P425/2
APPLIED
MATHEMATICS
Paper 2
July / Aug. 2023
3 hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

Answer **all** *questions in* **section A** *and any* **five** *from* **section B.**

All necessary working must be shown clearly.

Silent non – programmable scientific calculators and mathematical tables may be used.

Any extra question(s) attempted in section **B** *will* **not** *be marked.*

SECTION A (40 MARKS)

1. Given that A and B are independent events such that $P(A) = \frac{5}{8}$ and $P(A' \cup B) = \frac{1}{2}$. find,

a) $P(A \cup B')$

b) $P(A' \cup B')$

(05 marks)

2.

x	0.8	1.2	1.6
$\ln x$	-0.24	0.18	0.48

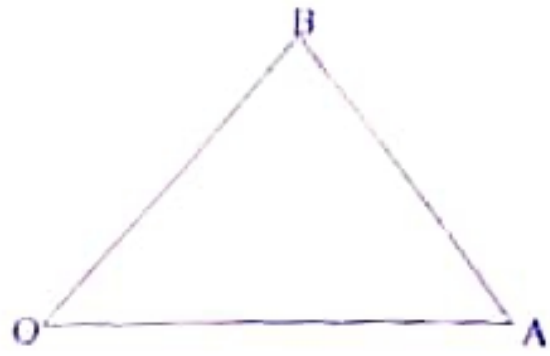
Use linear estimation to find;

(i) $\ln(0.5)$

(ii) x *when* $\ln x = -0.12$

(05 marks)

3



OAB is a uniform triangular lamina with vertices 0(0,0). $A(9,0)$ *and* $B(6,6)$

(a) Find the coordinates of the centre of gravity of the lamina. **(02 marks)**

(b) If the lamina is freely suspended at point 0(0,0). calculate the angle the side OA makes with the vertical. **(03 marks)**

4.

	Ranks						
Height	1	2	3	4	5	6	7
Mass	2	1	4	3	7	5	6

The heights and corresponding masses of 7 tourists were taken, and ranked as shown.

Calculate the spearman's rank correlation coefficient for this data. Comment on your result. **(05 marks)**

5. The velocity of a particle after t seconds is; $12t^2\mathbf{i} + (8t + 23)\mathbf{j}\ ms^{-1}$. Calculate the average speed of particle in the time interval $t = 1$ to $t = 3$ s. *(05 marks)*

6. Given that $x = 1.25$ (2dps); $y = 1.6400$ (3 dps), calculate the interval within which the exact value of xy lies. Deduce the maximum error in xy. *(05 marks)*

7. In any trial, the probability that a head occurs when a coin is tossed is three times the probability that a tail occurs. The coin is tossed 15 times, calculate the probability that a head will occur at least 7 times. *(05 marks)*

8. A particle projected with a speed of $12ms^{-1}$ to move in a straight line on a rough horizontal surface comes to rest in 5 seconds. Calculate the distance it covers in its last second of motion. *(05 marks)*

SECTION B (60 MARKS)

9. Study the frequency table below;

Marks	0 – 10	10 -	15 -	25 -	40 -	50 - 60
No. of candidates	8	10	25	15	4	2

(a) Calculate the;
(i) mean mark
(ii) modal mark *(07 marks)*

(b) Plot a cumulative frequency curve and use it to estimate the 10^{th} to 80^{th} percentile deviation. *(05 marks)*

10. (a) Use the trapezium rule with 7 ordinates to evaluate,

$$\int_0^{\pi/2} (2x + \cos x)dx$$

(06 marks)

(b) Calculate the percentage error made in the evaluation in (a) above. Suggest how this error can be minimized. *(06 marks)*

11 A particle executes simple harmonic motion. If it has speeds of $8ms^{-1}$ and $6ms^{-1}$ at points at respective distances of 3m and 4m from the centre of motion; calculate the

(a) amplitude and period of motion *(08 marks)*

(b) time the particle takes to move directly from A to B. *(04 marks)*

12 X is a continuous random variable whose distribution function is given by;

$$F(x) = \begin{cases} a(x^2 - 1) & : \quad 1 \le x \le 2 \\ a + bx & : \quad 2 \le x \le 3 \\ 1 & : \quad x \ge 3 \end{cases}$$

(a) Find the constants a and b, hence sketch the graph of $F(x)$. *(04 marks)*

(b) Compute, $P(X < 2.5 \ / \ X > 1.5)$ *(04 marks)*

(c) Calculate, $E(X)$ the mean of X *(04 marks)*

13. A uniform ladder AB of mass 10kg stands on a rough horizontal surface at A, and leans against a rough vertical wall at B, the coefficients of friction at A and B being $\frac{1}{2}$ and $\frac{1}{3}$ respectively. The angle of inclination of the ladder to ground is $\tan^{-1}\frac{3}{4}$. A boy of mass 40kg starts to climb the ladder.

Calculate the,

a) distance he climbs before the ladder starts to slide. *(06 marks)*

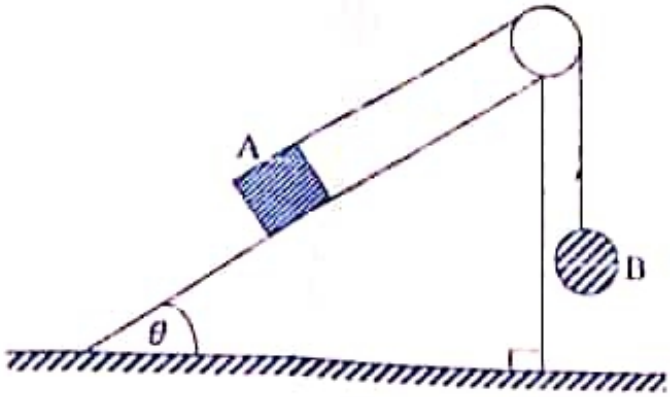
b) minimum horizontal force that should be applied at A so that the boy just reaches the top of the ladder *(06 marks)*

14. The weights of goats sold at a certain market are normally distributed with a mean of 16kg. given that 8 of every 12 goats picked at random weighed more than 20kg.

(a) Calculate the standard deviation of the masses of the goats, correct to the nearest whole number. *(06 marks)*

(b) A random sample of 25 goats is picked, calculate the probability that their mean weight exceeds 15kg. *(06 marks)*

5.



(a) A particle B of mass m kg keeps particle A of mass 10kg at rest on a rough inclined plane of angle $\theta = tan^{-1}\frac{4}{3}$. If the coefficient of friction between A and the inclined plane is 0.5, calculate the minimum and maximum values of **m**.

(b) If the mass of A is doubled, calculate the magnitude of the accelerations of the particles. ***(04 marks)***

16. (a) Show that the equation $xsinx = 1$ has a root lying between 1 and 1.5. ***(03 marks)***

(b) Use linear interpolation once to find the first approximation, x_o of the equation. Hence use the Newton – Raphson Method to compute the root correct to 4dps. ***(09 marks)***

END