P425/2

3 hours

SAVIO SECONDARY SCHOOL - KAWEMPE
INTERNAL MOCK EXAMINATIONS 2023

APPLIED MATHEMATICS

PAPER 2

TIME :3 HOURS

INSTRUCTIONS:

Answer all questions in section A and only five questions from section B.

Take acceleration due to gravity g=9.8ms^{-2}

All working must be shown.

Graph papers are provided.

SECTION A

1. Forces of 20N and 12N act away from a common point in direction E30°S and N40°E respectively. Find the resultant force. (5mks)

2. Given the distribution $X \sim N(100, a^2), P(X > 108) = 0.0548$, find a. (5mks)

3. A lorry of mass 2 tones travels against a constant resistance of 0.13 N per kg with a speed of 60kmhr^{-1} along a level road. Find the rate at which its engine is working. (5mks)

4. A discrete random variable, X has the following cumulative probability distribution.

X	1	2	3	4	5
$P(X \leq x)$	a	2a	5a	7a	10a

Find a) a (2mks)

   b) E(X) (3mks)

5. Locate the roots of the equation $x^3 = 4x^2 - 4$ in the interval $|x| \leq 4$ (5mks)

6. Use trapezium rule with 5 strips to find the approximate value of $\int_0^{\frac{\pi}{4}}(x - \cos x)dx$, correct to three decimal places. (5mks)

7. Eight applicants for a job obtained the following marks in oral and written tests.

Applicant	A	B	C	D	E	F	G	H
Oral test	15	20	28	12	40	60	20	80
Written test	40	30	50	30	20	10	30	60

Calculate rank correlation coefficient for the data and test for significance at 1% level. (5mks)

8. The position vector of ship A relative to ship B at any time is given by

$A_rB(t) = \binom{4}{13a} + \binom{-2}{-4}t$, if the ships are closest top each other at t=3 seconds. Find a. (5mks)

SECTION B

9. a)A and B are two independent events such that $P(A \cup B) = \frac{5}{8}$ and $P(A \cap B) = \frac{1}{8}$. Find

   (i)P(A)   (ii)P(B) (6mks)

   b) For a married couple the probability that a husband is employed is 0.8and that of his wife is 0.6. The probability that at least one of them is employed is 0.9.

   (i)Find the probability that they are both employed.

   (ii)If the husband is unemployed, find the probability that his wife is also unemployed. (6mks)

10. a)Forces $F_1 = \binom{5}{7}, F_2 = \binom{-3}{-4}$ and $F_3 = \binom{-2}{-3}$ act at points A(2,-4)m, B(6,2)m and C(-4,3) respectively. Show that the forces reduce to a couple. (5mks)

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b)The figure below represents a uniform lamina formed by welding a rectangular, semicircular and a triangular metal sheet together. $\overline{AB}=12cm, \overline{CE}=\overline{DE}=10cm, \overline{AD}=9cm$ and the radius of the semicircular lamina is 4.5cm
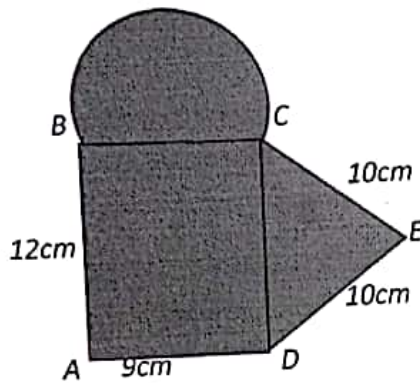
Find the position of center of gravity of the lamina from sides AB and AD.   (7mks)

11.a)Real numbers x=26.23 and y=5.1 are calculated with relative errors of 0.04 and 0.02 respectively.Find the relative error in $\dfrac{x}{y-x}$ (7mks)

b) Given the table below

x	0.1	0.2	0.3	0.4
$\sqrt{x}$	0.3162	0.4472	0.5477	0.6325

Use linear interpolation/extrapolation to find the value of   (5mks)

(i)$\sqrt{0.25}$ (ii)0.75^2

12.At 10:00 a.m. ,ship A and ship B are 16 km apart. Ship A is on a bearing N35°E from ship B.Ship A is travelling at $14kmhr^{-1}$ on a bearing S29°E.Ship B is travelling at $17kmhr^{-1}$on a bearing N50°E.Determine the

a) velocity of ship B relative to ship A.

b) closest distance between the ships in their subsequent motion and the time when it occurs.   (12mks)

13.a)A body of mass 30kg is placed on a rough plane inclined at an angle of 60° to the horizontal and angle of friction is $\tan^{-1}\left(\frac{1}{6}\right)$. Find the least horizontal force required to keep the body in equilibrium.   (5mks)

b) A particle of mass 4kg starts from rest at a point (2, -3,1)m.It moves with acceleration $=(4i+2j-3k)ms^{-2}$when a constant force acts on it. Find the

(i)applied force

(ii)velocity of the particle after 6 seconds.

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(iii)work done by the forge after 6 seconds. (7mks)

14. By plotting graphs $y=2x^3$ and $y=8-5x$ on same axes, find the initial approximation of the root of the equation $2x^3=8-5x$ between 1 and 2. Hence use New ton Raphson method and find the exact root of the equation to three decimal places.

15. The table below shows marks obtained in in a certain mathematics test

marks	10 -< 20	20 -< 25	25 -< 35	35 -< 55	55 -< 70	70 -< 80
frequency	10	20	15	40	10	5

a) Calculate the (i)mean

(ii)mode

b) Draw an ogive and use it to find the

(i)median

(ii)semi inter quartile range. (12mks)

16. A continuous random variable X has p.d.f given by

$$f(x) = \begin{cases} \dfrac{x^2}{27}, & 0< x \le \alpha \\ \dfrac{1}{3}, & \alpha \le x \le \beta \\ 0, & \text{else where} \end{cases}$$

Find the (i)values of α and β hence sketch $f(x)$

(ii)mean of X

(iii)$P(\alpha \le X \le \beta)$ (12mks)

END

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