

S475/1  
SUBSIDIARY MATHEMATICS  
PAPER 1  
July/August 2013  
2<sup>2</sup>/<sub>3</sub> hours



WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

PAPER 1

2hours 40minutes

INSTRUCTIONS TO CANDIDATES:

- Attempt **all** the **eight** questions in section **A** and any **four** questions in section **B**.
- Any additional question(s) answered will **not** be marked.
- All working **must** be shown clearly.
- Each question in section **A** carries **5** marks while each question in section **B** carries **15** marks.
- Begin each answer on a fresh sheet of paper.
- Silent non-programmable scientific calculator and mathematical tables with a list of formulae may be used.
- Take  $g = 9.8ms^{-2}$ .

### SECTION A (40 MARKS)

1. Express  $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$  in the form  $a + b\sqrt{c}$ .  
Hence find the value of  $a$ ,  $b$  and  $c$  (05 marks)
2. Given that  $A$  and  $B$  are mutually exclusive events such that;  
 $P(A) = 0.5$ ,  $P(A \cup B) = 0.9$ ,  
Find;  
 $P(A' \cup B)$   
 $P(A' \cap B')$  (05 marks)
3. A force of magnitude  $10\text{N}$  acts on a body in a direction  $\tan^{-1}\left(\frac{3}{4}\right)$  with the horizontal. If the body moves horizontally a distance of  $6\text{m}$ , find the work done by the force. (05 marks)
4. Simplify without using calculator or mathematical tables.  
a)  $\log_{10} 8 + \log_{10} 125 - 1$   
b)  $\frac{8^2 \times (16)^{1/2}}{(2)^5}$  (05 marks)
5. Calculate the four points moving average of the data.  
 $32, 54, 56, 61, 64, 70, 72, 78$ . (05 marks)
6. A car travelling at  $50\text{ms}^{-1}$  accelerates uniformly to  $80\text{ms}^{-1}$  in  $10\text{seconds}$ .  
Find the acceleration and distance it travelled in  $10\text{seconds}$ . (05 marks)
7. Given that  $x-1$  is a factor of  $ax^4+bx-3$  and the remainder is  $31$  when divided by  $x - 2$ . Find the value of  $a$  and  $b$ . (05 marks)
8. The marks obtained by ten students in a sub mathematics test are as follows;  
 $26, 28, 40, 36, 38, 46, 30, 48, 36, 50$ .  
Determine the semi-interquartile range. (05 marks)

### SECTION B (60marks)

Answer only **four** questions from this section

9. (a) (i) Integrate  $3x^2 + 2x + 4$  (02marks)  
(ii) Find the derivative of the function  $y = (x^2 - 1)(2x + 4)$  (03marks)

- (b) Find the coordinates and the nature of the turning point of the curve  $y = 5 + x - x^2$ .

Hence sketch the curve  $y = 5 + x - x^2$ .

(10marks)

10. The table below shows the weights in kilogrammes of thirty pupils.

48	44	33	52	54	44
53	38	37	35	53	46
59	51	32	37	49	42
48	59	52	40	54	46
45	62	35	54	48	35

- a) (i) Construct a frequency table with a class width of 5 starting from the class of 30 – 34. (06marks)
- (ii) Use this table to calculate the mean and the variance of weight for the pupils. (04marks)
- b) Draw a histogram and use it to estimate the modal weight of the pupils. (05marks)

11. Forces of 1N, 2N, 3N, 5N and 4N act on the sides of a rectangle ABCD where  $\overline{AB} = 4\text{cm}$  and  $\overline{BC} = 3\text{cm}$ .

The forces act in the directions of the order of the letters  $\overline{AB}$ ,  $\overline{BC}$ ,  $\overline{CD}$ ,  $\overline{DB}$  and  $\overline{AD}$  respectively.

- a) Determine the resultant force acting on the rectangle ABCD. (12marks)
- b) What is the magnitude of the acceleration caused by this resultant force? (03marks)

12. a) Without using tables or calculator, find the value of the following leaving your answer in surd form.

(i)  $\tan 240^\circ$  (02 marks)

(ii)  $\cos 135^\circ$  (02 marks)

(iii)  $\sin 330^\circ$  (02 marks)

- b) Solve for  $\theta$  in the equation,  $3\cos^2\theta = 2 + \cos\theta$  for  $0^\circ \leq \theta \leq 360^\circ$ . (06 marks)

- c) Given that  $\tan A = \frac{3}{4}$  where A is an acute angle. Find the value of  $\cos A$  and  $\sin A$ . (03 marks)

13. a) A random variable has a p.d.f. Given by

x	0	1	2	3	4
P(x = x)	0.1	0.2	0.4	0.2	0.1

- (i) Find  $E(x)$  and  $\text{var}(x)$
- (ii) Given that  $y = 3x + 6$ , Find  $E(y)$  and  $\text{var}(y)$ . (09 marks)



- b) A continuous random variable  $x$  has a p.d.f.

$$\text{Where } f(x) = \begin{cases} k(x) & ; 0 \leq x \leq 2 \\ k(2+x) & ; 2 \leq x \leq 4 \\ 0 & ; \text{else where} \end{cases}$$

Determine,

- (i) value of the constant  $k$  (06 marks)
- (ii)  $P(1 \leq x \leq 3)$
14. a) Find the coefficient of friction ( $\mu$ ) between the body of mass of 10kg and a rough horizontal plane if the body is given a force of 37N to accelerate at  $1.25 \text{ ms}^{-2}$ . (05marks)
- b) A mass of 40 kg is placed on a plane inclined at an angle of  $30^\circ$  to the horizontal. What force parallel would?
- (i) hold the mass at rest. (05 marks)
- (ii) make the mass move steadily up the plane.  
(take coefficient of friction between the mass and the plane as 0.4, and  $g = 9.8 \text{ ms}^{-2}$ ). (05 marks)

**END**

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- Silent non-programmable scientific calculator and mathematical tables with a list of formulae may be used.
- Where necessary take  $g = 9.8ms^{-2}$ .

## SECTION A (40 MARKS)

*Answer all questions in this section.*

1. If  $\frac{-2 + \sqrt{3}}{-2 - \sqrt{3}} = a + b\sqrt{c}$ ,  
Find the value of a, b and c. (05marks)

2. Given that A and B are mutually exclusive events such that  $P(A) = 0.4$ ,  
 $P(A \cup B) = 0.7$ .  
Find; i)  $P(A^1 \cap B^1)$  (03marks)  
ii)  $P(A^1 \cup B)$  (02marks)

3. Find; i)  $\int (x - 1)(x^3 + 2) dx$   
ii)  $\int \frac{x^5 - x^2 + 1}{x^2} dx$  (05marks)

4. The table below shows the marks obtained by students in a sub-maths test marked out of 40.

Marks	10-14	15-19	20-24	25-29	30-34	35-39
Cumulative frequency	2	8	17	38	45	50

Calculate the mean mark of the students. (05marks)

5. Find the equation of the tangent to the curve  $y = 3x^2 + 7x - 2$  at the point, P where  $x = -1$ . (05marks)

6. The table below shows the prices of items and their weights in 2010 and 2013.

Price (Ug Shs.)

Items	2010	2013	weights
Rice	2,400	2,800	3
Meat	5,000	7,000	1
Posho	1,200	1,600	2
Beans	2,000	2,500	4

Calculate the aggregate weighted index for the items taking 2010 as the base year. (05marks)

7. Solve the equation  $6\cos^2\theta = 5 - \sin\theta$   
For  $0^\circ \leq \theta \leq 90^\circ$ . (05marks)
8. A body of 5kg resting on a smooth horizontal table is connected by a light inextensible string passing over a smooth pulley at the edge of the table to a mass of 3kg hanging freely.  
Find the tension and the acceleration of the system. (05marks)



**SECTION B: (60marks)***Answer four questions from this section.*

9. The table below shows the weights in kilograms of 200 cows.

Weight (kg)	Frequency.
44 - 47	15
48 - 51	3
52 - 55	45
56 - 59	7
60 - 63	46
64 - 67	20
68 - 71	61
72 - 75	3

- a) Find the mean weight and standard deviation. (06marks)
- b) Calculate the modal weight. (02marks)
- c) Draw an Ogive and use it to estimate, (02marks)
- i) Semi-interquartile range. (03marks)
- ii) The percentage of cows weighing below 65kg. (02marks)
10. a) Given that matrix  $A = \begin{pmatrix} 4 & 1 \\ 5 & 2 \end{pmatrix}$ ,  $B = \begin{pmatrix} -1 & 1 \\ 2 & 3 \end{pmatrix}$   
and  $C = \begin{pmatrix} 0 & 3 \\ 2 & -1 \end{pmatrix}$ . Find i)  $2A + 3B - C$ . (04marks)
- ii)  $(AB)^{-1}$  (04marks)
- b) If matrix  $A = \begin{pmatrix} 4 & 2 \\ a & 3 \end{pmatrix}$  is a singular matrix, find the value of  $a$ . (02marks)
- c) Sarah found that she could buy 12 pencils and 10 books for Shs. 2100.  
Alternatively, she could buy 20 pencils and 4 books for Shs. 1600 at the same price per unit item. Find the cost of each item. (05marks)
11. a) A random variable  $x$  is normally distributed with mean 40 and standard deviation 5.  
Determine the probability that  $x$  lies between 43 and 54. (06marks)
- b) A discrete random variable  $x$  has a probability distribution given below.  
 $p(x = 0) = p(x = 4) = k$ ,  $p(x = 1) = p(x = 3) = 2k$  and  
 $p(x = 2) = 4k$ . Where  $k$  is a positive constant.
- i) Find the value of  $k$ .
- ii) State the mode.
- iii) Calculate the median.

(09marks)

**Turn Over**

12. a) Solve the equation;  $2x^2 - 3x - 44 = 0$ . (04marks)
- b) Find the equation whose roots are 8 and -9. (04marks)
- c) The roots of the equation  $3x^2 + 5x - 12 = 0$  are  $\alpha$  and  $\beta$ .  
Find the equation whose roots are  $\frac{1}{\alpha}$  and  $\frac{1}{\beta}$ . (07marks)

13. The table below shows the number of bags sold by a certain shop, over the period of 12 weeks.

Week.	1	2	3	4	5	6	7	8	9	10	11	12
No. of bags sold.	422	318	349	252	386	230	256	141	264	168	272	260

- a) Calculate the 3- weekly moving averages. (06marks)
- b) On the same axes, show the weekly sales and the 3- weekly moving averages. (08marks)
- c) Comment on the trend of sales of the bags over the 12- weeks period. (01mark)
14. a) A force of magnitude 500N acts on a body causing it to change its velocity from  $10\text{ms}^{-1}$  to  $15\text{ms}^{-1}$  after 5 seconds.  
Find the work done by the force on the body. (07marks)
- b) A block of mass 200kg was pulled up a smooth incline of  $30^\circ$  to the horizontal with uniform velocity. Find the work done by the pulling force, if the block moves a distance of 15m up the incline. (08marks)

END



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- Graph paper is provided.
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- Where necessary take  $g = 9.8ms^{-2}$ .

## SECTION A (40 MARKS)

Answer all questions in this section.

### SECTION A

1. Given that  $\log_2 x + \log_2 x^2 + \log_2 x^3 = 24$ . Find the value of  $x$ . (05marks)
2. Events A and B are independent such that  $P(A) = 0.3$  and  $P(B) = 0.2$ , Find;  
(i)  $P(A \cup B)$   
(ii)  $P(A \cap B)$   
(05marks)
3. Given that matrix  $P = \begin{pmatrix} 1 & 2 \\ 4 & 5 \end{pmatrix}$ ,  $Q = \begin{pmatrix} -1 & 1 \\ 3 & 2 \end{pmatrix}$  and  $R = \begin{pmatrix} 4 & 6 \\ 10 & 15 \end{pmatrix}$ .  
Find the matrix M if  $M + R = P^2 + 3Q$  (05marks)
4. The mean of  $n$  number is 5. If the number 13 is included with the  $n$  numbers, the new mean becomes 6. Find the value of  $n$ . (05marks)
5. Solve the differential equation  $\frac{dy}{dx} = \frac{x+1}{y}$ .  
Hence find the solution given that  $y = 5$  at  $x = 2$ . (05marks)
6. The monthly price of a bunch of banana in 2014 was as follows;

Months	Jan	Feb	March	April	May	June	July	Aug
Price (Shs)	4500	5000	5200	5500	6000	6500	5700	7000

  
Calculate the 4-months moving average for the data. (05marks)
7. Show that  $\sin(x + 60)^\circ + \sin(x - 120)^\circ = 0$
8. A particle travelling in a straight line passes through points A, B and C. Given that  $AB = 40\text{m}$ ,  $BC = 20\text{m}$  and the particle take 12 seconds and 8 seconds to travel between AB and BC respectively. Find the  
(i) initial velocity,  
(ii) acceleration  
of the particle. (05marks)

## SECTION B

*Answer only four questions from this section.*

9. In an investigation carried out, the masses of 50 animals were noted and recorded as below.

88	108	113	103	104	100	105	86
92	116	117	102	100	110	99	106
116	101	105	83	103	100	95	109
92	108	92	99	107	98	105	113
101	96	107	101	118	106	102	97
93	101	111	96	93	92	87	118
114	101						

- a) Construct a frequency distribution table with equal class intervals of 5kg taking 85-89 as the first class.
  - b) Calculate the modal weight. (05marks)
  - c) Draw a cumulative frequency curve and use it to estimate.
    - (i) Semi-interquartile range.
    - (ii) The 80<sup>th</sup> percentile.
10.
  - a) By completing squares, solve the equation  $2x^2 - 3x - 5 = 0$  (04marks)
  - b) Find the equation whose roots are  $\frac{3}{5}$  and  $\frac{1}{2}$ . (04marks)
  - c) The roots of the equation  $3x^2 + 2x - 4 = 0$  are a and b.  
Find the equation whose roots are  $\frac{1}{a}$  and  $\frac{1}{b}$  (07marks)
11. In a certain class, the expected number of students offering sub maths is 5 and the variance is 2.5.
- a) Find the probability (P) of choosing a student who offers sub maths.  
Hence determine the number(n) of students in the class. (08marks)
  - b) Calculate the probability that;
    - (i) exactly 5 students offer sub maths.
    - (ii) no student offers sub maths.
    - (iii) at least 8 students offer sub maths. (07marks)
12. Given the curve  $y = 6 - x - x^2$ .
- a) Find the turning point of the curve and determine its nature.  
Hence sketch the curve. (10marks)
  - b) Find the area bound by the curve and the x - axis between  $x = -3$  and  $x = 2$ . (05marks)

**Turn Over**



13. Eight candidates seeking to join a certain school were given physics and mathematics tests and their scores were shown below.

Physics (x)	55	54	35	62	87	53	71	50
Maths (y)	57	60	47	65	83	56	74	63

- a) Calculate the rank correlation coefficient and hence comment on the relationship between physics and mathematics. (07marks)
- b) (i) Draw a scatter diagram for the data.  
(ii) Draw a line of best fit on your diagram.  
(iii) Use the line of best fit to find the value of y when  $x = 60$ . (08marks)
14. (a) A particle A of mass 9kg resting on a horizontal table is connected by a light inelastic string passing over a smooth pulley fixed at the edge of the table to another particle B of mass 4Kg hanging freely. Given that the coefficient of friction between the particle A and the table is 0.2 and the system is released from rest, find the;  
(i) acceleration of the system.  
(ii) tension in the string. (07marks)
- (b) A particle of mass 0.1kg is released from rest at a height of 25 m above the ground and falls freely under gravity.  
Assuming the ground level is the zero level potential energy, find the sum of the kinetic and potential energy of the particle 2 seconds after being released. (08marks)

END

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## SECTION A (40 MARKS)

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### SECTION A

1. Given that  $\log_2 x + \log_2 x^2 + \log_2 x^3 = 24$ . Find the value of  $x$ . (05marks)
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3. Given that matrix  $P = \begin{pmatrix} 1 & 2 \\ 4 & 5 \end{pmatrix}$ ,  $Q = \begin{pmatrix} -1 & 1 \\ 3 & 2 \end{pmatrix}$  and  $R = \begin{pmatrix} 4 & 6 \\ 10 & 15 \end{pmatrix}$ .  
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(i) initial velocity,  
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  - b) Find the equation whose roots are  $\frac{3}{5}$  and  $\frac{1}{2}$ . (04marks)
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14. (a) A particle A of mass 9kg resting on a horizontal table is connected by a light inelastic string passing over a smooth pulley fixed at the edge of the table to another particle B of mass 4Kg hanging freely. Given that the coefficient of friction between the particle A and the table is 0.2 and the system is released from rest, find the;  
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# SECTION A (40 MARKS)

Answer all questions in this section.

1. Express  $\sqrt{5} + \frac{1-\sqrt{5}}{\sqrt{5}-2}$  without surd in it. (05 marks)

2. Two events M and N are such that  $P(M) = \frac{1}{3}$ ,  $P(N) = \frac{3}{5}$  and  $P(M \cap \bar{N}) = \frac{2}{7}$ .

Find;

(i)  $P(M \cap N)$  (02 marks)

(ii)  $P(M/N)$  (03 marks)

3. Vectors  $\underline{a} = 3x\underline{i} + 9\underline{j}$  and  $\underline{b} = x\underline{i} - 12\underline{j}$  are perpendicular vectors. Find the value of x. (05 marks)

4. A traveller finds that the price index for breakfast (B), lunch (L) and Supper(S) in Kampala and Mbarara were as shown in the table.

Town	Price index		
	B	L	S
Kampala	120	130	125
Mbarara	115	135	110

If the actual quantities consumed by the traveler for B , L and S were 300g, 400g and 300g respectively. Calculate the weighted index for each town.

(05 marks)

5. Solve the equation  $2\sec^2 \theta + \tan \theta = 3$  for  $0^\circ \leq \theta \leq 360^\circ$ . (05 marks)

6. Mr. Mukasa makes a set of chairs. Each new set produced costs shs. 20,000 more than the previous set. Given that cost of first set produced is shs. 250,000.

Find; (i) cost of the sixth set produced. (03 marks)

(ii) the total cost of the first five sets produced. (02 marks)

7. The mass of animals on a certain farm is normally distributed with mean 60kg and variance 25kg. Find the percentage of the animals that weigh at least 52.5 kg. (05 marks)

8. A body of mass 5kg rests on a rough horizontal table. If the coefficient of friction between the body and the table is 0.35. Find the magnitude of the minimum force, P, acting on the body at an angle of  $40^\circ$  to the horizontal which will move the body. (05 marks)

# SECTION B (60 MARKS)

The data below shows the marks scored by students in a certain test.

40	44	56	45	44	35	53	54
54	30	57	50	46	48	60	67
61	31	41	39	56	38	62	53
46	55	36	42	39	64	42	62
56	49	39	43	54	51	56	40

- Construct a grouped frequency table for the data using equal classes of width 4 marks starting with 30- 33 as the first class. (07 marks)
- Use the table in (a) above to calculate the;
  - Mode. (03 marks)
  - Median. (03 marks)
  - Variance. (02 marks)

10. A gradient function for a certain curve is given by  $\frac{dy}{dx} = x - 1$ .

Given that the curve passes through point  $\left(0, -\frac{3}{2}\right)$ .

- Determine the equation of the curve. (05 marks)
- Find the intercepts of the curve at x-axis and y-axis. (03 marks)
- Determine the turning point on the curve. (05 marks)
- Sketch the curve. (02 marks)

11. A certain market operates on Monday, Wednesday and Friday. The table below shows the sales made by a trader in February 2018.

Week	Days		
	Monday	Wednesday	Friday
1	201	222	243
2	234	246	225
3	252	261	207
4	216	237	240

- Calculate a 3point moving averages for the data. (06 marks)
- Plot the graph of the 3point moving averages for the data. (05 marks)
- Use the graph in (b) above to estimate the sales for;
  - First Monday in March 2018. (02 marks)
  - Last Friday in January 2018. (02 marks)

- Solve the equation  $3(2^{2x}) - 8(2^x) + 4 = 0$  (08 marks)
  - If  $p + q = 5$  and  $p^2 + q^2 = 20$ , find the;
    - Value of  $pq$ . (05 marks)
    - equation in terms of  $x$  whose roots are  $p$  and  $q$ . (02 marks)

Turn Over



13. The table below shows the probability distribution of the number of decoders sold by a GO – TV agent in a certain town.

Number of decoders sold ( $x$ )	0	1	2	3	4	5
Probability $p(x = x)$	0.02	0.34	d	0.41	0.10	0.06

Determine;

- Value of d. (03 marks)
  - $E(x)$ . (05 marks)
  - Standard deviation. (05 marks)
  - $P(x \leq 3)$ . (02 marks)
14. (a) A train starts from rest at station A and accelerates uniformly to a speed of  $15\text{ms}^{-1}$  in 1 minute. It maintains the speed for 5 minutes after which it decelerates to rest to station B in 2 minutes. Sketch a velocity – time graph for the motion of the train. (05 marks)
- Use the graph to find;
- Distance between stations A and B. (02 marks)
  - Acceleration and deceleration of the train. (04 marks)
- (b) A particle is projected vertically upwards with a speed  $5\text{ms}^{-1}$ . Find
- time taken to reach the maximum height. (02 marks)
  - the maximum height attained. (02 marks)

END