

KENYA NATIONAL EXAMINATIONS**121/2 – MATHEMATICS Paper 2****Form 4 End Term Examination**

Time: 2½ Hours

INSTRUCTIONS TO CANDIDATES:

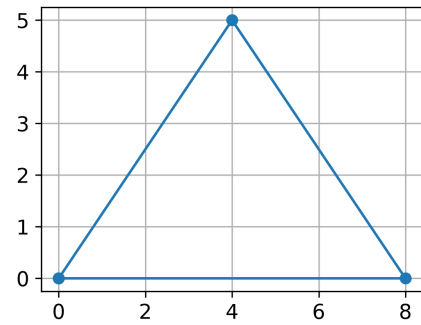
1. Write your name and index number in the spaces provided.
2. This paper consists of TWO sections: Section I and Section II.
3. Answer ALL questions in Section I and only FIVE questions from Section II.
4. Show all the steps in your calculations, giving your answers at each stage.
5. Non-programmable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

SECTION I (50 Marks)

Answer all questions in this section in the spaces provided.

1. Given that $\log 3 = 0.4771$ and $\log 2 = 0.3010$, find without using a calculator the value of $\log 4.5$.

(3 marks)



(3 marks)

2. Simplify the expression by rationalizing the denominator:

$$\frac{3 + \sqrt{2}}{5 - 2\sqrt{2}}$$

(3 marks)

5. A businessman bought a machine for Ksh. 1,500,000. It depreciates at a rate of 12% p.a. Calculate its value after 3 years.

(3 marks)

3. Find the inverse of the matrix A. Hence solve the simultaneous equations:

$$A = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$$

$$2x + y = 5$$

$$3x + 4y = 6$$

(3 marks)

6. A chord XY of length 12cm is drawn in a circle of radius 10cm. Calculate the perpendicular distance from the center of the circle to the chord.

(3 marks)

4. In triangle PQR, PQ = 8cm, QR = 6cm and angle PQR = 112° . Calculate the length PR correct to 2 decimal places.

7. Given vectors $\vec{OA} = [3, -2]$ and $\vec{OB} = [-1, 5]$, find the magnitude of the vector $\vec{AB}$ correct to 1 decimal place.

(3 marks)

8. The mean of the numbers 4, 8, x , 12, and 15 is 9. Find the value of x and hence calculate the standard deviation σ .

(3 marks)

12. A triangle with vertices A(1,1), B(3,1), and C(2,3) undergoes an enlargement scale factor -2 center (0,0). Find the coordinates of the image.

(3 marks)

9. Make x the subject of the formula: $y = \sqrt{(x^2 + a) / (x^2 - b)}$.

(3 marks)

13. A bag contains 4 red and 5 blue balls. Two balls are drawn at random without replacement. Find the probability that they are of different colors.

(3 marks)

10. Find the equation of a line passing through (-2, 4) and perpendicular to the line $3y - 2x = 6$.

(3 marks)

14. Find the derivative dy/dx of the curve $y = 2x^3 - 5x^2 + 4x - 1$ at the point where $x = 2$.

(3 marks)

11. Expand $(1 - 2x)^5$ up to the term in x^3 . Use your expansion to estimate $(0.98)^5$.

(3 marks)

15. Form all the inequalities that define the region R bounded by the vertices (0,0), (4,0), and (0,3).

(3 marks)

16. The 3rd term of a geometric progression is 18 and the 6th term is 486. Find the first term and the common ratio.

(3 marks)

SECTION II (50 Marks)

Answer any five questions from this section.

17. A particle moves along a straight line such that its displacement s meters from a fixed point O at time t seconds is given by $s = t^3 - 6t^2 + 9t + 5$.

- (a) Find the velocity of the particle when $t = 4$. (3 marks)
- (b) Find the time when the particle is momentarily at rest. (3 marks)
- (c) Determine the acceleration of the particle when $t = 2$. (2 marks)
- (d) Find the maximum velocity attained in the first 3 seconds. (2 marks)

18. Consider the curves $y = x^2 - 2x$ and the line $y = x$.

- (a) Find the coordinates of the points of intersection of the curve and the line. (3 marks)
- (b) Evaluate $\int (x^2 - 2x) dx$. (2 marks)
- (c) Calculate the exact area of the region enclosed by the curve and the line. (5 marks)

19. In a factory, machines A, B, and C produce 30%, 50%, and 20% of the total output respectively. The probability of producing a defective item is 4% for A, 2% for B, and 5% for C.

- (a) Draw a tree diagram to represent this information. (3 marks)
- (b) Find the probability that an item selected at random is defective. (3 marks)
- (c) If a defective item is chosen, find the probability that it was produced by machine B. (4 marks)

20. A tailor makes two types of dresses, X and Y. Dress X requires 2m of cotton and 1m of silk. Dress Y requires 1m of cotton and 2m of silk. The tailor has 20m of cotton and 16m of silk. The profit on X is Ksh. 800 and on Y is Ksh. 600.

- (a) Form all the linear inequalities representing this information. (3 marks)
- (b) On the grid provided, graph the inequalities and shade the unwanted region. (4 marks)
- (c) Determine the number of each dress to make to maximize profit, and find the max profit. (3 marks)

21. An arithmetic progression (A.P.) has the 4th term as 14 and the 8th term as 26.

(a) Find the first term (a) and the common difference (d). (3 marks)

(b) Find the sum of the first 20 terms of the A.P. (3 marks)

(c) The first, second, and fifth terms of this A.P. form the first three terms of a G.P. Find the common ratio of the G.P. (4 marks)

22. The coordinates of a triangle are A(-2, 1), B(4, 3) and C(1, 6).

(a) Find the equation of the line AB in the form $y = mx + c$. (3 marks)

(b) Find the equation of the perpendicular bisector of AB. (4 marks)

(c) Calculate the exact area of triangle ABC. (3 marks)

23. The table below shows the distribution of marks scored by 50 students in a mathematics test.
(Marks: 10-19(4), 20-29(8), 30-39(12), 40-49(15), 50-59(8), 60-69(3)).

- (a) State the modal class. (1 mark)
- (b) Calculate the mean mark using an assumed mean of 44.5. (4 marks)
- (c) Calculate the median mark. (3 marks)
- (d) Calculate the standard deviation σ . (2 marks)

24. In triangle OAB, $\vec{OA} = a$ and $\vec{OB} = b$. Point M divides OA in the ratio 2:1 and N divides OB in the ratio 1:2. The lines AN and BM intersect at X.

- (a) Express $\vec{AN}$ and $\vec{BM}$ in terms of a and b . (3 marks)
- (b) Given that $\vec{OX} = h(\vec{OA} + \vec{AN})$ and $\vec{OX} = k(\vec{OB} + \vec{BM})$, find the values of h and k . (5 marks)
- (c) Express $\vec{OX}$ in terms of a and b . (2 marks)
