



EDUZEDCO
Form 4 Mathematics Paper 2 Examination

Subject: Mathematics | Class: Form 4 | Duration: 150 min | Total Marks: 100

INSTRUCTIONS TO CANDIDATES:

1. Write your name and index number in the spaces provided.
2. This paper consists of TWO sections: Section I and Section II.
3. Answer ALL questions in Section I and any FIVE questions from Section II.
4. Show all the steps in your calculations, giving your answers at each stage.
5. Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

SECTION I (50 Marks)

Answer all questions in this section.

1. Make t the subject of the formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$.

(3 marks)

2. Simplify $\frac{2}{\sqrt{5} - 1} - \frac{1}{\sqrt{5} + 2}$, leaving your answer in the form $\frac{a}{\sqrt{5}} + b$ where a and b are integers.

(4 marks)

3. A rectangular piece of land is measured as 40 m by 25 m, correct to the nearest metre. Calculate the percentage error in its area.

(3 marks)

4. y varies partly as the square of x and partly as a constant. When $x=2$, $y=10$ and when $x=3$, $y=22$. Find the equation connecting y and x .

(4 marks)

5. The third term of a geometric progression is 12 and the sixth term is 96. Find the sum of the first eight terms.

(4 marks)

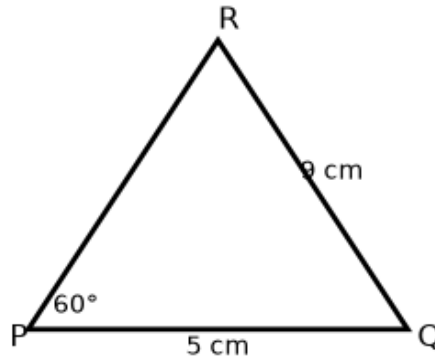
6. Solve the equation $x^2 - 6x + 2 = 0$ by completing the square, giving your answer in surd form.

(3 marks)

7. Expand $(1 + 2x)^5$ up to the term in x^3 . Hence evaluate $(1.02)^5$ correct to 4 decimal places.

(4 marks)

8. In the figure below, O is the centre of the circle. $\angle ABC = 60^\circ$ and $\angle ACB = 50^\circ$. Find $\angle AOC$. [Diagram: Circle with centre O , points A, B, C on circumference, triangle ABC inscribed.]



(3 marks)

9. Solve the equation $2\sin^2\theta - \sin\theta - 1 = 0$ for $0^\circ \leq \theta \leq 360^\circ$.

(3 marks)

10. Given that $\mathbf{a} = 2\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ and $\mathbf{b} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$, find $|\mathbf{a} - \mathbf{b}|$.

(3 marks)

11. A transformation T is represented by the matrix $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$. Find the image of the point $P(2, -1)$ under T .

(2 marks)

12. Bag A contains 2 white and 3 black balls. Bag B contains 1 white and 2 black balls. A bag is chosen at random and a ball is drawn. Find the probability that the ball is white.

(4 marks)

13. Evaluate $\int_0^1 (3x^2 - 2x + 1) \, dx$.

(3 marks)

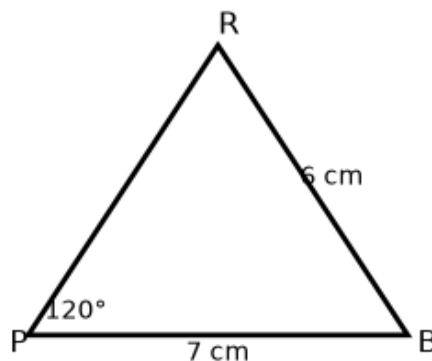
14. A rectangular block has dimensions 4 cm by 3 cm by 5 cm. Find the angle between the diagonal of the base and the diagonal of the block.

(4 marks)

15. Two points A and B lie on the equator. A is at longitude 30°E and B at longitude 45°E . Find the distance between A and B along the equator, given that the radius of the earth is 6370 km. (Take $\pi = 3.142$)

(3 marks)

16. Construct the locus of a point P such that $\angle APB = 90^\circ$ given that $AB = 5$ cm. Also construct the locus of P such that $PA = 3$ cm. Find the number of possible positions of P .



(4 marks)

SECTION II (50 Marks)

Answer any FIVE questions from this section.

17. The table shows monthly income tax rates for a certain year.

Monthly taxable income (Ksh)	Tax rate (%)
0 - 10,000	10
10,001 - 20,000	15
20,001 - 30,000	20
30,001 - 40,000	25
Over 40,000	30

Mr. Kamau earns a basic salary of Ksh 45,000 per month and a house allowance of Ksh 12,000. He is entitled to a personal relief of Ksh 1,200 per month. (a) Calculate his taxable income per month. (2 marks) (b) Determine his gross tax per month. (4 marks) (c) Find his net tax after relief. (2 marks) (d) Calculate his net salary per month. (2 marks)

(10 marks)



18. The marks of 50 students in a mathematics test are given below.

Marks	Frequency
30-39	4
40-49	8
50-59	12
60-69	14
70-79	8
80-89	4

(a) Calculate the mean mark. (3 marks) (b) Calculate the variance and standard deviation. (4 marks) (c) Draw an ogive for the data and estimate the median. (3 marks)

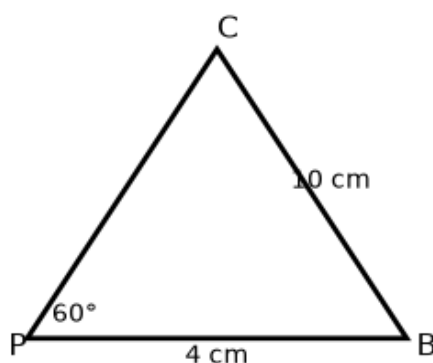
(10 marks)



19. A triangle with vertices $A(1,2)$, $B(3,4)$, and $C(2,1)$ is transformed by the matrix $M = \begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$ followed by $N = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$. (a) Find the image of A under the combined transformation NM . (3 marks) (b) Find the matrix representing the combined transformation. (3 marks) (c) Determine the area of the image of triangle ABC after the transformation. (4 marks)

(10 marks)

20. In the figure below, O is the centre of the circle. PQ is a tangent to the circle at P . $\angle QPR = 40^\circ$ and $\angle PRS = 70^\circ$. [Diagram: Circle with centre O , points P, Q, R, S on circumference, tangent at P , lines PR, RS, PS .] (a) Find $\angle PSR$. (3 marks) (b) Find $\angle OPS$. (3 marks) (c) Find $\angle PQR$. (4 marks)



(10 marks)

21. Points P, Q , and R have position vectors $\mathbf{p} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$, $\mathbf{q} = 4\mathbf{i} + 3\mathbf{j} - \mathbf{k}$, and $\mathbf{r} = 8\mathbf{i} + 9\mathbf{j} - 5\mathbf{k}$ respectively. (a) Show that P, Q , and R are collinear. (4 marks) (b) Find the ratio $PQ:QR$. (3 marks) (c) Find the coordinates of the point S on PR such that $\overrightarrow{PS} = \frac{1}{3}\overrightarrow{PR}$. (3 marks)

(10 marks)

22. (a) Sketch the graph of $y = 2\sin(3x) + 1$ for $0^\circ \leq x \leq 120^\circ$. (4 marks) (b) State the amplitude, period, and phase shift of the function. (3 marks) (c) Solve the equation $2\sin(3x) + 1 = 0$ for $0^\circ \leq x \leq 120^\circ$. (3 marks)

(10 marks)

23. Two towns A and B are located on the earth's surface. A is at $(30^\circ\text{N}, 20^\circ\text{E})$ and B is at $(30^\circ\text{N}, 40^\circ\text{W})$. Take the radius of the earth as 6370 km and $\pi = 3.142$. (a) Find the difference in longitude between A and B. (2 marks) (b) Calculate the distance between A and B along the parallel of latitude. (3 marks) (c) Find the shortest distance between A and B along the great circle. (5 marks)

(10 marks)

24. A particle moves along a straight line such that its velocity v m/s is given by $v = 3t^2 - 6t + 2$, where t is time in seconds. (a) Find the initial velocity. (1 mark) (b) Find the time when the particle is momentarily at rest. (2 marks) (c) Find the displacement of the particle from the starting point after 3 seconds. (3 marks) (d) Find the acceleration of the particle when $t = 2$ seconds. (2 marks) (e) Determine the distance travelled during the first 3 seconds. (2 marks)

(10 marks)

