S475/1
SUBSID.MATHEMATICS
Paper 1
Nov. / Dec. 2015
2⅔ hours.

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **all** *the* **eight** *questions in section* **A** *and only* **four** *questions in section* **B**.

Any additional question(s) will **not** *be marked.*

Each question in section **A** *carries* **5** *marks while each question in section* **B** *carries* **15** *marks.*

All *working* **must** *be shown clearly.*

Begin each answer on a fresh sheet of paper.

Graph paper is provided.

Where necessary, take acceleration due to gravity $g = 9.8\ ms^{-2}$

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

SECTION A: (40 MARKS)

Answer **all** *the questions in this section.*

1. Evaluate $\dfrac{\log_6 216 + \log_2 64}{\log_3 243 - \log_{10} 0.1}$. *(05 marks)*

2. The table below shows the ranks of marks awarded by Judge 1 (R_X) and Judge 2 (R_Y) to 7 choir groups A to G.

Choir	A	B	C	D	E	F	G
Rank Judge 1 (R_X)	2	4	6	1	5	3	7
Rank Judge 2 (R_Y)	2	3	5	1	6	4	7

Calculate Spearman's rank correlation coefficient between the marks awarded by the two judges.
Comment on your result.
(05 marks)

3. Solve the equation $3\sin^2\theta + \cos\theta + 1 = 0$ for values of θ from 0^0 to 180^0 inclusive. *(05 marks)*

4. A committee of 5 people is to be formed from a group of 6 men and 7 women.
   (a) Find the number of possible committees. *(02 marks)*

   (b) What is the probability that there are only 2 women on the committee? *(03 marks)*

5. Find the gradient of the curve $y = 4x^2(3x + 2)$ at the point $(1, 20)$. *(05 marks)*

6. Three events A, B and C are such that $P(A) = 0.6$, $P(B) = 0.8$, $P(B/A) = 0.45$ and $P(B \cap C) = 0.28$. Find:
   (a) $P(A \cap B)$. *(03 marks)*
   (b) $P(C/B)$. *(02 marks)*

7. The matrix $A = \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix}$ and I is a 2 x 2 identity matrix. Determine the matrix B such that $A^2 + \frac{1}{2}B = I$. *(05 marks)*

8. A bullet of mass 50 g is fired towards a stationary wooden block and enters the block when travelling horizontally with a speed of 500 ms^{-1}. The wooden block provides a constant resistance of 36,000 N. Find how far into the block the bullet will penetrate. *(05 marks)*

SECTION B: (60 MARKS)

Answer only **four** *questions from this section.*

9. The table below shows the number of students and the marks scored in a test.

MARKS	NUMBER OF STUDENTS
0 – 4	10
5 –9	7
10 – 14	5
15 – 19	3
20 – 24	7
25 –29	11
30 – 34	37
35 – 39	20

(a) (i) Draw a cumulative frequency curve (Ogive) for the data.
(ii) Use the Ogive to estimate the median mark.

(*06 marks*)

(b) Calculate the:
(i) mean mark.
(ii) standard deviation.

(*09 marks*)

10. The rate of decay of a radioactive material is proportional to the amount x grammes of the material present at any time t. Initially there was 60 grammes of the material. After 8 years the material had reduced to 15 grammes.

(a) Form a differential equation for the rate of decay of the material.

(*03 marks*)

(b) Solve the differential equation formed in (a) above. (*10 marks*)

(c) Find the time taken for the material to reduce to 10 grammes.

(02 *marks*)

11. The table below shows the prices (in Ug Shs) of some food items in January, June and December together with the corresponding weights.

Item	Price (in Ug Shs)			Weight
	January	June	December	
Matooke (1 bunch)	15,000	13,000	18,000	4
Meat (1kg)	6,500	6,000	7,150	1
Posho (1kg)	2,000	1,800	1,600	3
Beans (1kg)	2,200	2,000	2,860	2

Taking January as the base month, calculate the:

(a) Simple aggregate price index for June.
Comment on your result. *(05marks)*

(b) Weighted aggregate price index for December.
Comment on your result. *(10 marks)*

12. The roots of the equation $2x^2 - 6x + 7 = 0$ are α and β. Determine the:

(a) values of $(\alpha - \beta)^2$ and $\frac{1}{\alpha^2\beta} + \frac{1}{\alpha\beta^2}$. *(12 marks)*

(b) quadratic equation with integral coefficient whose roots are $(\alpha - \beta)^2$ and $\frac{1}{\alpha^2\beta} + \frac{1}{\alpha\beta^2}$. *(03 marks)*

13. A continuous random variable X has a probability density function given by,

$$f(x) = \begin{cases} \frac{kx}{6}, & 1 \leq x \leq 2, \\ 0, & \text{Otherwise}, \end{cases}$$

where k is a constant.

(a) Find

(i) the value of k. *(04 marks)*

(ii) $P(X \geq 1.5)$ *(04 marks)*

(iii) the mean of X, $E(X)$. *(03 marks)*

(b) Sketch the graph of $f(x)$. *(04 marks)*

14. A motorist moving at 90 kmh^{-1} decelerates uniformly to a velocity $V \text{ ms}^{-1}$ in 10 seconds. He maintains this speed for 30 seconds and then decelerates uniformly to rest in 20 seconds.

(a) Sketch a velocity- time graph for the motion of the motorist. *(06 marks)*

(b) Given that the total distance travelled is 800 m, use your graph to calculate the value of V. *(05 marks)*

(c) Determine the two decelerations. *(04 marks)*