S475/1
SUBSID. MATHEMATICS
Paper 1
Nov. / Dec. 2013
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) answered 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.

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

Where necessary, take $g = 9.8\ ms^{-2}$

SECTION A: (40 MARKS)

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

1. Given that $p = log_a (a^3y^{-2})$ and $q = log_a (ay^2)$, find the value of $p + q$.

(05 marks)

2. The table below shows the age in years of mothers at the time they had their first child.

Age in years	15 –	20 –	25 –	30 –	35 –	40 - 45
Number of mothers	2	14	29	43	33	9

Calculate the modal age of the mothers. *(05 marks)*

3. Find the sum of the first ten terms of the geometric progression (G.P.)

$$8 + 4 + 2 + \ldots$$

(05 marks)

4. The table below shows the prices of items and their corresponding weights in the years 2000 and 2004.

Item	**Price (U Shs)**		**Weight**
	2000	**2004**	
Food	55,000	60,000	4
Housing	48,000	52,000	2
Transport	16,000	20,000	1

Using 2000 as the base year, calculate the weighted price index for the items in 2004. *(05 marks)*

5. Solve the differential equation

$$8y\frac{dy}{dx} = 9x^2.$$

Hence find the solution given that $y = 2$ when $x = 1$. *(05 marks)*

6. Solve the equation $\sec^2\theta - \tan\theta = 1$ for $0^\circ \leq \theta \leq 90^\circ$.

(05 marks)

7. A bag contains 5 black pens (B) and 4 red pens (R). Two pens are picked at random, one after the other without replacement. Find the probability that both pens are of the same colour. *(05 marks)*

8. A powered trolley in a factory is moving in a straight line with a constant acceleration. It passes point A with a velocity of U ms^{-1}. It takes 8 seconds to travel 60 m from point A to point B. Finally it takes 4 seconds to travel from point B to point C. Find the value of U. *(05 marks)*

SECTION B: (60 MARKS)

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

9. Eight candidates seeking admission to a university course sat for written and oral tests. The scores were as shown in the table below:

Written (X)	55	54	35	62	87	53	71	50
Oral (Y)	57	60	47	65	83	56	74	63

(a) (i) Draw a scatter diagram for the data.
(ii) Draw a line of best fit on your scatter diagram.
(iii) Use the line of best fit to find the value of Y when $X = 70$.
(08 marks)

(b) Calculate Spearman's rank correlation co-efficient. Comment on your result. *(07 marks)*

10. (a) Sketch the curve $y = 5 + 4x - x^2$. *(10 marks)*

(b) Find the area enclosed between the curve and the x – axis from $x = -1$ to $x = 5$. *(05 marks)*

11. The table below shows the number of bags of sugar sold by a certain wholesale shop from the year 2009 to 2012.

YEAR	QUARTER			
	1st	2nd	3rd	4th
2009	192	280	320	260
2010	300	360	380	270
2011	342	420	430	320
2012	424	480	510	412

(a) Calculate the four-point moving averages for the data. *(06 marks)*

(b) (i) On the same axes, plot the original data and the four-point moving averages. *(05 marks)*
(ii) Comment on the trend of the number of bags of sugar sold over the four-year period. *(01 mark)*
(iii) Use your graph to estimate the number of bags to be sold in the first quarter of 2013. *(03 marks)*

12. The points P and Q have position vectors $\boldsymbol{OP} = -2\boldsymbol{i} - 5\boldsymbol{j}$ and $\boldsymbol{OQ} = \boldsymbol{i} - 2\boldsymbol{j}$ respectively. R is a point such that $\boldsymbol{OR} = \boldsymbol{OP} + \lambda\,\boldsymbol{PQ}$.

(a) Find the:
(i) value of $\boldsymbol{OP} \cdot \boldsymbol{OQ}$
(ii) angle between the two vectors $\boldsymbol{OP}$ and $\boldsymbol{OQ}$. *(07 marks)*

(b) Determine the

(i) vector ***PQ***.

(ii) vector ***OR*** in terms of λ.

(iii) value of λ for which ***OR*** is perpendicular to ***PQ***.

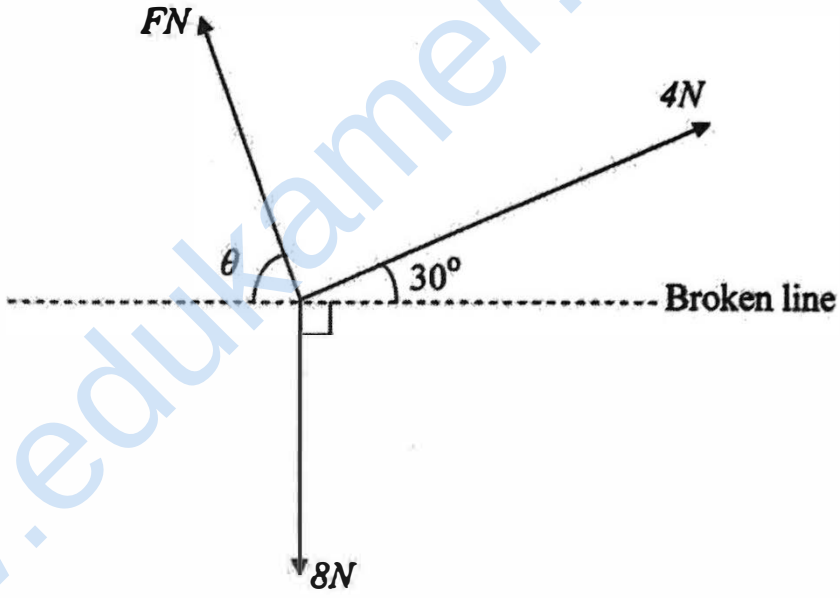
(08 marks)

13. A bakery produces loaves of bread whose weight is normally distributed with mean 1,000 g and standard deviation 40 g.

(a) Find the probability that a randomly selected loaf has a weight of utmost 1,020 g. *(07 marks)*

(b) Assuming that the bakery makes 10,500 loaves, find the approximate number of loaves with a weight greater than 950 g. *(08 marks)*

14. (a) The diagram below shows three forces *F*N, 4N and 8N acting on a particle.



If the forces are in equilibrium, find the value of

(i) θ.

(ii) F.

(06 marks)

(b) In a rectangle $ABCD$, $AB = 4$ m and $BC = 3$ m. Forces of magnitudes $3N$, $10N$, $4N$, $6N$ and $5N$ act in the directions of the letters AB, BC, CD, DA and AC respectively. Taking AB as horizontal, find the magnitude of the resultant force. *(09 marks)*