END OF YEAR EXAMINATIONS 2023

Uganda Advanced Certificate of Education

S.5 SUBSIDIARY MATHEMATICS

Paper 1

2 Hour 30 Minutes

INSTRUCTIONS:

- *Answer **all** the questions in section **A** and any **four (04)** questions from section **B**, picking at least one from each of the parts **I** and **II**.*

- *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. Solve the equation $\frac{3^4 \times 3^8}{9 \times 3^7} = 3^{2x}$. **(05 marks)**

2. Form a quadratic equation in terms of x whose roots are $\frac{3}{5}$ and -3. **(05 marks)**

3. Given that $X \sim N(72,225)$, find $P(45 \leq X \leq 90)$. **(05 marks)**

4. The vectors p, q and r are such that $p = 3i - 2j$, $q = 4i + 2j$ and $r = i + 2j$. Find the length of the vector $p - 4q + 3r$. **(05 marks)**

5. A and B are two independent events with A twice as likely to occur as B. If $P(A) = \frac{1}{2}$, find;
   (i) P(A or B but not both)
   (ii) $P(^A/_B)$
   (05 marks)

6. The table below gives the probability distribution of a random variable X.

x	1	2	3	4
$P(X = x)$	$^1/_{10}$	$^3/_{10}$	$^1/_5$	$^1/5$

Determine $E(X)$ and $Var(X)$. **(05 marks)**

SECTION B (60 MARKS)
Attempt only **four (04)** questions from this section, picking at least one from each of the parts **I** and **II**. All questions carry equal marks.
PART I (PURE MATHEMATICS)

7. (a) Give the matrices $A = \begin{pmatrix} 5 & 1 \\ 0 & 2 \end{pmatrix}$, $B = \begin{pmatrix} -2 & 3 \\ 1 & 0 \end{pmatrix}$ and $\begin{pmatrix} 2 & 1 & -1 \\ 1 & 5 & 2 \end{pmatrix}$, find;
   (i) ABC. **(05 marks)**
   (ii) $(A + B)C$. **(04 marks)**
   (b) Use the matrix method to solve the following system of simultaneous equations.
   $$3x + 4y = 8$$
   $$x + 2y = 3$$
   (06 marks)

8. (a) Given that α and β are the roots of the quadratic equation $x^2 - 3mx + n^2 = 0$, show that $\alpha + \beta = 3m$ and $\alpha\beta = n^2$. **(06 marks)**
   (b) If α and β are the roots of the equation $x^2 - 9x + 4 = 0$, find the values of $\alpha^2 + \beta^2$ and $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$ hence find the equation whose roots are $\frac{1}{\alpha^2}$ and $\frac{1}{\beta^2}$.
   (09 marks)

9. T is a tangent to the curve $y = x^2 + 6x - 4$ at (1,3) and N is the normal to the curve $y = x^2 - 6x + 8$ at (4,10). Find the;
   (i) equation of T.
   (ii) equation of N.
   (iii) coordinates of intersection of T and N.
   (15 marks)

PART II (STATISTICS AND PROBABILITY)

10. The cost of making a toasted bread is calculated from the cost of baking flour, sugar, milk, eggs and food colour. The table below gives the cost of each of these items in 2017 and 2018 together with their corresponding weights.

Item	2017	2018	Weight
Wheat	5100	5700	10
Sugar	4000	3600	5
Milk	1000	1400	4
Eggs	9000	8500	2
Food colour	1000	1300	1

(a) Using 2017 as the base year, calculate the;

    (i) price relatives for each of the items. **(04 marks)**

    (ii) Simple aggregate price index and comment on your answer. **(03 marks)**

    (iii) cost of living index and comment on your answer. **(05 marks)**

(b) If the cost of making bread was 2200 in 2018, what would be its cost in 2017?

(03 marks)

11. The table below shows the marks obtained by students in Fine art(x) and Mathematics(y).

Fine art(x)	80	76	96	41	68	31	42	88	68	91
Mathematics(y)	43	32	27	64	65	64	65	32	64	43

(a) Draw a scatter diagram for the above data and on it draw a line of best fit. Use your line of best fit to estimate the;

    (i) Fine art marks of a mark of a student who scored 61 in Mathematics.

    (ii) Mathematics marks of the student who scored 25 in Fine art.

(09 marks)

(b) Calculate the rank correlation coefficient between the students' performance in the two subjects and comment on your result at 1% level of significance. **(06 marks)**

12. (a) A certain aptitude test has 10 statements that require a candidate to respond by writing true or false. A candidate passes if he or she scores at least eight questions correct. Determine the probability that a candidate;

    (i) gets exactly 5 questions correct. **(04 marks)**

    (ii) passes the test. **(04 marks)**

(b) The pdf of a continuous random variable X is given by;

$$f(x) = \begin{cases} 3kx^2; & 1 \leq x \leq 3 \\ 0; & otherwise \end{cases}$$

Find:

    (i) the value of the constant k. **(03 marks)**

    (ii) $E(X)$. **(04 marks)**

*** END***