P425/2
Mathematics
Paper 2
July/August 2019
3hours

BUGANDA EXAMINATIONS COUNCIL MOCKS

Uganda Advanced Certificate of Education

MATHEMATICS

PAPER 2

3HOURS

INSTRUCTIONS

- *Answer all the eight questions in section **A** and only 5 questions from section **B***
- *Any additional question(s) answered will not be marked.*
- *All working must be shown clearly*
- *Begin each answer on a fresh sheet of paper.*
- *Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A (40 marks)

1. A force of 2P Newtons is acting parallel to the line of greatest slope on a particle of weight **W** placed on a rough plane inclined at an angle $\propto$ to the horizontal.
If μ is the coefficient of friction and that the force 2P just enough to make the mass reach at a point of sliding up the plane, show that $\mu = {}^{1}/_{3} \tan \propto$. ***(5 marks)***

2. Two events A and B are such that P(A) = 0.2, P(A'nB) = 0.22 and P(AnB) = 0.18.
Determine: i) P(B)
ii) P(A/B) ***(5marks)***

3. A car travels along a level road at a constant resistance to motion of 500N. The mass of the car is 1500kg and its maximum speed is $40ms^{-1}$.
i) Determinethe rate at which the engine is working.
ii) If the car maintains the rate of working and the resistance to motion is not changed, find its maximum speed when climbing on a slope inclined at an angle given by $\sin^{-1}\left(\frac{1}{49}\right)$. ***(5 marks)***

4. There are eight contestants in a singing (on spot) competition. The two judges X and Y assign the ranks as shown.

contestants								
Judge	A	B	C	D	E	F	G	H
X	3	4	8	1	7	5	2	6
Y	2	1	8	3	7	5	4	6

Compute spearman's rank correlation coefficient for the above results hence comment on the outcome. ***(5 marks)***

5. Find the approximate value of $\int_0^2 \frac{1}{1+x^2} dx$ using trapezium rule of 6 ordinates. Give your solution to three decimal places. ***(5 marks)***

6. A discrete random variable X has probability function
$P(X= x) = \frac{x}{k}$, 1, 2, …n
where K is the constant and expectation of x = 3.

Find: (i) the values of k and n
(ii) p(x=2/ x ≤ 2)

7. Show that $f(x) = e^x - 2x - 1$ has its real root between x = 1 and x = 1.5, hence use linear interpolation to show that the root approximates to 1.18. ***(5 marks)***

8. To a cyclist riding due north at 40km/hr. A steady wind appears to blow eastwards. On reducing his speed to 30km/hr. but moving in the same direction, the wind appears to come from S.W. Determine the true velocity of the wind. ***(5 marks)***

SECTION B (60 marks)

9(a) Two events A and B are such that $P(A/B) = \frac{5}{11}, P(A \cup B) = \frac{9}{10}$ and $P(B) = x$

i) Show that $P(A) = \frac{9}{10} - \frac{6x}{11}$.

ii) If $P(A \cap B) = 2P(A \cap B')$, show that $x = \frac{11}{15}$. ***(6 marks)***

(b) According to a firm's internal survey, of those employees living more than 2km from work place, 90% travel to work by car. Of the remaining employees, only 50% travel to work by car. It is known that 75% of employees live more than 2 km from work.
Determine;

(i) Overall proportion of employees, who travel to work by car,
(ii) Probability that an employee who travels to work by car lives more than 2km from work. ***(6 marks)***

10(a) Show that the Newton Raphson formula for finding the fifth root x of a number N from $x = N^{1/5}$ is given by

$$X_{n+1} = \frac{4X_n^5 + N}{5X_n^4}, for\ n = 0,1,2 \ldots\ldots$$ ***(4 marks)***

(b) Make a flowchart that;
i) Reads N and first approximation X_o
ii) Computes the root to three decimal places
iii) That prints the root (X_n) and number of iterations n. ***(5 marks)***

(c) Perform a dry run taking N = 50, $x_o = 2.2$ for your chart.

Give your answer to 3 decimal places. ***(3 marks)***

11(a) A policeman on training has a probability of hitting a target of 0.2.
i) Find the probability that he will hit the target at least once in 8 trials.
ii) Determine the minimum number of shots he must make in order to be 95% confident that at least one shot has hit the target.
iii) After some practice his probability of hitting the target increases to 0.64. Find the 95% confidence limits for the number of times he hits the target in 100 trials. ***(12 marks)***

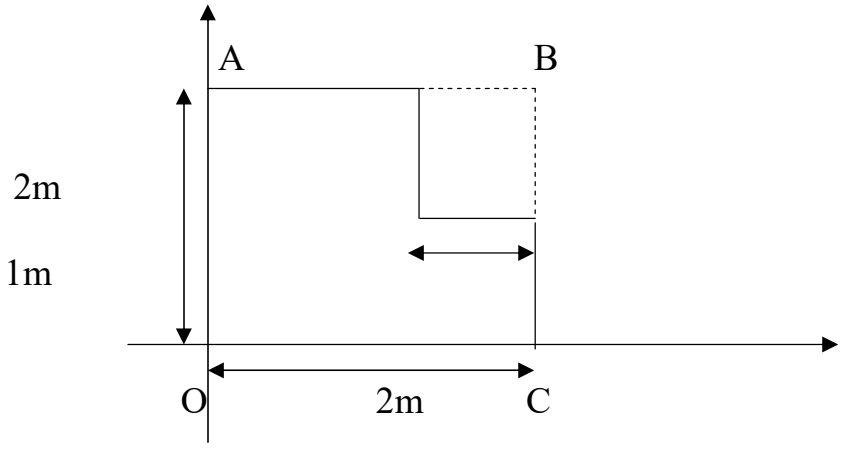
12(a) ABCD is a rectangle. Forces of 3N, 4N and 1N act along AB, BC and DC respectively in directions indicated by the order of letters. Find the magnitude and direction the resultant makes with side AB. ***(6 marks)***

(b) A uniform bar AB of weight 2W and length L is free to turn about its upper end A, and a horizontal force is applied to the end B so that the bar is in equilibrium with B at a distance x from the vertical through A. show that the magnitude of the reaction at the hinge is given by;

$$R = W\left[\frac{4L^2-3x}{L^2-x^2}\right]^{1/2}$$ ***(6 marks)***

13(a) Particles of masses 5kg, 2kg, 3kg and 2kg are placed at points with position vectors3i – j, 2i + 3j, -2i + 5j and –i – 2j respectively.
Determine the position vectors of their centre of mass. ***(4 marks)***

(b) A thin uniform plate originally of mass 12kg has a square part cut off as shown in the figure; referred to axes as shown.



i) Find the centre of mass of the remaining part.
ii) Determine the angle AC will make with the vertical if the plate is freely suspended from A. ***(8 marks)***

14. A random variable **X** takes values in the interval O < x < 3 and has a probability density function defined as

$$f(x) = \begin{cases} ax & 0 \le x \le 1 \\ \frac{a}{2}(3-x), & 1 \le x < 3 \\ 0 & elsewhere \end{cases}$$

Determine: (i) Constant a
(ii) P(0.5 < x < 2)
(iii) Expected value of x
(iv) Cumulative density function F(x) ***(12 marks)***

15(a) The table below shows marks scored in mathematical test by some students in central school.

Marks	Number of students
31 - 40	12
41 – 50	18
51 – 60	14
61 – 70	8
71 – 80	6
81 - 90	2

(b) Draw a histogram for the scores and hence use it to estimate the modal mark.
(c) Calculate the mean, median and standard deviation for score. ***(12 marks)***

16. The weights of 10,000 cattle on a commercial farm are normally distributed with mean of 115kg and standard deviation of 3kg
(i) A cow is selected at a random from the farm, find the probability that its weight could be between 115kg and 118kg. ***(4 marks)***

(ii) Find how many cattle would weigh between 109kg and 121kg. ***(4 marks)***

(iii) A farmer found out that 10% of the cattle with over weight (fatty) were rejected. Determine to the nearest kg, the weight at which they were rejected. ***(4 marks)***

END