P425/2
APPLIED MATHEMATICS
Paper 2
July/August, 2023
3 hours

ACHOLI SECONDARY SCHOOLS EXAMINATIONS COMMITTEE

Uganda Advanced Certificate of Education

Joint Mock Examinations, 2024

Uganda Advanced Certificate of Education
APPLIED MATHEMATICS
Paper 2
3 HOURS

INSTRUCTIONS TO CANDIDATES:

✓ Answer all the **EIGHT** questions in section **A** and any **FIVE** questions from section B. Any additional question(s) will **NOT** be marked.

✓ All working **MUST** be shown clearly.

✓ Graph paper(s) may be used where there is/are need(s).

✓ Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

✓ In numerical work, take **g** to be 9.8ms⁻².

✓ State the degree of accuracy at the end of each answer using **CAL** for calculator and **TAB** for tables.

✓ Clearly indicate the questions you have attempted on the answer scripts as illustrated. **DO NOT** hand in the question paper.

Question	Mark
Section A	
Section B	
Total	

CamScanner

SECTION A: (40 MARKS)

Answer ALL the questions in this section

1. A projected particle achieves the greatest range of 12 m. Find the;
   (i) speed of projection, (03 marks)
   (ii) greatest height attained. (02 marks)

2. The table below shows the marks obtained by students in Chemistry and Physics in a certain school.

Chemistry	77	84	67	78	64	73	84	66	89
Physics	88	83	66	81	65	75	80	67	85

   Calculate the rank correlation coefficient and comment and comment on your results. (05 marks)

3. Two events M and N are such that $P(M \cap N) = 3x$, $P(M \cap N') = x$ and $P(M) = \frac{6}{7}$. Use a Venn diagram to find the values of;

   (i) x. (03 marks)
   (ii) $P(M \cap N)$. (02 marks)

4. A train of mass 1450Kg initially moving at 144Kmh^{-1} decelerated uniformly to rest when the brakes were applied. If the car came to rest after covering a distance of 40m, calculate the braking force. (05 marks)

5. A and B are two independent events with A twice as likely to (05 marks) occur as B. If $P(A) = 0.5$, find
   (i) $P(A \cup B)$
   (ii) $P\left(A \cap B/A\right)$

6. X is a random variable such that $X \sim B$ is (12, 0.4). (05 marks)
   Find the most likely value of X.

7. A car of mass 1500kg runs at a speed of 64.8 km h^{-1} and rams (05 marks) into a stationary truck of mass 1000kg. They become coupled together and move on with a common velocity V ms^{-1}. Calculate the gain in kinetic energy by the truck.

8. The table below shows the values of a function f(x). (05 marks)

x	3.0	3.2	3.3	3.4	3.5
f(x)	0.0986	0.1632	−0.1061	−0.1762	−0.2472

   Use linear interpolation or extrapolation to find:
   (i) f(x) when x = 3.25

(ii) x when f(x) = – 0.3621

SECTION B: (60 MARKS)
Answer any FIVE questions from this section

Question 9:

The table below shows the time intervals between successive arrivals of telephone calls at the president's office.

Time (minutes)	Number of Calls
$0 < X \leq 0.5$	23
$0.5 < X \leq 1.0$	39
$1.0 < X \leq 2.0$	23
$2.0 < X \leq 3.0$	9
$3.0 < X \leq 6.0$	6

(a)   Calculate the;   (i) mean,   (04 marks)

(ii) standard deviation, of the time intervals. (04 marks)

(b)   Draw a histogram to illustrate the above information and use it to estimate the modal time interval.   (04 marks)

Question 10:

(a)   Use trapezium rule with five strips to estimate $\int_{0}^{4} 3^{2x} \, dx$, correct to two decimal places.   (06 marks)

(b)   Find the exact value of $\int_{0}^{4} 3^{2x} \, dx$, correct to two decimal places. (04 marks)

(c)   Calculate the relative error made in (a) above and state how you can reduce on such error.   (02 marks)

Question 11:

An experiment consists of removing 2 sweets, one at a time without replacement from the box containing 3 red and 4 blue sweets.

(a)   If A is the event that both sweets picked are of the same colour, find the probability that event A has occurred.   (04 marks)

(b)   If the experiment is repeated 70 times, find the probability that event A occurred;   (i) between 20 and 35 times,   (04 marks)

(ii) at least 25 times.   (04 marks)

Question 12:

The random variable X has a probability function given by:

$$f(x) \begin{cases} kx(1-x^2) \; ; \; 0 \leq x \leq 1 \\ 0 \qquad\qquad ; \text{Elsewhere} \end{cases}$$

(a)   Find the cumulative probability function F(x) and hence, calculate the
       value of; (i) k,   (05 marks)
                 (ii) median of X   (03 marks)
(b)   Calculate the mean of X.   (04 marks)

Question 13:

Two ships are observed from a coast guard station at 10:00 hrs and 11:00 hrs
respectively. They have the following displacements (x) and velocity (V):

$$x_1 = \begin{pmatrix} 1 \\ 3 \end{pmatrix} Km, \quad V_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix} Km\ h^{-1} \text{ at 10:00 hrs}$$

$$x_2 = \begin{pmatrix} 1 \\ 2 \end{pmatrix} Km, \quad V_2 = \begin{pmatrix} 5 \\ 6 \end{pmatrix} Km\ h^{-1} \text{ at 11:00 hrs}$$

If they continue with the same velocities, determine the;
       (i) least distance between the two ships in the subsequent motion. (06 marks)
       (ii) time it takes place.   (06 marks)

Question 14:
(a)   Show that there is real root of the equation $x^3 + 2x = 1$ between $x = 0$ and
       $x = 1$.   (04 marks)
(b)   Use linear interpolation once to find the first estimation of the equation above,
       correct to one decimal place. Hence, by Newton – Raphson method, find the
       root of the equation, correct to two decimal places.   (08 marks)

Question 15:
(a)   The radii of a frustum of heights 30cm are 14cm and 20cm. Find the distance
       of centre of gravity of the frustum from the larger base. (06 marks)
(b)   If a conical hole of radius 2cm and height 24cm is centrally drilled from the
       smaller face of the frustum, find the distance of centre of gravity of the new
       body from the base.   (06 marks)

Question 16:
(a)   A car of mass 960Kg has a maximum speed of $50ms^{-1}$ on a horizontal road.
       If the power output of the engine is 40kW, calculate the frictional resistance
       to the motion of the car, assuming it's constant.   (04 marks)
(b)   The car now ascends a slope which is 1 in 6 with the same power output but
       the frictional resistance to its motion is 900N. Calculate the;
       (i) maximum speed of the car up the slope.   (04 marks)
       (ii) acceleration of the car when its speed is $10ms^{-1}$.   (04 marks)

THE END