



**121/2 – MATHEMATICS – Paper 2**  
**ALT A**  
**Nov. 2017 – 2½ hours**

Name ..... Index Number .....

Candidate's Signature ..... Date .....

**Instructions to candidates**

- Write your name and index number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- This paper consists of **two** sections: **Section I** and **Section II**.
- Answer **all** the questions in **Section I** and **only five** questions from **Section II**.
- Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable** silent electronic calculators **and** KNEC Mathematical tables may be used, except where stated otherwise.
- This paper consists of 20 printed pages.**
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- Candidates should answer the questions in English.**

**For Examiner's Use Only**

**Section I**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

**Section II**

17	18	19	20	21	22	23	24	Total

Grand Total

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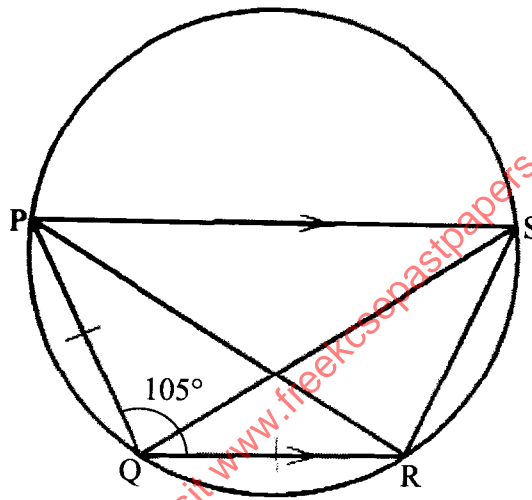
**SECTION I (50 marks)**

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

1. The roots of a quadratic equation are  $x = \frac{-3}{5}$  and  $x = 1$ . Form the quadratic equation in the form  $ax^2 + bx + c = 0$  where  $a$ ,  $b$  and  $c$  are integers. (2 marks)
2. A tailor intended to subdivide a piece of cloth into 7 equal parts. She approximated  $\frac{1}{7}$  m to 0.14 m. Calculate the percentage error in the approximation. (3 marks)
3. A miller was contracted to make porridge flour to support a feeding program. He mixed millet, sorghum, maize and Omena in the ration 1:2:5:1. The cost per kilogram of millet was Ksh 90, sorghum Ksh 120, maize Ksh 30 and omena Ksh 150.
- Calculate:
- (a) the cost of one kilogram of the mixture; (2 marks)
- (b) the selling price of 1 kg of the mixture if the miller made a 30% profit. (2 marks)

4. Without using mathematical tables or a calculator, evaluate  $\frac{5}{6} \log_{10} 64 + \log_{10} 50 - 4 \log_{10} 2$ .  
(3 marks)

5. In the figure below, PQRS is a cyclic quadrilateral.  $PQ = QR$ ,  $\angle PQR = 105^\circ$  and PS is parallel to QR.



Determine the size of:

- (a)  $\angle PSR$ ;

(1 mark)

- (b)  $\angle PQS$ .

(2 marks)

6. Make  $t$  the subject of  $s = \sqrt{\frac{3d(t-d)}{8}}$ . (3 marks)

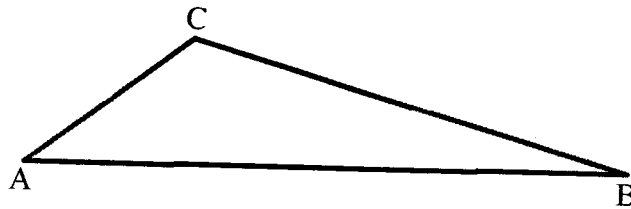
7. Simplify  $\frac{3}{3-\sqrt{7}}$ . (2 marks)

8. Using a ruler and a pair of compasses only, construct:

(a) a triangle LMN in which LM = 5 cm, LN = 5.6 cm and  $\angle MLN = 45^\circ$ . (2 marks)

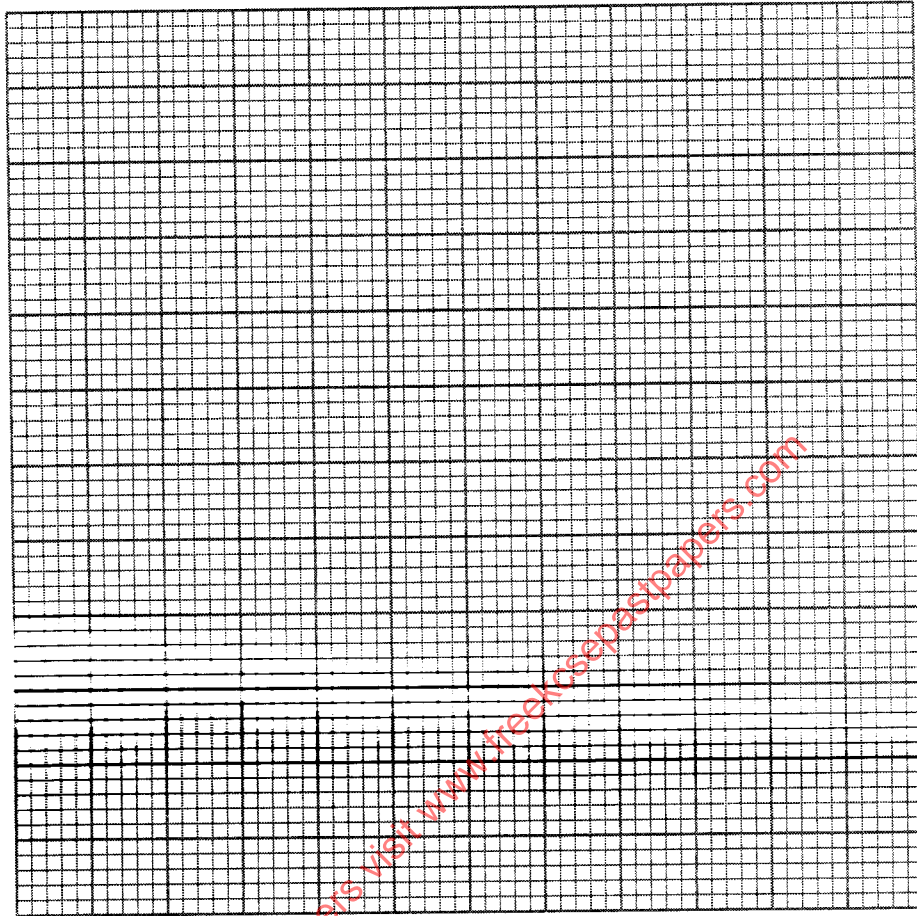
(b) the circle that touches all the sides of the triangle. (2 marks)

9. The figure below is a triangle ABC.



- (a) On the triangle, locate the locus of points equidistant from AC and AB and 5 cm from B. (2 marks)
- (b) Shade the region R, inside the triangle, which is less than 5 cm from B and nearer to AC than AB. (1 mark)
10. An aircraft took off from a point P ( $65^{\circ}$  S,  $76^{\circ}$  W) and flew due North to a point Q. The distance between P and Q is 5 400 nm. Determine the position of Q. (3 marks)

11. The equation of a circle is  $x^2 + y^2 - 4x + 6y + 4 = 0$ . On the grid provided, draw the circle.



(4 marks)

12. Determine the amplitude, period and the phase angle of the curve:

(3 marks)

$$y = \frac{5}{2} \sin(4\theta + 60^\circ)$$

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13. A basket ball team scored the following points in 6 matches:  
10, 12, 14, 16, 28 and 30.  
Using an assumed mean of 15. **determine** the standard deviation correct to 2 decimal places.  
(4 marks)

14. A committee of 3 people was chosen at random from a group of 5 men and 6 women. Find the probability that the committee consisted of more men than women.  
(4 marks)

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15. The area of a triangle is 24 square units. The triangle is mapped onto image P by the matrix

$$\begin{pmatrix} 6 & 5 \\ 3 & 4 \end{pmatrix}. \text{ Find the area of the image P.} \quad (2 \text{ marks})$$

16. Given that  $\mathbf{OA} = 3\mathbf{i} + 4\mathbf{j} + 7\mathbf{k}$ ,  $\mathbf{OB} = 4\mathbf{i} + 3\mathbf{j} + 9\mathbf{k}$  and  $\mathbf{OC} = \mathbf{i} + 6\mathbf{j} + 3\mathbf{k}$ ,

show that points A, B and C are collinear. (3 marks)

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**SECTION II (50 marks)**

*Answer any five questions from this section in the spaces provided.*

17. The income tax rates of a certain year were as shown in the table below:

Monthly taxable income in Kenya shillings(Ksh)	Tax rate percentage(%) in each shilling
0 to 9 680	10
9 681 to 18 800	15
18 801 to 27 920	20
27 921 to 37 040	25
37 041 and above	30

In that year, Shaka's monthly earnings were as follows:

Basic salary	Ksh 28 600
House allowance	Ksh 15 000
Medical allowance	Ksh 3 200
Transport allowance	Ksh 540

Shaka was entitled to a monthly tax relief of Ksh 1056.

- (a) Calculate the tax charged on Shaka's monthly earnings. (6 marks)

- (b) Apart from income tax, the following monthly deductions were made; a Health Insurance fund of Ksh 500, Education Insurance of Ksh 1 200 and 2% of his basic salary for widow and children pension scheme. Calculate Shaka's monthly net income from his employment. (4 marks)

18. The vertices of a rectangle ABCD are: A(0,2), B(0,4), C(4,4) and D(4,2). The vertices of its image under a transformation T are; A'(0,2), B'(0,4), C'(8,4) and D'(8,2).

- (a) (i) On the grid provided, draw the rectangle ABCD and its image A'B'C'D' under T. (2 marks)



- (ii) Describe fully the transformation T. (3 marks)
- (iii) Determine the matrix of transformation. (2 marks)
- (b) On the same grid as in (a), draw the image of rectangle ABCD under a shear with line  $x = -2$  invariant and  $A(0, 2)$  is mapped onto  $A''(0,0)$ . (3 marks)

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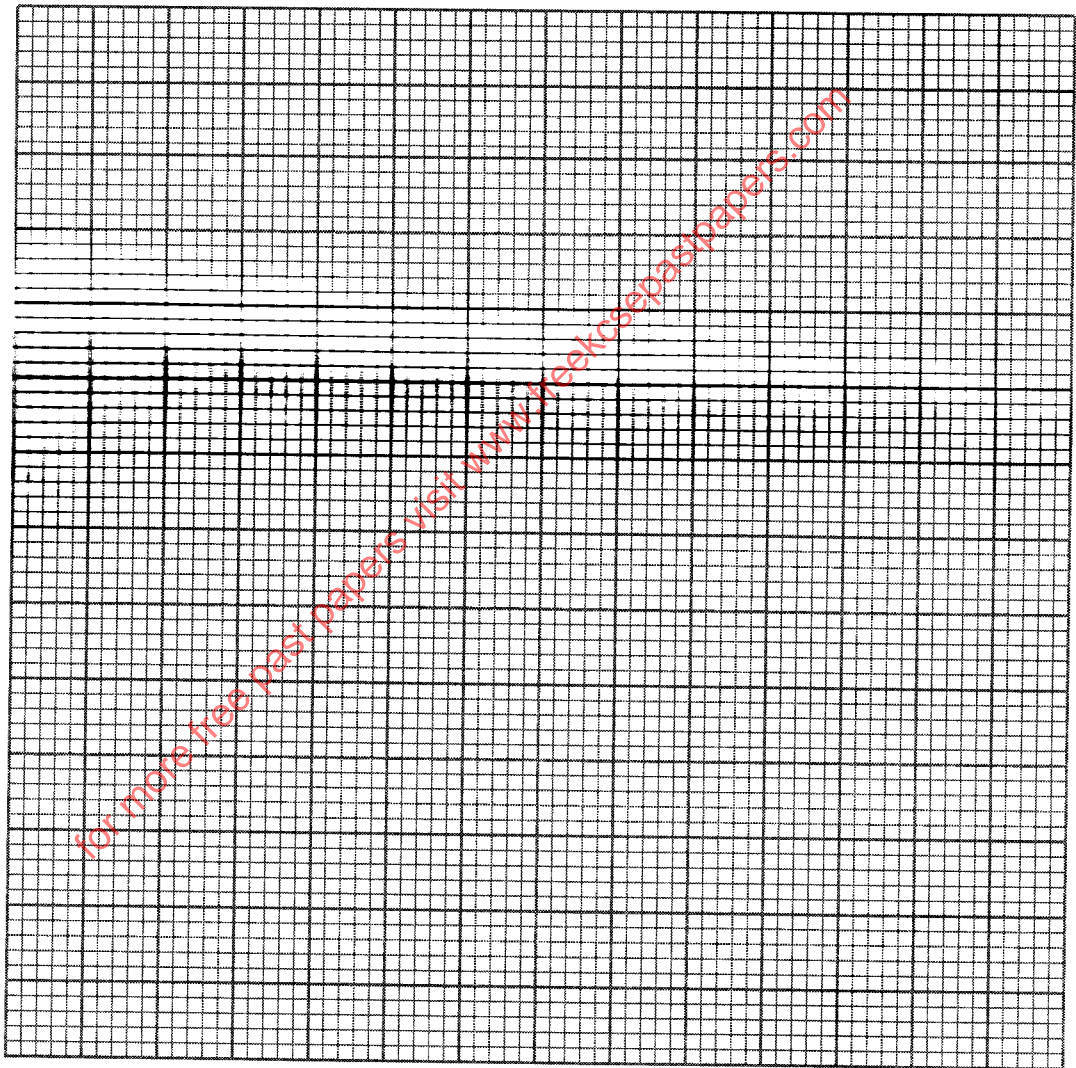
19. (a) The table below shows values of  $x$  and some values of  $y$  for the curve  $y = x^3 - 2x^2 - 9x + 8$  for  $-3 \leq x \leq 5$ . Complete the table.

$x$	-3	-2	-1	0	1	2	3	4	5
$y = x^3 - 2x^2 - 9x + 8$	-10		14	0		-10		4	

(2 marks)

- (b) On the grid provided, draw the graph of  $y = x^3 - 2x^2 - 9x + 8$  for  $-3 \leq x \leq 5$ .  
Use the scale; 1 cm represents 1 unit on the  $x$ -axis  
2 cm represents 10 units on the  $y$ -axis

(3 marks)



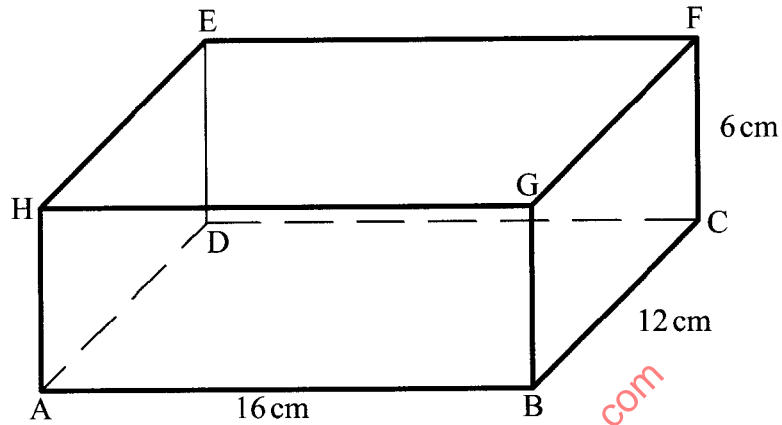
(c) (i) Use the graph to solve the equation  $x^3 - 2x^2 - 9x + 8 = 0$ . (1 mark)

(ii) By drawing a suitable straight line on the graph, solve the equation  $x^3 - 2x^2 - 11x + 6 = 0$ . (4 marks)

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20. The figure below represents a cuboid ABCDEFGH in which  $AB = 16\text{ cm}$ ,  $BC = 12\text{ cm}$  and  $CF = 6\text{ cm}$ .



- (a) Name the projection of the line BE on the plane ABCD. (1 mark)
- (b) Calculate, correct to 1 decimal place:
- (i) the size of the angle between AD and BF; (2 marks)
- (ii) the angle between line BE and the plane ABCD; (3 marks)
- (iii) the angle between planes HBCE and BCFG. (2 marks)
- (c) Point N is the midpoint of EF. Calculate the length BN, correct to 1 decimal place. (2 marks)

21. Three quantities X, Y and Z are such that X varies directly as the square root of Y and inversely as the fourth root of Z. When  $X = 64$ ,  $Y = 16$  and  $Z = 625$ .

(a) Determine the equation connecting X, Y and Z. (4 marks)

(b) Find the value of Z when  $Y = 36$  and  $X = 160$ . (2 marks)

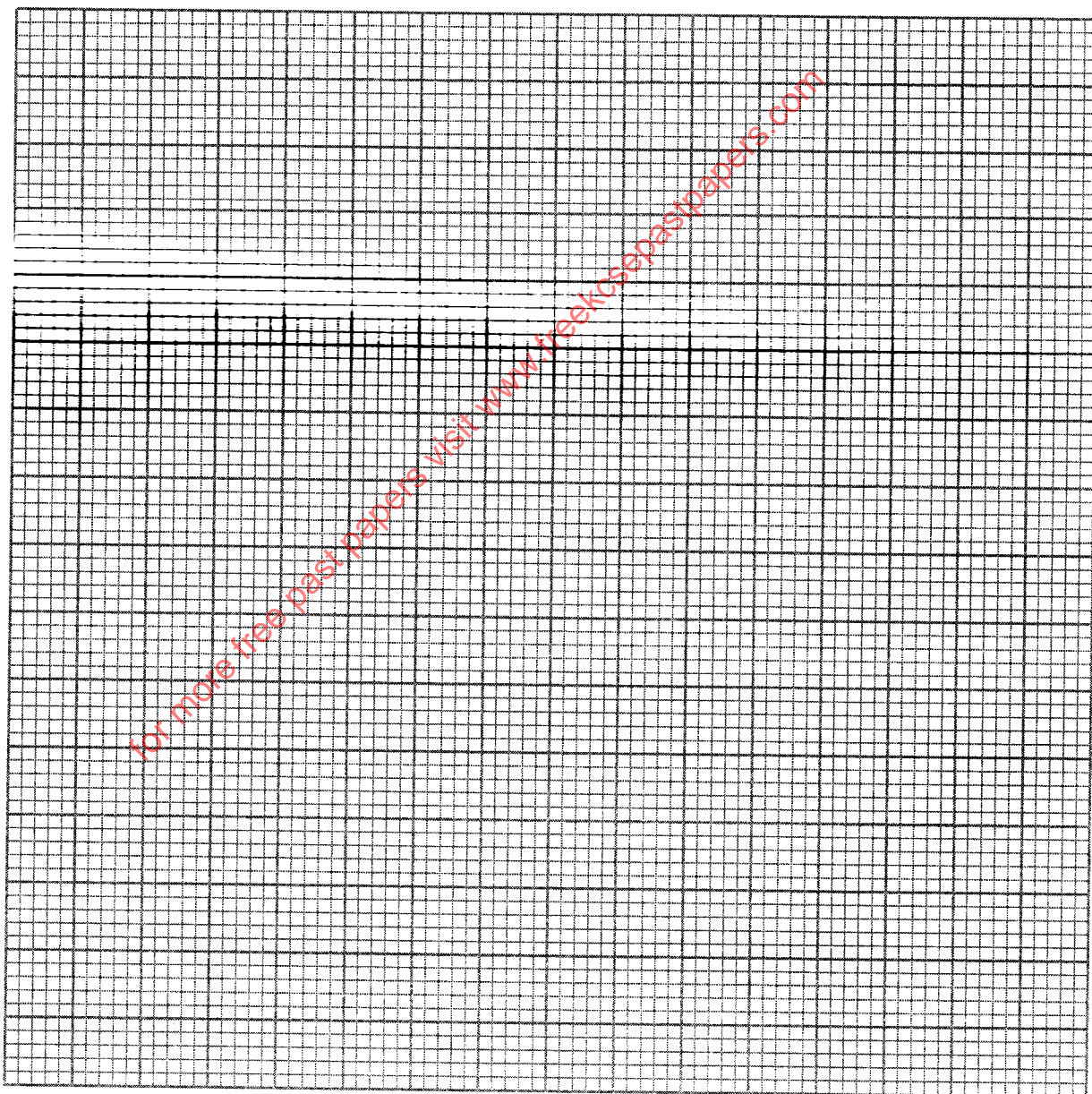
(c) Find the percentage change in X when Y is increased by 44%. (4 marks)

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22. A trader stocks two brands of rice A and B. The rice is packed in packets of the same size. The trader intends to order fresh supplies but his store can accommodate a maximum of 500 packets. He orders at least twice as many packets of A as of B. He requires at least 50 packets of B and more than 250 packets of A. If he orders  $x$  packets of A and  $y$  packets of B,

(a) Write the inequalities in terms of  $x$  and  $y$  which satisfy the above information. (4 marks)

(b) On the grid provided, represent the inequalities in part (a) above. (4 marks)





- (c) The trader makes a profit of Ksh 12 on a packet of type A rice and Ksh 8 on a packet of type B rice. Determine the maximum profit the trader can make. (2 marks)

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23. (a) The 5<sup>th</sup> term of an AP is 82 and the 12<sup>th</sup> term is 103.

Find:

- (i) the first term and the common difference; (3 marks)

- (ii) the sum of the first 21 terms. (2 marks)

- (b) A staircase was built such that each subsequent stair has a uniform difference in height. The height of the 6<sup>th</sup> stair from the horizontal floor was 85 cm and the height of the 10<sup>th</sup> stair was 145 cm.

Calculate the height of the 1<sup>st</sup> stair and the uniform difference in height of the stairs. (3 marks)

- (c) During the construction of the staircase, each step was supported by a vertical piece of timber. If the staircase has 11 stairs, calculate the total length of timber used. (2 marks)

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24. The length of a room is 3 m shorter than three times its width. The height of the room is a quarter of its length. The area of the floor is  $60 \text{ m}^2$ .

(a) Calculate the dimensions of the room.

(5 marks)

(b) The floor of the room was tiled leaving a border of width  $y$  m, all round. If the area of the border was  $1.69 \text{ m}^2$ , find:

(i) the width of the border;

(4 marks)

(ii) the dimensions of the floor area covered by tiles.

(1 mark)



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