

### 1.3.2 Mathematics Alt. A Paper 2 (121/2)

#### SECTION 1 (50 marks)

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

- 1 Use logarithms, correct to 4 decimal places, to evaluate

$$\sqrt[3]{\frac{83.46 \times 0.0054}{1.56^2}} \quad (4 \text{ marks})$$

- 2 Three grades A, B, and C of rice were mixed in the ratio 3:4:5. The cost per kg of each of the grades A, B and C were Ksh 120, Ksh 90 and Ksh 60 respectively.

Calculate:

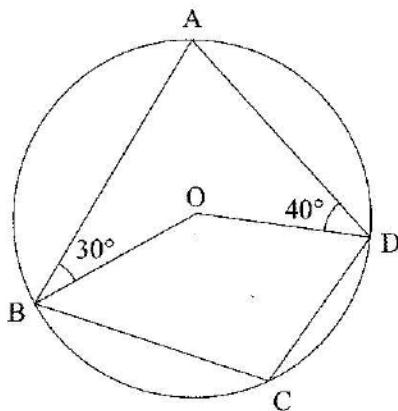
- (a) the cost of one kg of the mixture; (2 marks)  
(b) the selling price of 5 kg of the mixture given that the mixture was sold at 8% profit. (2 marks)

- 3 Make s the subject of the formula.

$$w = \sqrt[3]{\frac{s+t}{s}} \quad (3 \text{ marks})$$

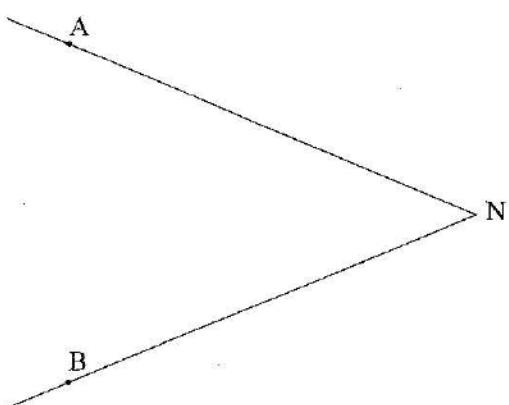
- 4 (a) Solve the inequalities  $2x - 5 > -11$  and  $3 + 2x \leq 13$ , giving the answer as a combined inequality. (3 marks)  
(b) List the integral values of  $x$  that satisfy the combined inequality in (a) above. (1 mark)

- 5 In the figure below, ABCD is a cyclic quadrilateral. Point O is the centre of the circle. Angle ABO =  $30^\circ$  and angle ADO =  $40^\circ$ .



Calculate the size of angle BCD. (2 marks)

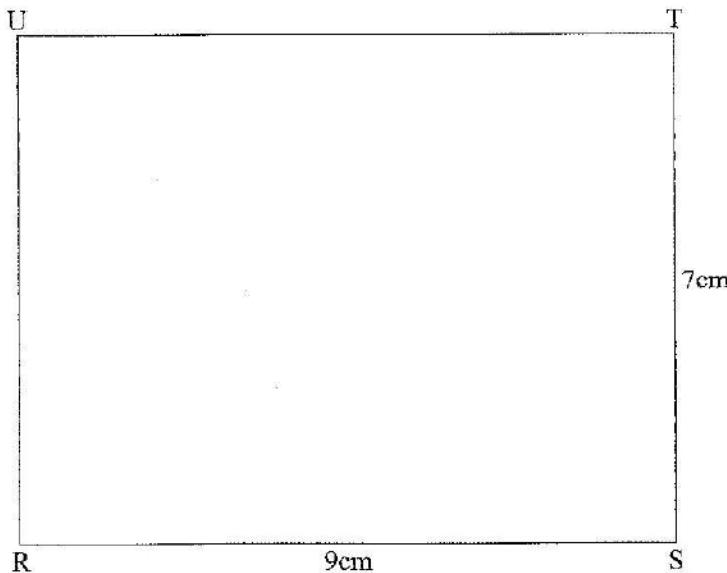
- 6 The ages in years of five boys are 7, 8, 9, 10 and 11 while those of five girls are 4, 5, 6, 7 and 8. A boy and a girl are picked at random and the sum of their ages is recorded.
- (a) Draw a probability space to show all the possible outcomes. (1 mark)
- (b) Find the probability that the sum of their ages is at least 17 years. (1 mark)
- 7 The vertices of a triangle are A(1,2), B(3,5) and C(4,1). The coordinates of C' the image of C under a translation vector T, are (6,-2).
- (a) Determine the translation vector T. (1 mark)
- (b) Find the coordinates of A' and B' under translation vector T. (2 marks)
- 8 Write  $\sin 45^\circ$  in the form  $\frac{1}{\sqrt{a}}$  where a is a positive integer. Hence simplify  $\frac{\sqrt{8}}{1 + \sin 45^\circ}$ , leaving the answer in surd form. (3 marks)
- 9 The radius of a spherical ball is measured as 7 cm, correct to the nearest centimetre. Determine, to 2 decimal places, the percentage error in calculating the surface area of the ball. (4 marks)
- 10 (a) In the figure below, lines NA and NB represent tangents to a circle at points A and B. Use a pair of compasses and ruler only to construct the circle. (2 marks)



- (b) Measure the radius of the circle. (1 mark)
- 11 Expand and simplify the expression.

$$\left(a + \frac{1}{2}\right)^4 + \left(a - \frac{1}{2}\right)^4 \quad (3 \text{ marks})$$

- 12 The figure below represents a scale drawing of a rectangular piece of land, RSTU. RS = 9 cm and ST = 7 cm.



An electric post P, is to be erected inside the piece of land. On the scale drawing, shade the possible region in which P would lie such that  $PU > PT$  and  $PS \leq 7$  cm. (3 marks)

- 13 Vector  $\mathbf{OP} = 6\mathbf{i} + \mathbf{j}$  and  $\mathbf{OQ} = -2\mathbf{i} + 5\mathbf{j}$ . A point N divides  $\mathbf{PQ}$  internally in the ratio 3:1.  
Find  $\mathbf{PN}$  in terms of  $\mathbf{i}$  and  $\mathbf{j}$ . (3 marks)

- 14 A point M ( $60^{\circ}\text{N}, 18^{\circ}\text{E}$ ) is on the surface of the earth. Another point N is situated at a distance of 630 nautical miles east of M.

Find:  
 (a) the longitude difference between M and N; (2 marks)  
 (b) the position of N. (1 mark)

- 15 The equation of a circle centre (a,b) is  $x^2 + y^2 - 6x - 10y + 30 = 0$ .  
Find the values of a and b. (3 marks)

- 16 The table below shows values of  $x$  and  $y$  for the function  $y = 2 \sin 3x^{\circ}$  in the range  $0^{\circ} \leq x \leq 150^{\circ}$ .

$x^{\circ}$	0	15	30	45	60	75	90	105	120	135	150
y	0	1.4	2	1.4	0	-1.4	-2	-1.4	0	1.4	2

- (a) On the grid provided, draw the graph of  $y = 2 \sin 3x$ . (2 marks)

- (b) From the graph determine the period. (1 mark)

## SECTION II (50 marks)

*Answer only five questions in this section in the spaces provided.*

- 17 The cash price of a laptop was Ksh 60 000. On hire purchase terms, a deposit of Ksh 7 500 was paid followed by 11 monthly installments of Ksh 6 000 each.

(a) Calculate:

(i) the cost of a laptop on hire purchase terms; (2 marks)

(ii) the percentage increase of hire purchase price compared to the cash price. (2 marks)

- (b) An institution was offered a 5% discount when purchasing 25 such laptops on cash terms. Calculate the amount of money paid by the institution. (2 marks)

- (c) Two other institutions, X and Y, bought 25 such laptops each. Institutions X bought the laptops on hire purchase terms. Institution Y bought the laptops on cash terms with no discount by securing a loan from a bank. The bank charged 12% p.a. compound interest for two years.

Calculate how much more money institution Y paid than institution X. (4 marks)

- 18 The first, fifth and seventh terms of an Arithmetic Progression (AP) correspond to the first three consecutive terms of a decreasing Geometric Progression (G.P). The first term of each progression is 64, the common difference of the AP is  $d$  and the common ratio of the G.P is  $r$ .

- (a) (i) Write two equations involving  $d$  and  $r$ . (2 marks)

- (ii) Find the values of  $d$  and  $r$ . (4 marks)

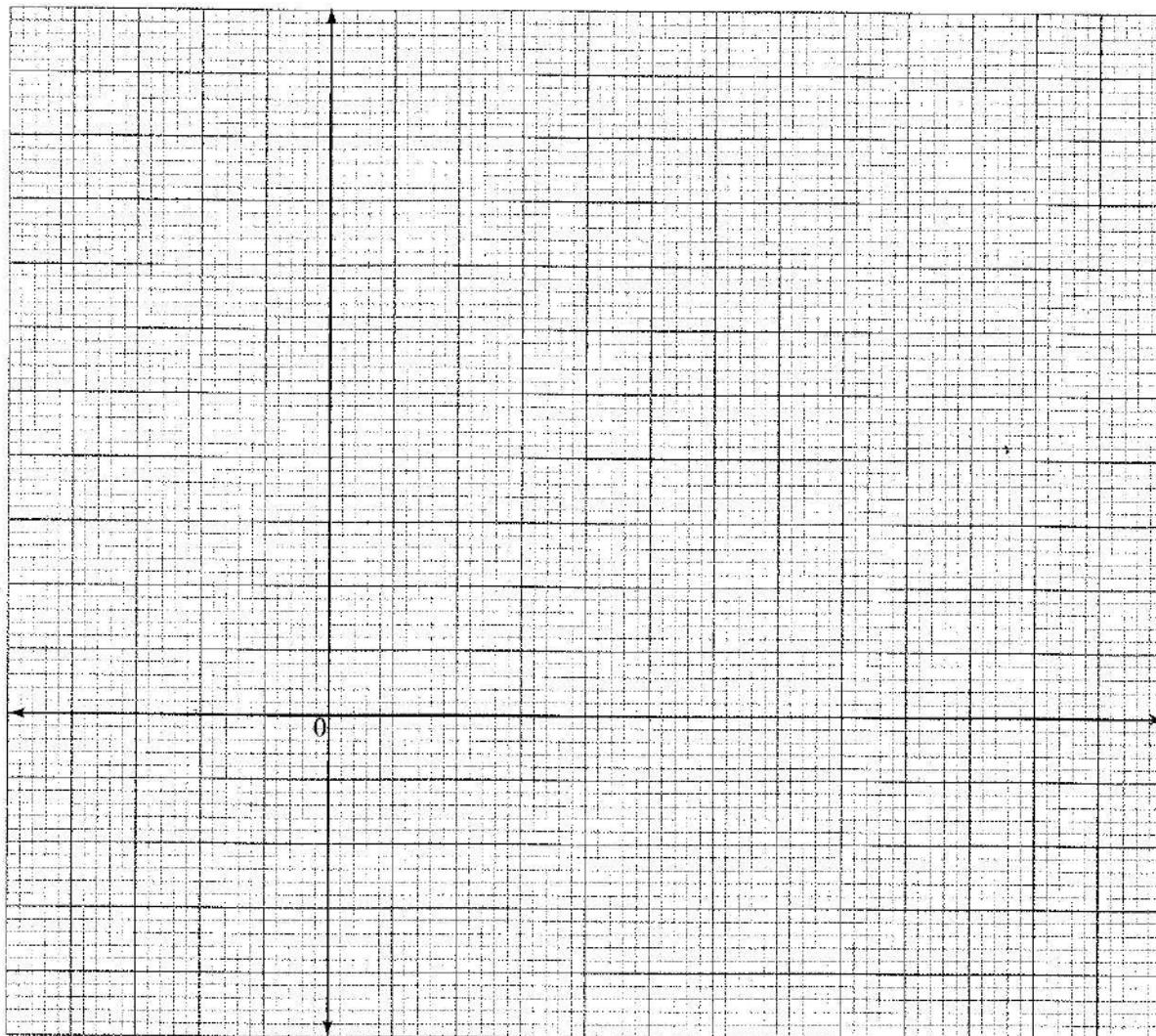
- (b) Find the sum of the first 10 terms of:

- (i) the Arithmetic Progression (A.P); (2 marks)

- (ii) the Geometric Progression (G.P). (2 marks)

- 19 The vertices of a rectangle are A(-1,-1), B(-4,-1), C(-4,-3) and D(-1,-3).

- (a) On the grid provided, draw the rectangle and its image A' B' C' D' under a transformation whose matrix is  $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ . (4 marks)



- (b) A'' B'' C'' D'' is the image of A' B' C' D' under a transformation matrix,

$$P = \begin{pmatrix} \frac{1}{2} & 1 \\ 1 & \frac{1}{2} \end{pmatrix}.$$

- (i) Determine the coordinates of A'', B'', C'' and D''. (2 marks)
- (ii) On the same grid draw the quadrilateral A'' B'' C'' D''. (1 mark)
- (c) Find the area of A'' B'' C'' D''. (3 marks)

- 20** A parent has two children whose age difference is 5 years. Twice the sum of the ages of the two children is equal to the age of the parent.

- (a) Taking  $x$  to be the age of the elder child, write an expression for:
- (i) the age of the younger child; (1 mark)
- (ii) the age of the parent. (1 mark)
- (b) In twenty years time, the product of the children's ages will be 15 times the age of their parent.
- (i) Form an equation in  $x$  and hence determine the present possible ages of the elder child. (4 marks)
- (ii) Find the present possible ages of the parent. (2 marks)
- (iii) Determine the possible ages of the younger child in 20 years time. (2 marks)

- 21** The table below shows values of  $x$  and some values of  $y$  for the curve  $y = x^3 + 2x^2 - 3x - 4$  for  $-3 \leq x \leq 2$ .

$x$	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
$y$	-4.0	-0.4		1.6	0		-4.0	-4.9			6

- (a) Complete the table by filling in the missing values of  $y$ , correct to 1 decimal place. (2 marks)
- (b) On the grid provided, draw the graph of  $y = x^3 + 2x^2 - 3x - 4$ .  
Use the scale: 1 cm represents 0.5 units on  $x$ -axis.  
1 cm represents 1 unit on  $y$ -axis. (3 marks)

- (c) Use the graph to:
- solve the equation  $x^3 + 2x^2 - 3x - 4 = 0$ ; (3 marks)
  - estimate the coordinates of the turning points of the curve. (2 marks)
- 22 The figure below represents a rectangular based pyramid VABCD. AB = 12 cm and AD = 16 cm. Point O is vertically below V and VA = 26 cm.
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- Calculate:
- the height, VO, of the pyramid; (4 marks)
  - the angle between the edge VA and the plane ABCD; (3 marks)
  - the angle between the planes VAB and ABCD. (3 marks)
- 23 The cost C, of producing n items varies partly as n and partly as the inverse of n. To produce two items it costs Ksh 135 and to produce three items it costs Ksh 140.  
Find:
- the constants of proportionality and hence write the equation connecting C and n; (5 marks)
  - the cost of producing 10 items; (2 marks)

- (c) the number of items produced at a cost of Ksh 756. (3 marks)
- 24 A building contractor has two lorries, P and Q, used to transport at least 42 tonnes of sand to a building site. Lorry P carries 4 tonnes of sand per trip while lorry Q carries 6 tonnes of sand per trip. Lorry P uses 2 litres of fuel per trip while lorry Q uses 4 litres of fuel per trip. The two lorries are to use less than 32 litres of fuel. The number of trips made by lorry P should be less than 3 times the number of trips made by lorry Q. Lorry P should make more than 4 trips.
- (a) Taking  $x$  to represent the number of trips made by lorry P and  $y$  to represent the number of trips made by lorry Q, write the inequalities that represent the above information. (4 marks)
- (b) On the grid provided, draw the inequalities and shade the unwanted regions. (4 marks)
- (c) Use the graph drawn in (b) above to determine the number of trips made by lorry P and by lorry Q to deliver the greatest amount of sand. (2 marks)