P425/2
Applied Mathematics
Paper 2
July - August, 2022
3 hours

UGANDA MUSLIM TEACHERS' ASSOCIATION
UMTA JOINT MOCK EXAMINATIONS 2022
UGANDA ADVANCED CERTIFICATE OF EDUCATION
Applied Mathematics
Paper 2
3 hours

INSTRUCTIONS:

- *Answer **all** the eight questions in section A and any five from section **B**.*
- *Any additional question(s) answered will **not** be marked.*
- ***All** necessary working **must** be shown clearly.*
- *Begin each number on a fresh sheet of paper.*
- *Graph paper is provided.*
- *Silent, non-programmable scientific calculators and mathematical table with a list of formulae may be used.*
- *In numerical work, take acceleration due to gravity g, to be $9.8ms^{-2}$*

Include the allocation table on your answer sheet

Question	Marks
Section A	
9	
10	
11	
12	
13	
14	
15	
16	
Total	

SECTION A: (40 marks)

Answer all questions in this section

1. The forces $\begin{pmatrix}-2\\-3\end{pmatrix}, \begin{pmatrix}7\\p\end{pmatrix}, \begin{pmatrix}-1\\-1\end{pmatrix}$N act at points (2,0) , (0,-3) and (1, 1) respectively. The resultant is $\begin{pmatrix}4\\9\end{pmatrix}$N acting at $(3, q)$. Find the values of p and q. *(05 marks)*

2. Given that $P(A)=\frac{2}{5}$, $P\left(\frac{\bar{B}}{A}\right)=\frac{3}{5}$ and $P\left(\frac{B}{\bar{A}}\right)=\frac{1}{3}$, find $P(\bar{B})$ *(05 marks)*

3. The numbers $A = 2.719$ and $B = -3.80$ have been rounded off to the given decimal places. Find the limits within which the exact value of $\frac{A}{B}$ lies correct to 4 decimal places. *(05 marks)*

4. A block of weight 20N rests on a rough plane of inclination 30^0, the coefficient of friction being 0.25. Find the horizontal force that will be required just to prevent it from slipping down. *(05 marks)*

5. Two judges rank eight competitors as follows;

Position	1st	2nd	3rd	4th	5th	6th	7th	8th
Judge (J_1)	E	A	C	G	B	D	H	F
Judge(J_2)	E	C	A	B	F	H	G	D

Calculate the coefficient of rank correlation. Comment on your result at 5% level of significance. *(05 marks)*

6. 10% of the chocolates produced in a factory are mis-shapes . A random sample of 1000 chocolates is taken. Find the probability that 120 or more are mis-shapes. *(05 marks)*

7. The table below gives values of x and their corresponding natural logarithms.

x	30.18	30.20	30.22	30.24
lnx	3.4072	3.4078	3.4085	3.4092

Use linear interpolation/extrapolation to estimate the value of;

(a) $ln30.27$ *(03 marks)*

(b) x when $lnx = 3.4075$ *(02 marks)*

8. A uniformly accelerating particle with initial velocity of $10ms^{-1}$ covered 20m during its *third* second of motion.

Find the;

(a) Acceleration of the particle. *(03 marks)*

(b) Distance covered by the particle in the first 3 seconds of its motion. *(02 marks)*

SECTION B (60 marks)

*Answer any **five** questions in this section. All questions carry equal marks.*

9. The table shows time in seconds taken by the telephonists to answer the call 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 lie. *(07 marks)*

10. Two aircrafts A and B are flying at the same height in direction 030^0 and 350^0 respectively. At the instant when B is $10km$ due east of A it is realized that they are on a collision course. The speed of A is $500kmh^{-1}$.

(a) Find the speed of B. *(03 marks)*

(b) If at this instant, A changes course to 045^0 without altering speed, find the shortest distance between A and B and the time taken for this to occur.

(09 marks)

11. (a) Use trapezium rule with 7 ordinates to estimate $\int_0^{\pi}\left(\sqrt{x}+\cos\frac{x}{3}\right)dx$ correct to 4 decimal places. *(06 marks)*

(b) Calculate the exact value of $\int_0^{\pi}\left(\sqrt{x}+\cos\frac{x}{3}\right)dx$ correct to 4 decimal places.

(03 marks)

(c) Determine the error in your estimation in (a) above and state how it can be reduced. *(03 marks)*

12. A box contains 1 red bead and 1 white bead. When a bead is drawn from the box, it is returned together with a bead of the other colour. If three such random draws are made,

(a) Find the probability that the second and third beads drawn are of the same colour. *(06 marks)*

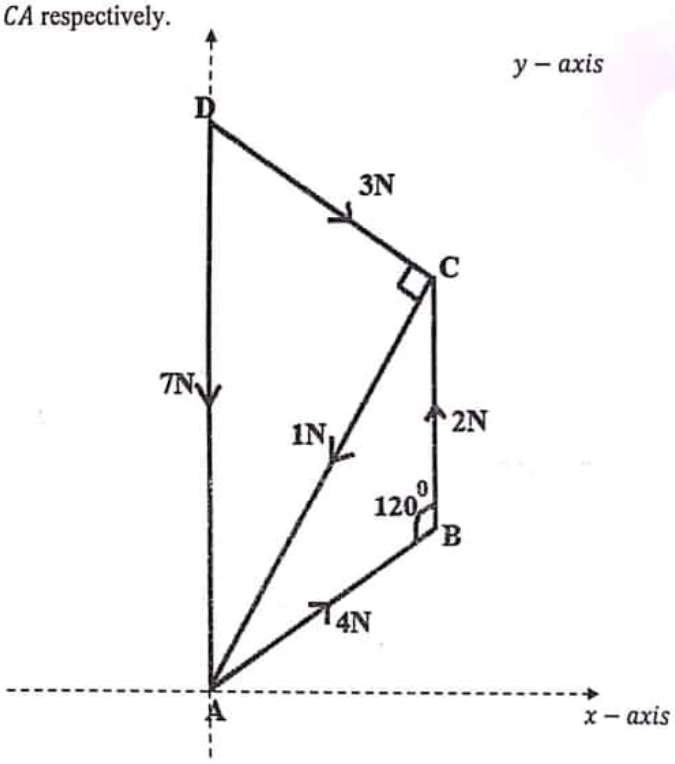
(b) (i) Construct a probability distribution for the number of red beads in the box after the experiment.

(ii) Find the expected number of red sweets in the box after the draws.

(06 marks)

13. The diagram below shows a trapezoid $ABCD$, $\overline{AB}=\overline{BC}=\overline{CD}=a$ units and $\overline{AD}$

13. The diagram below shows a trapezoid $ABCD$. $\overline{AB} = \overline{BC} = \overline{CD} = a$ *units* and $\overline{AD} = 2a$ units. The vertical through AD is y-axis and horizontal through A the $x-axis$. Forces of magnitude 4N, 2N , 3N, 7N and 1N act in directions AB, BC, DC, DA and CA respectively.



(a) Find the magnitude and direction of the resultant force . **(09 marks)**

(b) Determine where the line of action of the resultant force cuts line AD.

(03 marks)

14. By drawing graphs of $y = Inx$ and $y = 2 - x$ on the same axes. Show that the equation $Inx = 2 - x$ has a root between 1 and 2 . Hence use Newton Raphson method to find the root correct to 3 decimal places. ***(12 marks)***

14. By drawing graphs of $y = lnx$ and $y = 2 - x$ on the same axes. Show that the equation $lnx = 2 - x$ has a root between 1 and 2 . Hence use Newton Raphson method to find the root correct to 3 decimal places. *(12 marks)*

15. The random variable X has the probability density function.

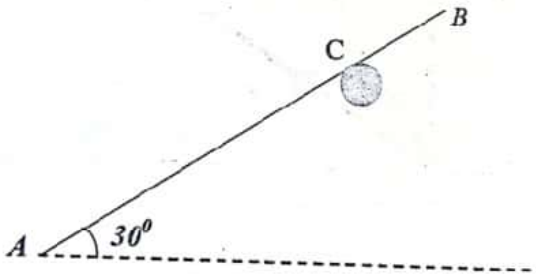
$$f(x) = \begin{cases} \frac{1}{5}(x+1) & ;1 \le x \le 2 \\ \frac{1}{5}(5-x) & ;2 \le x \le 3 \\ 0 & ;otherwise \end{cases}$$

(a) (i) Find the cumulative distribution function, $F(x)$

(ii) Sketch $F(x)$ *(09 marks)*

(b) Calculate $P(X < 2/\ X > 1.5)$ *(03 marks)*

16. A uniform rod AB of weight 12N is smoothly hinged at A and rests in equilibriun against a rough horizontal peg coefficient of friction 0.35 at C where $4AC = 3AE$ The rod makes an angle of 30^0 with the horizontal.



Find the reactions at A and C *(12 marks*

END