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P425/2 **S.6**

APPLIED MATHEMATICS

PRE MOCK EXAMS

June, 2023

KASAWO ISLAMIC SCHOOL

Uganda Advanced Certificate of Education

PRE MOCK EXAMINATIONS 2023

APPLIED MATHEMATICS (P425/2)

SENIOR SIX

Time: 3 hours

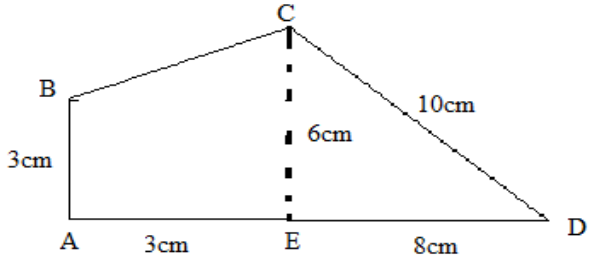
INSTRUCTIONS

- *Answer* **all** *questions in section* **A** *and not more than* **five** *questions in section* **B**
- *Begin each solution to a new question on a* **fresh page.**
- *All necessary calculations must be done of the same page as the rest of the answers and therefore no paper should be given for rough work.*

SECTION A (40 MARKS)

(*Attempt all questions in this section)*

1. Real numbers **X** and **Y** are rounded off to 2.74 and 6.760 respectively. Find the limits between which $\frac{X}{X-Y}$ lies, giving your answer correct to three decimal places. **(05 marks)**
2. Find the coordinates of the centre of mass of the lamina shown below. Take A as the origin and AD, AB as $x-$ and $y-$ axes respectively **(05 marks)**



3. The continuous random variable Y is uniformly distributed on the interval $\boldsymbol{a} \leq x \leq \boldsymbol{b}$. Given $E(Y) = 2$ and$Var(Y) = 3$. Find
   (a) The values of **a** and **b** **(03 marks)**

(b) $P(X > 1.8)$ **(02 marks)**

4. (a) If events A and B are independent, show that A^1 and B^1 are also independent **(03marks)**

   (b) Given that P (A) = 0.13 and P (B) = 0.724, find $P(A^1 \cap B^1)$ **(02 marks)**

5. A stone is thrown vertically upwards with a speed of 20ms^{-1} from a point at a height *h* above the ground level. If the stone hits the ground 5s later, find the
   (i) Velocity with which it hits the ground **(03 marks)**
   (ii) The value of *h* **(02 marks)**
6. Given below are values of $f(x)$ for given values of$x$. $f(0.4) = -0.9613$,$f(0.6) = -0.5108$, and $f(0.8) = -0.2231$. Use linear interpolation to determine $f^{-1}(-0.4308)$ correct to 2 decimal places.
7. A particle of mass 4kg rests on a smooth plane inclined at 60^0 to the horizontal. The particle is attached to one end of a light inelastic string which passes over a fixed smooth pulley at the top of the plane and carries a mass of 2kg at the other end. Find the acceleration of the system. **(05 marks)**
8. The price relatives for five commodities A, B, C, D and E are shown in the table below with their respective weights.

Commodity	A	B	C	D	E
Price relative	145	125	130	**X**	120
weight	2	3	4	5	1

Find the value of x if the weighted price index is 127. **(05 marks)**

SECTION B (60 marks)

(Attempt five questions from this section)

9. (a) Of a large group of men, 5% are less than 60 inches in height and 40% are between 60 and 65 inches. Assuming a normal distribution, find the mean height and standard deviation **(08 marks)**

   (b) A sample of ***n*** independent observations is taken from a normal population with mean 74 and standard deviation 6. The sample mean is denoted by$\bar{\boldsymbol{X}}$. Find ***n*** if $P(\bar{\boldsymbol{X}} > 75) = \mathbf{0.282}$ **(04 marks)**

10. The table shows time in seconds taken by telephonists to answer the calls received during one day.

Time(seconds)	**Number of calls**
10-19	20
20-24	20
25-29	10
30	14
31-34	16
35-39	10
40-59	10

(a) Calculate the modal time taken to answer the calls **(05 marks)**

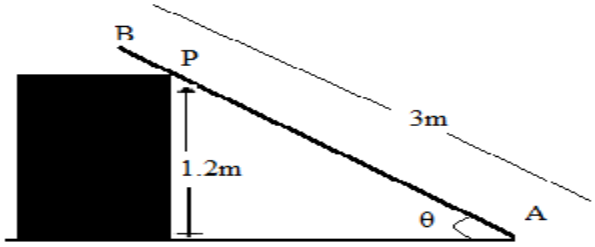
(b) Draw a cumulative frequency curve for the data and use it to estimate the limits with which the time of the middle 70% of the calls lies **(07 marks)**

11. (a) Use trapezoidal rule with five ordinates to evaluate $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}}\ dx$ to 3 decimal places. **(06 marks)**

(b) Find the exact value of $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}}\ dx$ to 3 decimal places **(03 marks)**

(c) Find the absolute error in the function and state how this error can be reduced. **(03 marks)**

12. The figure below shows a uniform rod AB of weight 120N and length 3m rests in limiting equilibrium against a rough box where the contact P between the rod and the box located 1.2m above the level horizontal ground. The end A of the rod rests on smooth ground inclined at θ° to the ground. The coefficient of friction between the rod and the box is 0.75. The points A, P and B lie in the vertical plane which is perpendicular to the ground.



(a) Show clearly that $tan\theta = \frac{3}{4}$ **(02 marks)**

(b) Calculate the magnitude of the reaction between the rod and the ground and the magnitude of the reaction between the rod and the box. **(10 marks)**

13. On a journey from Kasawo to Kampala, a lorry with a heavy load accelerated uniformly during the first 4minutes until it reached a speed of 12kmh^{-1}. Because of traffic conditions, it had to maintain this speed for next 20 minutes until it reached a motorway where it accelerated uniformly reaching a maximum speed of after a further 7.5 minutes. The lorry maintained this speed until it applied its brakes 2km before the end of the motor way to give a uniform retardation. It came to rest at the end of the motor way having travelled 49km on the motor way.

(a) Draw a velocity time graph for the journey. **(02 marks)**

(b) Calculate using the graph or equations of motion the

(i) the rates of acceleration and retardation **(04 marks)**

(ii) The total distance travelled and the average speed **(06 marks)**

14. (a) Locate each of the roots of the equation $\boldsymbol{x^3 + 4 = 4x^2}$ in the interval $\boldsymbol{|x| \leq 4}$. Hence use linear interpolation to estimate the largest root to one decimal place

(b) Show that the Newton Raphson formula for calculating the reciprocal of a number α is $x_{n+1} = x_n(2 - x_n\ \alpha)$ for n = 0, 1, 2... Hence taking $x_o = 1$, find the second approximation of the reciprocal of **1.3** **(05 marks)**

15. (a) Catherine is allowed three attempts at a high jump. If she succeeds on any attempt, she does not jump again. The probability that she succeeds on the first attempt is $\frac{3}{4}$. If she fails on her first attempt, the probability that she succeeds on her second attempt is $\frac{3}{8}$. If she fails on her first two attempts, the probability that she succeeds on her third attempt is$\frac{3}{16}$. Find the probability that she succeeds. **(06 marks)**

(b) Khaled is allowed two attempts to pass an examination. If he succeeds on his first attempt, he doesnot make a second attempt. The probability that he passes at the first attempt is 0.4 and the probability that he passes on either first or second attempt is 0.58. find the probability that he passes on the second attempt, given he failed on the first attempt. **(06 marks)**

16. A mass of 12kg rests on a smooth inclined plane which is 6m long and 1m high. The mass is connected by a light inextensible string, which passes over a smooth pulley fixed at the top of the plane, to a mass of mass 4kg which is hanging freely. With the string taut, the system is released from rest.

    (a) Find the

        (i) Acceleration of the system **(05 marks)**

        (ii) Tension of the string **(02 marks)**

    (b) Determine the

        (i) Velocity with which the 4kg mass hits the ground **(03 marks)**

        (ii) Time the 4kg mass takes to hit the ground **(02 marks)**

END

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