

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:

$$P(A) = \frac{5}{8} \quad \text{and} \quad P(A^1UB) = \frac{1}{2}; \text{ find;}$$

a) $P(AUB^1)$

b) $P(A^1UB^1)$

(05 marks)

- 2.

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

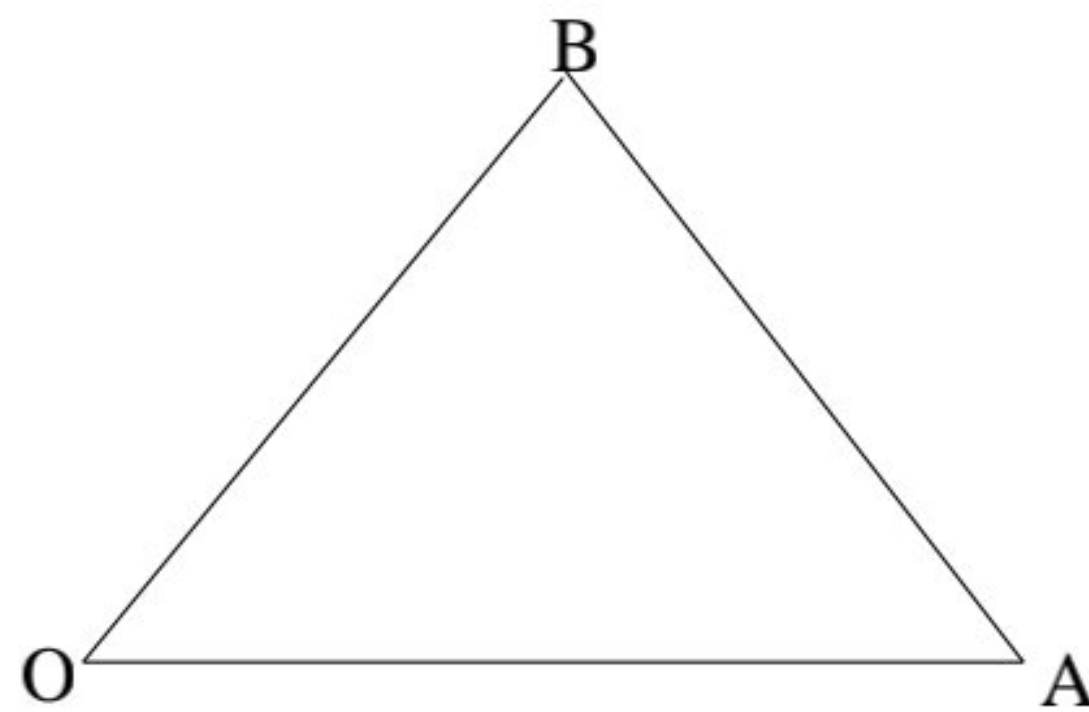
Use linear estimation to find;

(i) $\ln(0.5)$

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

(05 marks)

- 3.



OAB is a uniform triangular lamina with vertices $O(0,0)$, $A(9,0)$ 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 $O(0,0)$, 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;

$12t^2\mathbf{i} + (8t + 23)\mathbf{j} \text{ ms}^{-1}$. 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); $y = 1.600$ (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^{-2} 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 10th to 80th 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;

$$F(x) = \begin{cases} a(x^2 - 1) & ; \quad 1 \leq x \leq 2 \\ a + bx & ; \quad 2 \leq x \leq 3 \\ 1 & ; \quad x \geq 3 \end{cases}$$

- (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.

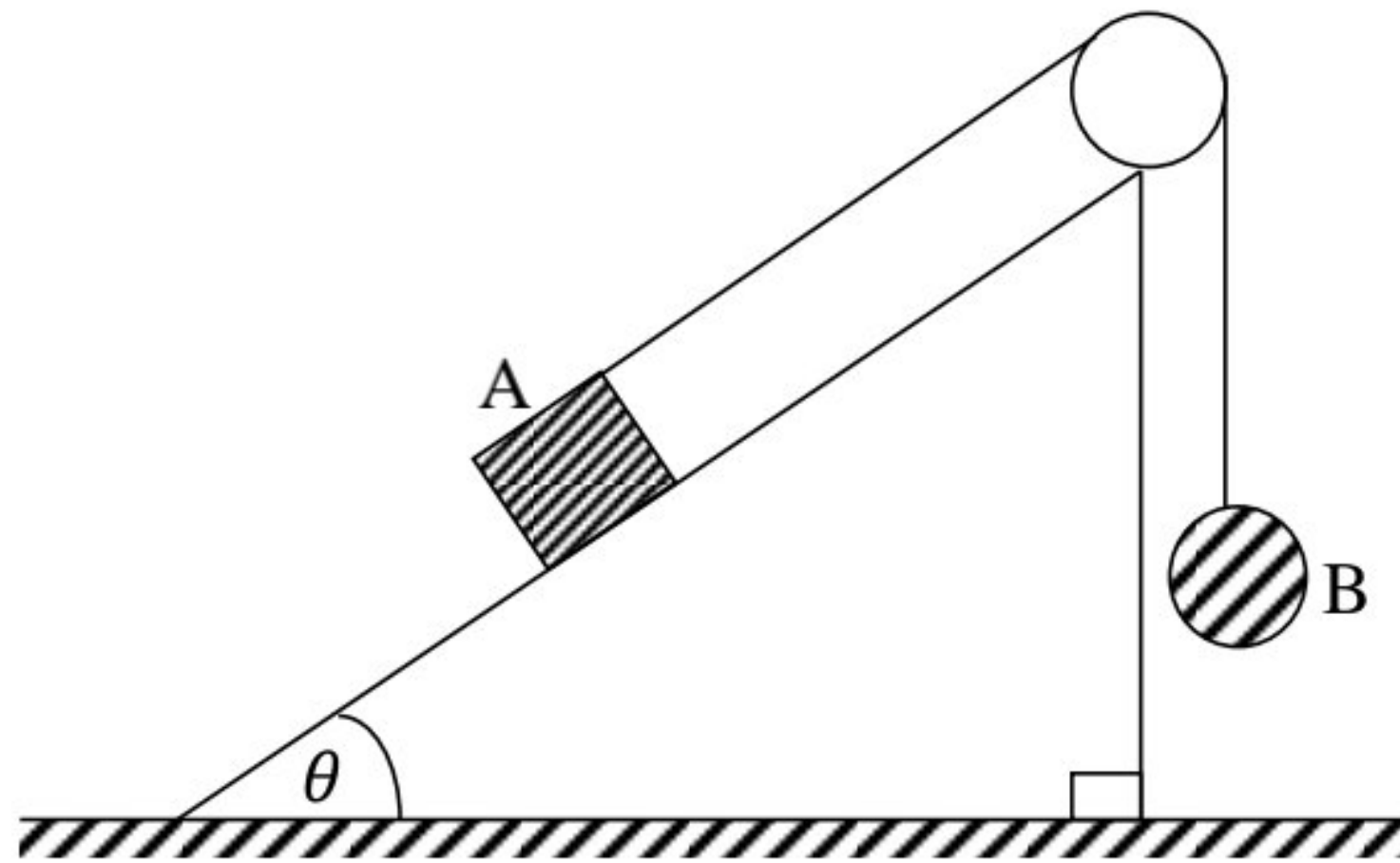
Calculate the;

- 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)

15.



- (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 $x \sin x = 1$ has a root lying between 1 and 1.5. (03 marks)
- (b) Use linear interpolation once to find the first approximation, x_0 of the equation. Hence use the Newton – Raphson Method to compute the root correct to 4dps. (09 marks)

END