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P425/2 APPLIED MATHEMATICS PAPER 2 3 HOURS

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 from Section B.
- All necessary working **must** be shown clearly.
- Begin each answer on a fresh page.
- In numerical work, take g to be $9 \cdot 8 \text{ms}^{-2}$.
- Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

• SECTION A: (40 MARKS)

Answer **all** the questions in this section.

- 1. A certain frequency distribution with standard deviation 2.5 has the following results: $\sum f = n$, $\sum fx = 177$ and $\sum fx^2 = 5259$. Find the value of n (05 marks)
- 2. ABCD is a square of side 2a metres. Forces of magnitude 9N, 5N and $\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow 3\sqrt{2}N$ act along \overrightarrow{AB} , \overrightarrow{BC} , and \overrightarrow{BD} respectively. Find the equation of the line of action of the resultant force. (05 marks)

3. Use the trapezium rule with 6 ordinates to estimate $\int_{1}^{2} tan^{-1}x \, dx$ correct to 4 decimal places. (05 marks)

- 4. Events A and B are such that 3P(A n B) = 2P(A n B) = P(A n B) = x and P(A) = 3/5. Use a Venn diagram to find:
 (i) the value of x
 (ii) P(A or B but not both A and B)
 (05 marks)
- 5. A ball projected from level ground with a speed of $25\sqrt{2}ms^{-1}$ at an elevation of 45° passes just above the top of two vertical posts each of height 30m. Find the distance between these posts. [Take g = $10ms^{-2}$] (05 marks)
- 6. The resistance of <u>a wire at different temperatures is</u> as follows:

Resistance (Ω)	24	42
Temperature (°C)	15	51

Use linear interpolation or extrapolation to estimate the:

- (i) temperature corresponding to 35Ω .
- (ii) resistance whose value is equal to that of the temperature.

(05 marks)

7. The masses of meat cans are normally distributed with a standard deviation of 18g. A random sample of 25 cans had a mean mass of DOWNLOAD MORE RESOURCES LIKE THIS ON **ECOLEBOOKS.COM**

458g. Find the 99% confidence interval for the mean mass of all the meat cans (05 marks)

8. A particle executes S·H·M about centre O, with amplitude 5m and period $\frac{\pi}{2}$ s. Find the distance it travels from O until when its speed is half the maximum value. (05 marks)

SECTION B: (60 MARKS)

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Answer any five questions from this section.
All questions carry equal marks.
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9. Given that $P(A) = \frac{3}{5}$, $P(A/B) = \frac{5}{7}$ and $P(B/A) = \frac{2}{3}$,

(a) State with reasons whether A and B are:	
(i) independent events	(02 marks)
(ii) mutually exclusive events	(02 marks)

(b) Find:

(i) P(A n B)	(02 marks)
(ii) P(B)	(02 marks)
(iii) $P(A/\overline{B})$	(04 marks)

10. (i) The quantities a and b were measured with errors Δa and Δb respectively. Show that the maximum relative error in calculating

 $z = a\sqrt{b}$ is $\left|\frac{\Delta a}{a}\right| + \frac{1}{2}\left|\frac{\Delta b}{b}\right|$ (08 marks)

- (ii) Given that a = 2.5 and b = 0.16 were estimated with percentage errors of 4 and 5 respectively. Calculate the absolute error in evaluating $a\sqrt{b}$ (04 marks)
- 11. Two cyclists P and Q are 11km apart with Q on a bearing of 110° from P. Cyclist P is riding at 5kmh⁻¹ due North–East and Q is riding due N15°W at 8kmh⁻¹. Find the:
 - (i) closest distance between them in the subsequent motion
 - (ii) time that elapses before they are closest to each other.

(12 marks)

12. The lengths in cm of 40 metal rods were as follows:

Lengths	Frequency	
30 - < 35	8	
35 - < 40	5	
40 - < 55	12	
55 - < 60	9	
60 - < 65	6	
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(a) Calculate the:

(i) mean length (03 marks) (ii) upper quartile (03 marks) (b) Display the data on a histogram and use it to estimate the mode (06 marks)

- 13. (i) Show graphically that the equation 2sinx Inx = 0 has a root between 2 and 3. (06 marks)
 - (ii) Use Newton Raphson's method to find the root of the equation in(i) above correct to 4 significant figures. (06 marks)
- 14. (a) A car of mass 2000kg has a maximum speed of $72kmh^{-1}$ up a hill inclined at $sin^{-1}\left(\frac{1}{7}\right)$ to the horizontal when the engine is working at 64kW. Find the resistance to motion of the car.

(05 marks)

- (b) A car of mass 500kg tows a van of mass 300kg up a hill inclined at 30° to the horizontal. The resistances to motion of the car and the van are 200N and 180N respectively. If the power output of the car is 196kW, find the acceleration of the vehicles and the tension in the tow rope at the instant when the speed of the car is $40ms^{-1}$. (07 marks)
- 15. The distribution function of a continuous $r \cdot v X$ is as follows:

$$F(x) = \begin{cases} 0 & , x \leq 1 \\ \frac{1}{12}(x-1)^2 & , 1 < x \leq 3 \\ \frac{1}{24}(\beta x + \lambda - x^2) & , 3 < x \leq 7 \\ 1 & , x > 7 \end{cases}$$

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