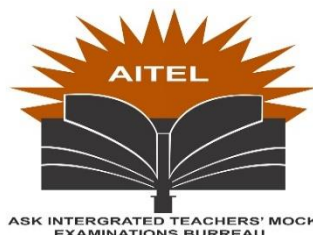


P425/2
APPLIED
MATHEMATICS

Paper 2
July/Aug. 2022
3 hours



AITEL JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 Hours

INSTRUCTIONS TO CANDIDATES:

*Answer **all** the **eight** questions in the section **A** and*

*Answer any **five** questions in section **B***

In numerical work, take $g = 9.8 \text{ms}^{-2}$

SECTION A (40 MARKS)

1. Forces 7N and 9N act on a particle at an angle of 60° between them.
Find the magnitude and the direction of the resultant. (5 marks)
2. Show that the equation $3x^2 + x - 5 = 0$ has a real root between $x = 1$ and $x = 2$ hence determine the root to two decimal places using linear interpolation. (5 marks)
3. A game consists of throwing tennis balls into a bucket from a given distance, the probability that Joan will get the tennis ball in the bucket is 0.4. A turn consists of three attempts, construct a probability distribution for X, the number of tennis balls that lands into the bucket. (5 marks)
4. An object is projected from the ground making an angle $\tan^{-1}\left(\frac{3}{4}\right)$ with the horizontal. The particle passes through a point 20m horizontally and 10m vertically from the point of projection. Find the speed of projection. (5 marks)
5. A bullet of mass 20g is fired into a block of wood of mass 40g lying on smooth horizontal surface. If the bullet and the wood move together with speed 20ms^{-1} . Calculate the loss in kinetic energy. (5 marks)
6. Obtain the interval of values within which the exact value of the expression $\frac{15.36 + 27.1 - 1.672}{2.36 \times 1.043}$ lies to 3.d.ps. (5 marks)
7. Event A and B are such that $P(A) = \frac{4}{7}$, $P(A \cap B^c) = \frac{1}{3}$ and $P(A|B) = \frac{5}{14}$.
Find;
(i) $P(A \cup B)$
(ii) $P(A^c \cap B^c)$ (5 marks)

8. The following shows the marks obtained by eight students in Mathematics and physics examinations.

Maths	55	65	70	75	75	80	85	85
Physics	50	55	58	55	65	58	61	65

Calculate the rank correlation coefficient and comment on the significance of your result at 5% level of significance. (5 marks)

SECTION B (60 MARKS)

9. A body of mass M kg lies on a rough plane inclined at θ° to the horizontal when a force of $\frac{Mg}{2}$ newtons parallel to and up the plane is applied to the body, it is just about to move up the plane. When a force of $\frac{Mg}{4}$ newtons parallel to and down the plane is applied to the body, it is just about to move down the plane. Calculate to two decimal places the value of;
- (i) θ (8 marks)
- (ii) The coefficient of friction between the body and the plane. (4 marks)
10. The age of farmers in Nkoowe town Wakiso district are as shown in the table below.

Age (years)	Number of farmers
25 - < 29	6
29 - < 35	12
35 - < 40	27
40 - < 50	30
50 - < 55	18
55 - < 60	14
60 - < 70	9
70 - < 75	4
75 - < 80	5

- (a) Determine the variance and the modal age. (6 marks)

- (b) Construct a cumulative frequency curve and use to estimate the probability that a farmer randomly selected from Nkoowe town has age above 47 years. (6 marks)

11. In a box containing different balls, the probability that the ball is red is 0.3. If a sample of 400 balls is selected from the box. Find the probability that;

- (i) Less than 120 balls are red
- (ii) Between 120 and 150 inclusive are red
- (iii) More than 160 balls are red

12. (a) Use graphical method to locate the positive root of the equation $\sin x - \ln x = 0$ to 1 decimal place. (6 marks)

(b) Use the Newton- Raphson method to find the root of the equation to 3 decimal places.

13. (a) Use trapezium rule with 6 ordinates to estimate the value of $\int_1^3 x^2 \ln x dx$ correct to 3 decimal places. (6 marks)

(b) Find the error made in the above estimate and suggest ways of reducing the error. (6 marks)

14. A continuous random variable has a p.d.f

$$f(x) = \begin{cases} cx, & 0 \leq x \leq 2 \\ c(4-x), & 2 \leq x \leq 4 \\ 0, & elsewhere \end{cases}$$

Determine,

- (i) The value of c . (4 marks)
- (ii) The mean of X (4 marks)
- (iii) Upper quartile Q_3 (4marks)

15. A particle moving with an acceleration $a = 4e^{-3t}\mathbf{i} + 12\sin t\mathbf{j} - 7\cos t\mathbf{k}$ is located at a point (5,-6,2) and has velocity $V = 11\mathbf{i} - 8\mathbf{j} + 3\mathbf{k}$ at $t = 0$. Find the

- (i) Magnitude of acceleration when $t = 0$

(ii) Velocity at any time, t

(iii) Displacement at any time, t

(12 marks)

16. A uniform ladder of length 12m and mass 10kg, one end A resting on a rough horizontal surface and end B resting on a rough vertical wall. Coefficient of friction between the ladder and the wall is $\frac{1}{4}$ and coefficient of friction between the ladder and the horizontal surface is $\frac{1}{2}$. Find how far a man who is ten times the mass of the ladder can climb up the ladder before it slips. The angle between the ladder and the horizontal is 60°

(12 marks)

END

