

P425/2
APPLIED MATHEMATICS
PAPER 2
NOV. 2022
3HRS

KISINGA VOCATIONAL SECONDARY SCHOOL

Uganda Advanced Certificate of Education

END OF TERM 3 EXAMINATIONS 2022

APPLIED MATHEMATICS
PAPER 2
3hours

Instructions to Candidates

- Answer **ALL** the eight questions in Section A and any **FIVE** from Section B.
- All necessary working must be shown clearly
- Mathematical tables with a list of formulae and squared papers are provided
- In numerical work, take g to be 9.8ms^{-2}
- Include the allocation table on your answer sheet

SECTION A (40 MARKS)
Attempt all questions in this section

1. Events A and B are such that $P(A/B) = \frac{2}{3}$ and $P(A/B') = \frac{4}{7}$, Find the
 - i. $P(A)$ 3 marks
 - ii. $P(B/A')$ 2 marks
2. A force of $(3\mathbf{i} - 2\mathbf{j} + 8\mathbf{k})$ N acts on a body of mass 4kg initially at the origin. If the velocity is $(2t\mathbf{i} + 3\mathbf{j})\text{ms}^{-1}$, find the work done after 4 seconds 5 marks
3. The temperature ($^{\circ}\text{C}$) of a liquid measured at interval of 2 minutes were recorded as 55 and 52. If the initial temperature is 60, use linear interpolation or extrapolation to find
 - i. Temperature after 5 minutes
 - ii. Time taken if the temperature is 53.5°C 5 marks
4. The probability that a certain function starts early is $\frac{4}{7}$. If the function starts early, the probability that it takes a longer time is $\frac{3}{5}$. If the function starts late, the probability that it takes a shorter time is $\frac{1}{3}$. Find the probability that the function
 - i. Takes a shorter time 03 marks
 - ii. Starts early if it takes a shorter time 02 marks
5. The table below shows the expenditure of a certain family for months of September and October in 2020.

Items	Expenditures (shs.)		Weight
	September	October	
Food	300,000	325,000	5
Accommodation	260,000	565,500	3
Electricity	150,000	160,000	1
Miscellaneous	620,000	725,000	2

Calculate the cost of living index for the month of October base on September 2020

6. A discrete random variable X has the following probability distribution
 $P(1) = \beta, P(2) = 2\beta, P(3) = 3\beta, P(4) = 4\beta$ and $P(5) = 5\beta$.
 Find the
 - i. The value of β
 - ii. Probability distribution of $Y = 3X - 7$
 - iii. $E(Y)$.
7. The following scores were obtained during the sports day completion of different students houses in a certain school.
 42.2, 44.6, 47.5, 42.6, 51.4, 53.7, 56.8, 42.2, 59.2 and 61.7
 Find the
 - i. Mean score
 - ii. Variance 05 marks

8. Using graphical method, estimate the first approximation to the real root of the equation $x^3 - 3x + 4 = 0$

SECTION B. (60 MARKS)

Attempt any five questions from this section

9. a. The numbers X and Y were estimated with maximum errors of ΔX and ΔY respectively. Show that the maximum possible relative error in the estimation of X^2Y is given by $2 \left| \frac{\Delta X}{X} \right| + \left| \frac{\Delta Y}{Y} \right|$ 05 marks
- b. Given that the numbers $A = 7.4$, $B = 5.42$, and $C = 9.80$ are rounded off with percentage errors 2, 3, and 1 respectively. Calculate the relative error, made in evaluating $\frac{B}{A-C}$, correct to two decimal places. 07 marks

10. The table below shows the marks obtained by 8 candidates in physics and mathematics.

Candidate	A	B	C	D	E	F	G	H
Mathematics(X)	52	65	41	65	81	31	65	55
Physics (Y)	50	60	35	65	66	35	69	48

- a. Calculate the rank correlation coefficient for the data and comment on the significance of mathematics on physics at 1 % level 05 marks
- b. i. plot a scatter diagram for the scores in mathematics and physics
 iii. draw a line of best fit hence find the marks scored in physics by a student who scored 75 marks in mathematics 07 marks
11. a. Derive the equation of the path of a particle projected from O at an angle α to the horizontal with initial speed $u \text{ ms}^{-1}$ 06 marks
- c. A particle projected from point A with speed 30 ms^{-1} at an angle of elevation θ hits the ground again at B at the same level as A. If before landing the particle just clears the top of a tree which is at horizontal distance 72m from A, the top of the tree being 9m above the level AB. Calculate the possible angles of projection (use $g = 10 \text{ ms}^{-1}$) 06 marks
12. The particles P and Q move with constant velocities of $(4\mathbf{i} + \mathbf{j} - 2\mathbf{k})\text{ms}^{-1}$ and $(6\mathbf{i} + 3\mathbf{k})\text{ms}^{-1}$ respectively. Initially P is at the point with position vector $(-\mathbf{i} + 20\mathbf{j} + 21\mathbf{k})\text{m}$ and Q is at the point with position vector $(\mathbf{i} + 3\mathbf{k})\text{m}$. Find the
- i. Time for which the distance between P and Q is least
- ii. Distance of P from the origin at the time when the distance between P and Q is least
- iii. Least distance between P and Q 12marks

13. A continuous random variable X has the following p.d.f

$$f(x) = \begin{cases} \lambda x(3-x), & 0 \leq x \leq 2 \\ \lambda(4-x); & 2 \leq x \leq 4 \\ 0; & \text{otherwise} \end{cases}$$

Find the

- Value of λ
 - The mean of X
 - The cumulative distribution function F(X) and sketch it
 - $P(1 \leq X \leq 3)$
- 12 marks

14. A car is moving on a straight horizontal road. At a time $t = 0$, the car is at point P and moving with a speed of 20ms^{-1} . The car maintains this speed for 25s and the moves with a constant deceleration of 0.4ms^{-2} until its speed reduces to 8ms^{-1} . the car then maintains this speed for 60s and the moves with a constant acceleration until its speed is 20ms^{-1} at point Q.

- Sketch a velocity time graph for the motion of the car from P to Q
- Find the time for which the car is decelerating
- Given that the distance from P to Q is 1960m, find the time taken for the car to move from P to Q

15. The table below shows the distribution of marks in an examination of a certain class in a certain school

Marks	10 -	20 -	30 -	40 -	50 -	60 -	70 -	80 -90
Frequency	18	34	58	42	24	10	8	

- Calculate the mean and standard deviation
 - Construct an ogive and use it to estimate the
 - Number that failed if the pass mark is 40
 - Minimum mark of a distinction if 10% got a distinction
- 12 marks

16. The discrete random variable X can take only values 0, 1, 2, 3, 4, 5. The probability distribution is given by the following where a and b are constants.

$$P(X = 0) = P(X = 1) = P(X = 2) = a$$

$$P(X = 3) = P(X = 4) = P(X = 5) = b$$

$$P(X \geq 2) = 3P(X < 2)$$

- Determine the values of a and b
 - Show that the expectation of X is $\frac{23}{8}$ and find the variance of X
- 12 marks

END