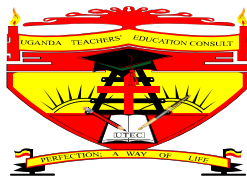


P425/2  
**APPLIED  
MATHEMATICS**  
Paper 2  
**July /Aug. 2023**  
3 hours



**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

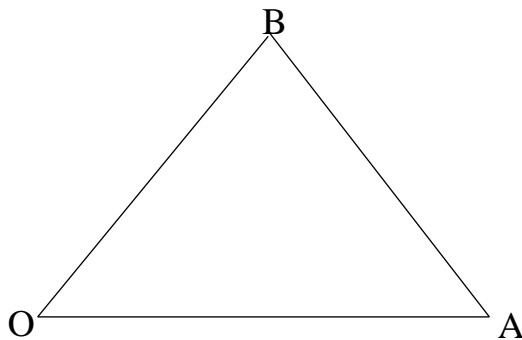
Use linear estimation to find;

(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  $12\text{ms}^{-2}$  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 10<sup>th</sup> to 80<sup>th</sup> 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  $8\text{ms}^{-1}$  and  $6\text{ms}^{-1}$  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.

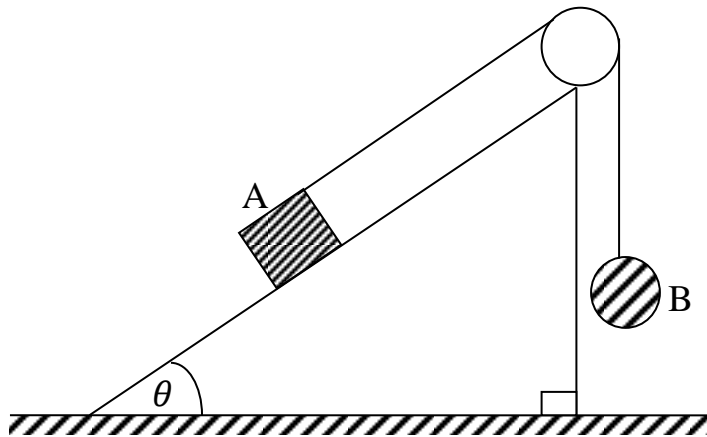
Calculate the;

- 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**