

EDUZEDCO
Form 3 Mathematics Paper 2 Examination

Subject: Mathematics | Class: Form 3 | 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. A cylindrical tank of radius 1.4 m and height 3.5 m is being filled with water through a pipe of diameter 7 cm at a speed of 2.5 m/s. Calculate the time, in minutes, to fill the tank. (Take $\pi = \frac{22}{7}$)

(3 marks)

2. The third term of a geometric progression is 81 and the sixth term is 2187. Find the first term and the common ratio.

(3 marks)

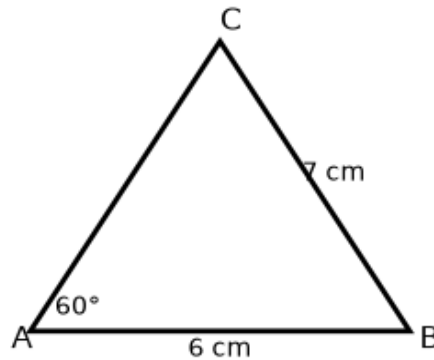
3. Given that $x^2 + 6x + k$ is a perfect square, find the value of k .

(2 marks)

4. Make x the subject of the formula: $y = \sqrt{\frac{ax + b}{cx + d}}$.

(3 marks)

5. Using a ruler and a pair of compasses only, construct a triangle ABC such that $AB = 6$ cm, $BC = 8$ cm, and angle $ABC = 60^\circ$. Construct the locus of point P such that P is equidistant from A and B. Measure the distance from P to C.

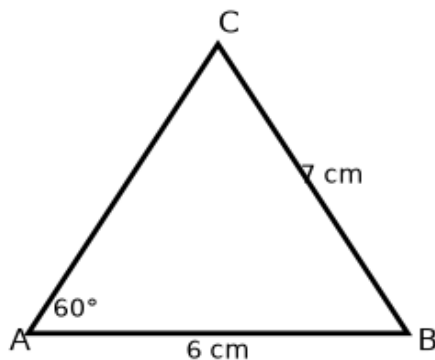


(4 marks)

6. y varies jointly as x and the square of z . When $x = 3$ and $z = 2$, $y = 36$. Find y when $x = 5$ and $z = 3$.

(4 marks)

7. A rectangular block of dimensions 6 cm by 8 cm by 10 cm. Calculate the angle between a diagonal of the base and the diagonal of the block.



(3 marks)

8. A television set costs Ksh 50,000 cash. A hire purchase plan requires a deposit of 20% and 12 monthly installments of Ksh 4,200 each. Calculate the total hire purchase price and the rate of compound interest charged per annum.

(4 marks)

9. The table below shows the distance (m) covered by a particle at time t (s).

t	0	1	2	3	4	5	6	7
s	0	3	10	21	36	55	78	105

 Estimate the velocity at $t = 3.5$ s using a suitable method.

(4 marks)

10. A wave is represented by $y = 5 \sin(2x + 30^\circ)$. Determine the amplitude, period, and phase shift.

(2 marks)

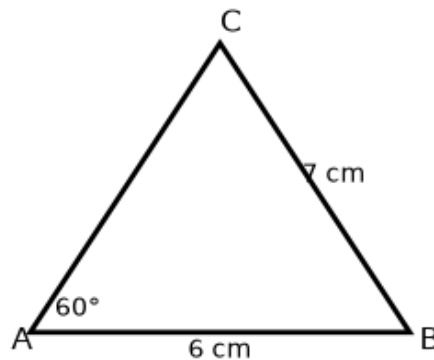
11. Two places A and B on the equator have longitudes 30°E and 45°W respectively. Calculate the distance between them along the equator. (Take radius of earth = 6370 km).

(3 marks)

12. A bag contains 5 red and 3 blue marbles. Two marbles are drawn without replacement. Find the probability that both are red.

(3 marks)

13. A point P moves such that its distance from a fixed point O is always 4 cm. It is also equidistant from two fixed points A and B which are 6 cm apart. Describe the locus of P.



(3 marks)

14. Given vectors $\vec{a} = (2, -1, 3)$, $\vec{b} = (4, 2, 1)$, and $\vec{c} = (10, 5, 9)$. Show that $\vec{c}$ is linearly dependent on $\vec{a}$ and $\vec{b}$.

(3 marks)

15. A transformation represented by matrix $M = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ maps a unit square onto a parallelogram. Find the area of the image.

(3 marks)

16. Evaluate $\int_0^2 (3x^2 - 4x + 1) \, dx$.

(3 marks)

SECTION II (50 Marks)

Answer any FIVE questions from this section.

17. Pump A can fill a tank in 6 hours. Pump B can fill the same tank in 4 hours. Pump C can empty the tank in 8 hours. All three are opened at the same time. After 2 hours, pump C is closed. Find the total time taken to fill the tank.

Calculate the rate of each pump per hour.

Find the fraction of tank filled in the first 2 hours with all pumps open.

Determine the time taken to fill the remaining part after pump C is closed.

Hence find the total time.

(10 marks)



18. A farmer wishes to fence a rectangular field of area 800 m^2 . One side of the field is along a river and does not require fencing. Find the dimensions that minimize the fencing needed.

Express the length of fencing in terms of one variable.

Find the derivative of the fencing function.

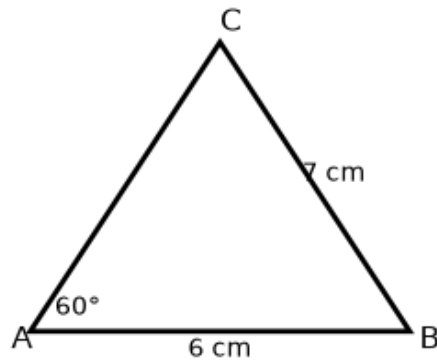
Determine the dimensions that minimize fencing.

Calculate the minimum fencing length.

(10 marks)



19. In the diagram, O is the centre of the circle. Angle $AOB = 80^\circ$ and angle $BOC = 120^\circ$. Find angles AOC, ABC, and BAC.



Find angle AOC.

Find angle ABC.

Find angle BAC.

(10 marks)



20. In a certain country, income tax is charged at the following rates:

Taxable income (Ksh)	Rate (%)
0 - 10,000	10
10,001 - 20,000	15
20,001 - 30,000	20
Above 30,000	25

A person earns a monthly salary of Ksh 45,000 and has a personal relief of Ksh 1,200 per month. Calculate the monthly tax paid.

Calculate the taxable income after relief.

Compute the tax for each bracket.

Sum up to find total tax.

State the tax paid.

(10 marks)



21. Point A(2, 1) is transformed by matrix $P = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ to image A'. Then A' is transformed by matrix $Q = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ to A''. Find the coordinates of A'' and the single matrix that maps A to A''.

Find A'.

Find A''.

Find the single matrix R such that $R(A) = A''$.

Verify that $R = QP$.

(10 marks)



22. The table below shows the distribution of heights (cm) of 50 plants.

Height	10-20	20-30	30-40	40-50	50-60	60-70	Freq
	5	8	12	15	7	3	

Calculate the mean height and the variance.

Find the class midpoints.

Calculate the mean height.

Calculate the variance.

Interpret the results.

(10 marks)



23. A particle moves along a straight line such that its velocity v (m/s) at time t (s) is given by $v = 2t^2 - 3t + 1$. Find: (a) the displacement after 3 seconds when initial displacement is 5 m. (b) the total distance travelled in the first 3 seconds. (c) the acceleration when $t = 2$ s.

Find the displacement function by integration.

Compute displacement at $t=3$.

Determine when velocity is zero to find direction changes.

Calculate total distance.

Find acceleration function and evaluate at $t=2$.

(10 marks)



24. A rectangular plot measures 40 m by 30 m. A path of uniform width is built around it. The area of the path is 456 m^2 . Find the width of the path.

Let the width be x . Express the total area including path.

Set up an equation for the area of the path.

Solve the quadratic equation.

State the width.

(10 marks)

