

Name: Comb:

PRE-MOCK EXAMINATIONS-2016
P425/2 APPLIED MATHEMATICS
PAPER 2

TIME: 3 Hours

S.6

Instructions:

- Attempt all questions in Section A and any Five from Section B.
- All working must be shown clearly
- Where necessary, take $g = 9.8\text{ms}^{-2}$

SECTION A

1. Events A and B are such that $P(A \cap B) = \frac{1}{12}$ and $P(A/B) = \frac{1}{3}$. Find $P(B \cap A^c)$
 (5 mks)
2. The heights (cm) and ages (years) of a random sample of ten farmers are given in the table below.

Height(cm)	156	151	152	160	146	157	149	142	158	140
Ages (years)	47	38	44	55	46	49	45	30	45	30

Calculate the rank correction coefficient. Comment on your result. (5 marks)

3. A student has ten-multiple choice questions to answer. There are four alternative answers to choose from. If a student answers the questions by guessing, find the probability;
 - (a) that at least four answers are correct
 - (b) of the most likely number of correct answers. (5 marks)
4. A particle is projected at an angle of 60° to the horizontal with a velocity of 20ms^{-1} . Calculate the greatest height the particle attains. (Use $g = 10\text{ms}^{-2}$).
 (5 marks)
5. The table below shows the cost y shillings for hiring a motor cycle for a distance x kilometers.

Distance (x km)	10	20	30	40
Cost (shs y)	2,800	3,600	4,400	5,200

Using linear interpolation or extrapolation to calculate;

- (i) the cost of lining a motor cycle for a distance of 45 km.
 - (ii) the distance mike travelled if he paid shs. 4,000 (5 marks)
6. The forces 3N, 4N, 5N, and 6N act along. The sides AB, BC, CD and DA of a rectangular. Their directions are in the order of the letters. BC is the horizontal. Find the resultant force and the couple at the centre of the rectangle of size 4m by 2m. (5 marks)
7. Two forces of magnitude 10N and 8N act on a particle producing an acceleration of 2.4ms^{-2} . The forces act at an angle of 50° to each other. Find the mass of the particle. (5 marks)
8. Given the numbers $X = 14.37$ and $Y = 2.586$, measured to their nearest number of decimal places indicated.
- (i) determine the absolute error in $\frac{X}{Y}$.
 - (ii) the limit within which $\frac{X}{Y}$ lies, correct to 3 decimal places. (5 marks)

SECTION B

9. The probability density function (*p.d.f*) of a continuous random variable X is given by.
- $$f(x) = \begin{cases} kx(16-x^2) & 0 \leq x \leq 4 \\ 0 & \text{elsewhere} \end{cases}$$
- where k is a constant
- find the;
- (i) value of K
 - (ii) mode of X
 - (iii) mean of X (12 marks)
10. The marks of 500 candidates in an examination are normally distributed with a mean of 45 marks and a standard deviation of 20 marks.
- (a) Given that the pass mark is 41, estimate the number of candidates who passed the examination
 - (b) If 5% of the candidates obtain a distribution by scoring x marks or more estimate the value of x
 - (c) Estimate the Interquartile range of the distinction. (12 marks)
11. The heights of a sample of tea trees in a tea estate were recorded (in cm) as follows;

110	112	105	102	129	112	103	128	121	126
109	107	109	131	124	116	119	127	120	106
120	118	111	126	107	123	102	122	113	129
125	120	113	119	123	130	123	103	109	111
130	124	121	118	119	125	133	115	117	113

- (a) Construct a frequency table with classes having an interval of 5.0cm and use it to estimate the average height of the tea trees.
- (b) Construct a cumulative frequency curve and use it to estimate the median height of the tea trees.
- (c) What is the probability of finding a tree with a height between 118cm and 124cm (12 marks)

12. (a)(i) On the same axis, draw graphs of $y = x^2$ and $y = \cos x$ for $0 \leq x \leq \frac{\pi}{2}$ at intervals of $\frac{\pi}{8}$.
- (ii) From your graph, obtain to one decimal place, an approximate root of equation $x^2 - \cos x = 0$. (6 marks)
- (b) Using Newton Raphson method, find the root of the equation $x^2 - \cos x = 0$. Taking the approximate root in (a) 0.5 an initial approximation. Give your answer to three decimal places. (6 marks)
13. At 11.00am, ship A has a position vector of $(3\mathbf{i} + \mathbf{j})$ km and moving at $(2\mathbf{i} + 3\mathbf{j})\text{kmh}^{-1}$. At 12:00 noon, another ship B has a position vector $(2\mathbf{i} - 3\mathbf{j})\text{km}$ and moving at $(3\mathbf{i} + 7\mathbf{j})\text{kmh}^{-1}$.
- (a) Find the position vector of ship A at 12:00 noon. (3 marks)
- (b) If the ships after 12:00 noon maintain their courses, find the;
- (i) time when they are closest.
- (ii) Least distance between them (9 marks)
14. (a) A body of mass 5kg is placed on a rough plane inclined at an angle of 30° to the horizontal. The angle of friction between the plane and the body is 20° . Find the maximum force that can be applied to the body without motion occurring, if the force acts upwards at an angle of 30° to the line of greatest slope. (6 marks)
- (b) Forces of 2N, 8N, 4N, 4N and $5\sqrt{2}\text{N}$ act along AO, AB, BC, CO and OB respectively of a square OABC in which $\overline{OA} = 2\text{cm}$. Taking OA and OC as the x- and y-axis respectively Find the;
- (i) equation of the line of actions of the resultant force.

- (ii) distance from C of the point where the line in (i) above crossed the side OC.
(6 marks)

15. (a) Use the trapezium rule with six ordinates to estimate

$$\int_1^3 x^2 \ln x \, dx$$

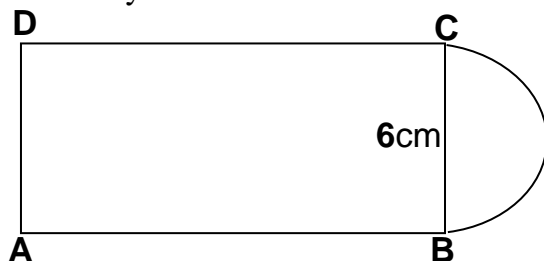
Give your answer correct to 3 decimal places. (6 marks)

- (c) Hence find the percentage error made in your estimate and suggest how it can be reduced. (6 marks)

16. (a) Find the coordinate of the gravity of the uniform lamina which lies in the first quadrant and is enclosed by the curves.

$$y = 3x^2, \quad y = 4 - x^2 \text{ and the } y - \text{axis.} \quad (5 \text{ marks})$$

- (b) The diagram below shows a uniform rectangle **ABCD** with a uniform semi-circular end. **AB** = 8cm and **BC** = 6cm. find the distance of the centre of gravity of the composite body from **AD**.



(7 marks)

END