has probability density function $f(x)$ defined by

12. Two unbiased tetrahedral dice having faces numbered 1, 2, 3 and 4 are thrown together. The random variable X represents the modulus of the difference between the numbers on the two faces that show up.

- a) show that $P(X=1) = \frac{3}{8}$ (3 marks)
 b) Generate the probability distribution table for X. (5 marks)
 (4 marks)
 c) Find $E(X)$

$$f(x) = \begin{cases} \frac{x}{3} - \frac{2}{3} & : 2 \leq x \leq 3 \\ \alpha & : 3 \leq x \leq 5 \\ 2 - px & : 5 \leq x \leq 6 \\ 0 & : \text{other wise} \end{cases}$$

Where α and β are constants. Find:

- (a) The values of α and β . (4 marks)
- (b) $F(x)$ and sketch $y = F(x)$. (4 marks)
- (c) $P(2 \leq x \leq 3.5)$ (4 marks)

14. (a) A ball is kicked from the top of a tower, below the horizontal at an angle of 60° with vertical through the point of kicking. If the tower is 70m high and the ball hits the ground 20m from the bottom of the tower, find the speed with which the ball was kicked and the direction of the ball just before it hits the ground. (7 marks)

(b) A particle is projected from a point O with initial velocity vector $i + 2j$. Find the velocity vector and the position vector of the particle:

(a) after t seconds (3 marks)

(b) after $\frac{3}{2}$ seconds (2 marks)

15. The marks obtained by 3 students in English language and Literature in English are as shown in the table below

English (x)	67	42	85	51	39	97	81	70
Literature (y)	70	59	71	38	55	62	80	76

- (a) Calculate the correlation coefficient between the two sets of marks and comment on your results. (6 marks)
- (b) (i) Plot the set of marks on a scatter diagram and draw a line of best fit. (4 marks)
- (ii) use your diagram to find the marks in English for a student who got 74 in literature. (2 marks)

16. Forces of magnitudes 6N, 2N, 2N and 1N act along the sides of a rectangle ABCD whose sides are a and $2a$.

Find:

- (a) The resultant force (5 marks)
- (b) Equation of the line of action of the resultant force. (7 marks)

END.