P425/2

APPLIED MATHS

Paper 2

$2^{1}/_{4}$ Hours

END OF YEAR EXAMINATIONS 2023

Uganda Advanced Certificate of Education

S.5 APPLIED MATHEMATICS

Paper 2

2 Hour 15 Minutes

INSTRUCTIONS:

- *Answer **all** the questions in section **A** and any **four (04)** questions from section **B**.*
- *Any additional question(s) answered shall **not** be marked.*
- *All the necessary working **should** be clearly shown.*
- *Begin each answer in section **B** on a **fresh** sheet of paper.*
- *Silent, non – programmable scientific calculators and mathematical tables with a list of formulae may be used.*
- *Attach the question paper on your answer sheets.*

SECTION A						SECTION B						TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	

SECTION A (30 MARKS)

Answer **all** questions in this section.

1. Two events A and B are such that $P(A) = \frac{8}{15}$, $P(B) = \frac{1}{3}$ and $p(A/B) = \frac{1}{5}$. Calculate the probability that;
   (i) both events occur. (ii) neither of the events occurs.

(05 marks)

2. Forces of magnitude $6N$ and $\boldsymbol{P}N$ are inclined to each other at $50°$. If their resultant is $9.6N$, find the;
   (a) value of P. (ii) direction of the resultant force.

(05 marks)

3. The table below shows the probability distribution of a random variable X.

x	0	1	2	3	4	5
$P(X = x)$	0.11	0.17	0.20	0.13	p	0.09

   (a) Calculate the value of p. **(02 marks)**
   (b) Determine $E(x)$. **(03 marks)**

4. A commuter bus moving along a straight road charges *UG.X* 2500 for a person stopping at a point $16km$ away from the bus station and *UG.X* 4000 for a person stopping at a point $23\ km$ away from the bus station.
   (a) Lucky is going to a point $8km$ away from the bus station. How much should she pay?
   (b) How far from the bus station does the bus leave a person who pays UG.X 5000?

(05 marks)

5. The table below show the masses of bolts bought by a carpenter.

Mass(g)	98	99	100	101	102	103	104
Number of bolts	8	11	14	20	17	6	4

   Calculate the;
   (a) median mass of the bolts. **(03 marks)**
   (b) mean mass of the bolts. **(02 marks)**

6. A stone is thrown vertically upwards with a velocity of $16ms^{-1}$ from a point $\boldsymbol{H}m$ above a level ground. If the stone hits the ground $4s$ later, calculate the;
   (a) value of H.
   (b) velocity of the stone as it hits the ground.

(05 marks)

SECTION B (48 MARKS)

Attempt only **four (04)** questions from this section. All questions carry equal marks.

7. The table below gives the distribution of heights (in *cm*) of 400 children in a certain school.

Height(cm)	< 110	< 120	< 130	< 140	< 150	< 160	< 170
Frequency	27	58	130	105	50	25	5

(a) Draw a cumulative frequency curve for the above data and hence estimate the;
(i) median.
(ii) interquartile range.
(iii) 10^{th} to 90^{th} percentile range.

(b) Calculate the model height.

(12 marks)

8. (a) Particles of mass $\boldsymbol{m_1}$ and $\boldsymbol{m_2}$ are connected by a light inextensible string passing over a smooth fixed pulley. The particles hang vertically. If $\boldsymbol{m_2 > m_1}$, show that when the particles are released from rest the acceleration of the system is $\frac{2(m_2-m_1)g}{m_{1+}m_2}$ and that the tension in the string is $\frac{2m_1m_2g}{m_{1+}m_2}$.

(b) Two particles ***A*** and ***B*** are connected by a light inextensible string passing over a smooth fixed pulley. The masses of ***A*** and ***B*** are $\frac{11}{2}m$ and $\frac{9}{2}$ respectively. With ***A*** and ***B*** hanging freely, the system is released from rest with particle ***A*** at a distance d above the floor. The time ***t*** elapses before A hits the floor. Show that $20d = t^2g$.

(12 marks)

9. (a) Use trapezium rule with 4 sub-intervals to estimate $\int_0^{\frac{\pi}{2}} \cos x dx$ to three decimal places. **(05 marks)**

(b) Show that there exists a root for the equation $x^3 - 6x^2 + 9x + 2$ between $x = -1$ and $x = 0$ hence use interpolation twice to estimate the root to 2 decimal places.

(07 marks)

10. (a) The numbers x and y are approximated as X and Y with errors Δx and Δy respectively. Show that the maximum relative error in $\frac{y^2}{x}$ is given by $\left|\frac{\Delta x}{x}\right| + 2\left|\frac{\Delta y}{y}\right|$.

(05 marks)

(b) If $x = 4.95$ and $y = 2.013$ are each round to the given number of decimal places, calculate the;

(i) percentage error in $\frac{y^2}{x}$.

(ii) limits with in which the exact values of $\frac{y^2}{y-x}$ is expected to lies giving your answer to three decimal places.

(07 marks)

11. A fair coin is tossed 100 times. Determine the probability of obtaining;
    (i) at most 53 heads.
    (ii) at least 45 heads.
    (iii) between 46 and 54 heads.

(12 marks)

12. A lift travels vertically upwards from rest at floor ***A*** to rest at flow ***B***, $20m$ above floor ***A***, in three stages. At first, the lift accelerates from ***A*** at $2ms^{-2}$ for $2s$. It then travels at a constant speed before finally decelerating to rest at ***B*** after a total time of $6^1/_2 s$.
    (a) Sketch the velocity-time graph for this motion.
    (b) Find the magnitude of the constant deceleration.
    (c) The mass of the lift and its contents is $500kg$. Find the tension in the lift cable during the stage of motion when the lift is;
        (i) accelerating upwards.
        (ii) moving with constant speed.

(12 marks)

***** END *****