

Name..... Index No.....
 School..... Candidate's sign.....
 Date.....

121/2
MATHEMATICS
Paper 2
PRE-MOCKS
2 ½ Hours

Kenya Certificate of Secondary Education, 2017

121/2
MATHEMATICS
Paper 2
March 2017
2 ½ Hours

Instructions to candidates.

1. Write your name and index number in the spaces provided above.
2. Sign and write the date of examination in the space provided above.
3. The paper contain two sections: **Section I and section II**
4. Answer **All**the questions in **section I** and **strictly any five** questions from **section II**.
5. All answers and working must be written in the question paper in the spaces provided below each question.
6. Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
7. Non-programmable silent electronic calculators and **KNEC** mathematical tables may be used, except unless stated otherwise.

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

This paper consists of 16 printed pages. Candidates should check the question paper to Ensure that all the pages are printed as indicated and no questions are missing.

SECTION I (50 marks)

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

1. Evaluate without using tables or calculators.

(3 marks)

$$\frac{\log \frac{1}{2} + \log 64}{\log \left(\frac{1}{32} \div \frac{1}{8} \right)}$$

2. Make x the subject of the equation

(3 marks)

$$\frac{t}{s} = \frac{b}{\sqrt{x-4}}$$

3. Two pipes, P and Q can fill an empty tank in 3 hours and 4 hours respectively. It takes 5 hours to fill the tank when an outlet pipe R is opened the same time with the inlet pipes. Calculate the time pipe R takes to empty the tank.

(3 marks)

4. Given that $M=i - 3j + 4k$, $W= 6i + 3j - 5k$ and $Q = 2M + 5N$, find the magnitude of Q to 3 significant figures. (3 marks)
5. A triangle ABC is such that $a =14.30$ cm, $b =16.50$ cm and $B =56^\circ$. Find the radius of a circle that circumscribes the triangle. (3 marks)
6. Construct a circle centre O and radius 3 cm. Construct two tangents from a point T, 6.5 cm from O to touch the circle at W and X. measure Angle WTX. (3 marks)

7. Grace deposited Ksh 16 000 in a bank that paid simple interest at the rate of 14% per annum. Joyce deposited the same amount of money as Grace in another bank that paid compound interest semi- annually. After 4 years, they had equal amounts of money in the banks.

Determine the compound interest rate per annum, to 1 decimal place, for Joyce's deposit. (4 marks)

8. Simplify $\frac{\sqrt{7}}{\sqrt{7-3}}$, leaving your answer in the form $a + b\sqrt{c}$, where a, b, and c are integers. (2 marks)

9. Solve the equation

$$x - y = 1$$

$$x^2 + 2y^2 = 1$$

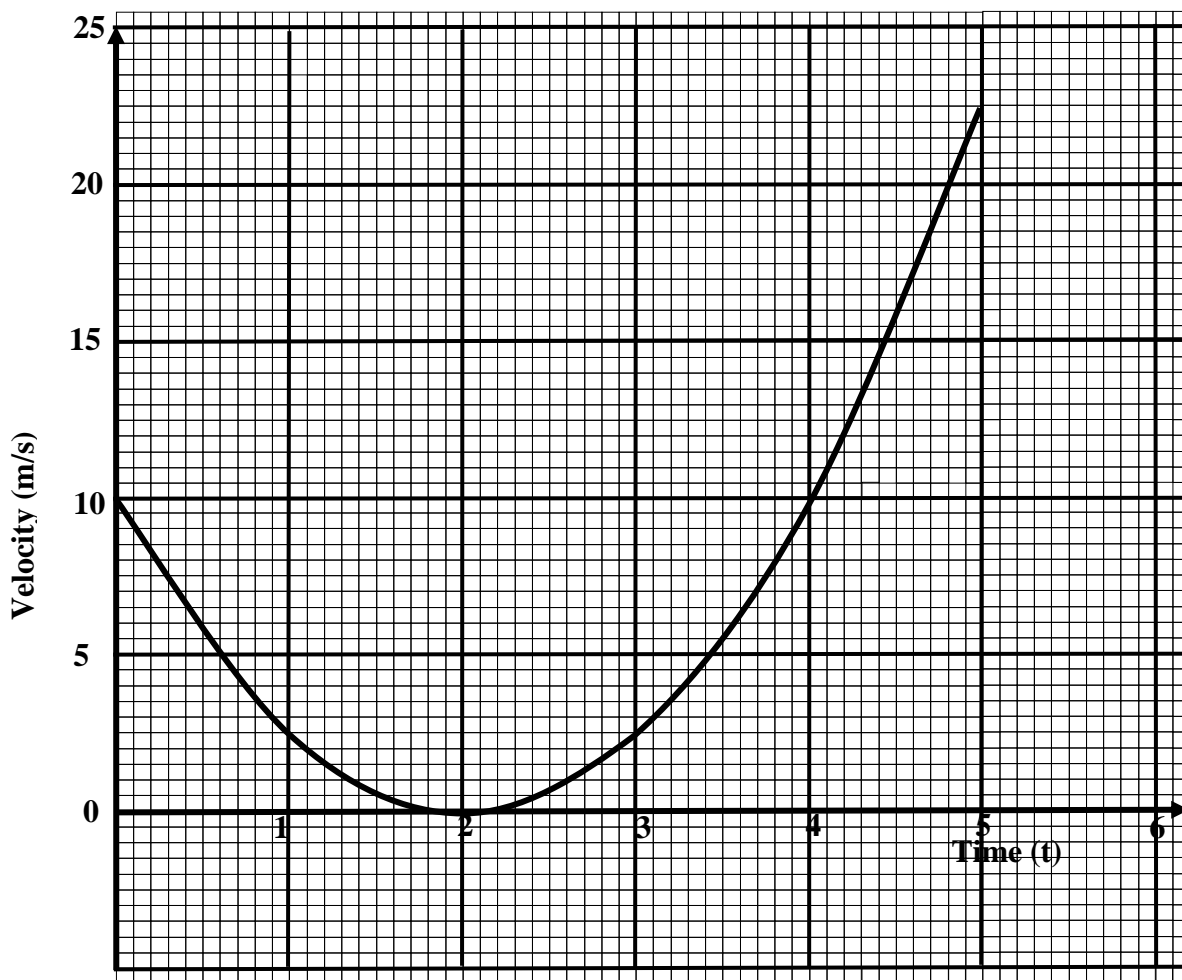
10. Grade I coffee cost sh 500 per kilogram while grade II coffee costs sh 400 per kilogram. The grades are mixed to obtain a mixture that costs sh 420 per kilogram. In what ratio should the two grades be mixed?
(3 marks)

11. The base length and height of parallelogram were measured as 8.4 cm and 4.5 cm respectively. Calculate the maximum absolute error in the area of the parallelogram.
(3 marks)

12. (a) Expand $(1 + \frac{1}{2}x)^{10}$ up to the fourth term.

(b) Hence, find the value of $(0.84)^{10}$. (3 marks)

13. The graph below shows the relationship between velocity of a body and time (t) seconds in the interval $0 \leq t = 5$.

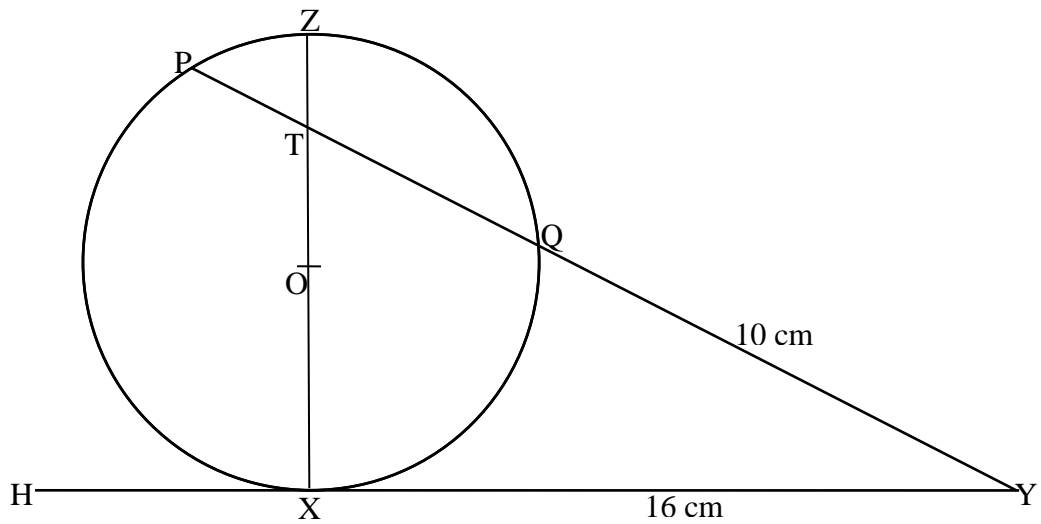


Use the graph to determine ;

(a) the average rate of change of velocity between $t = 2.5$ seconds and $t = 5$ seconds. (2 marks)

(b) the instantaneous rate of change at $t = 4$ seconds. (2 marks)

14. In the figure below, the tangent HXY meets chord PQ produced at Y. Chord XZ passes through the centre, O, of the circle and intersects PQ at T. Line XY = 16 cm and QY = 10 cm.



(a) Calculate the length PQ. (2 marks)

(b) If $ZT = 4$ cm and $PT : TQ = 3 : 5$, find XT. (2 marks)

15. Quantity P varies partly as Q and partly varies inversely as square of Q. When $Q = 1$, $P = 1$ and when $Q = \frac{1}{2}$, $P = -3$. Find the equation of the relationship connecting P and Q. (3 marks)

16. $OA = \begin{pmatrix} 4 \\ 1 \\ 0 \end{pmatrix}$ and $OB = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$. A point Q divides line AB externally the ratio 5:2. Find the position vector of point Q. (3 marks)

SECTION II (50 marks)

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

17. A plot contains 8 green, 6 red and 10 yellow beads. The beads are identical except for the colour.

(a) Find the probability of picking ;

(i) a yellow bead

(1 mark)

(ii) A red or green bead.

(2 marks)

(b) Two beads are picked at random, one at a time, without replacement.

Find the probability that:

(i) a red and a yellow bead are picked.

(3 marks)

(ii) at least one bead is green.

(4 marks)

18. In April of a certain year, an employee's basic salary was Kshs 25000. The employee was also paid a house allowance of Kshs 7500, a transport allowance of Kshs 2100 and a medical allowance of Kshs 2400. In May of that year, the employee's basic salary was raised by 5%.

(a) Calculate the employees:

(i) Basic salary for May; (2 marks)

(ii) Total taxable income in May of that year. (2 marks)

(b) In that year, the income Tax rates were as shown in the table below.

| Monthly taxable income Kshs | Percentage rate of tax per shilling |
|--------------------------------|----------------------------------------|
| Up to 9680 | 10 |
| From 9681 to 18800 | 15 |
| From 18801 to 27920 | 20 |
| From 27921 to 37040 | 25 |
| From 37041 and above | 30 |

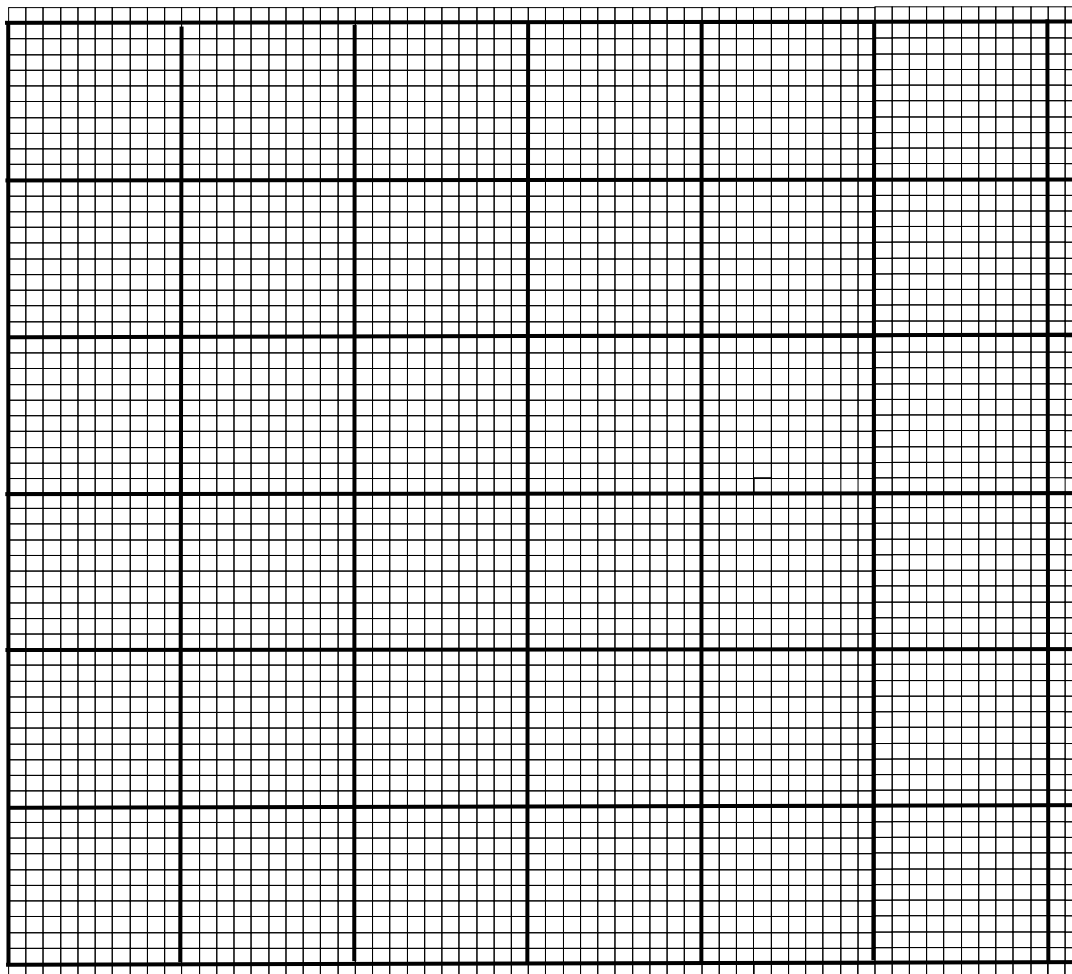
Given that the monthly personal relief was Kshs 1056, calculate the net tax paid by the employee. (4 marks)

(c) Given that the following monthly deductions are made: loan repayments sh 800, NHIF sh 280 and children calculate the employee's net income. (2 marks)

19. The table below shows the corresponding values T and a obtained from an experiment that are known to satisfy the equation $T = h a^n$

| | | | | | | |
|---|---|----|----|----|----|-----|
| a | 1 | 2 | 3 | 4 | 5 | 6 |
| T | 3 | 12 | 27 | 48 | 75 | 108 |

(a) Draw a suitable straight line graph to represent this information.



(2 marks)

(b) Determine the values of h and n.

(3 marks)

(c) State the equation relating T to a.

(1 mark)

20. The initial population of antelopes in a national park was 1.2 million with fixed annual increment. The population of weaverbirds was initially 160 000 but increased by 20% per year.

(a) Given that the population of antelopes in the 10th year was 5 200 000, determine:

(i) The annual population increment. (2 marks)

(ii) The total number of antelopes during the 10 years. (2 marks)

(b) Determine the population of weaver birds, correct to the nearest during the tenth year. (2 marks)

(c) Determine correct to the nearest bird;

(i) The total number of birds during the 10 years. (2 marks)

(ii) the population of the antelopes after a decrease 10% in the 11th year. (2 marks)

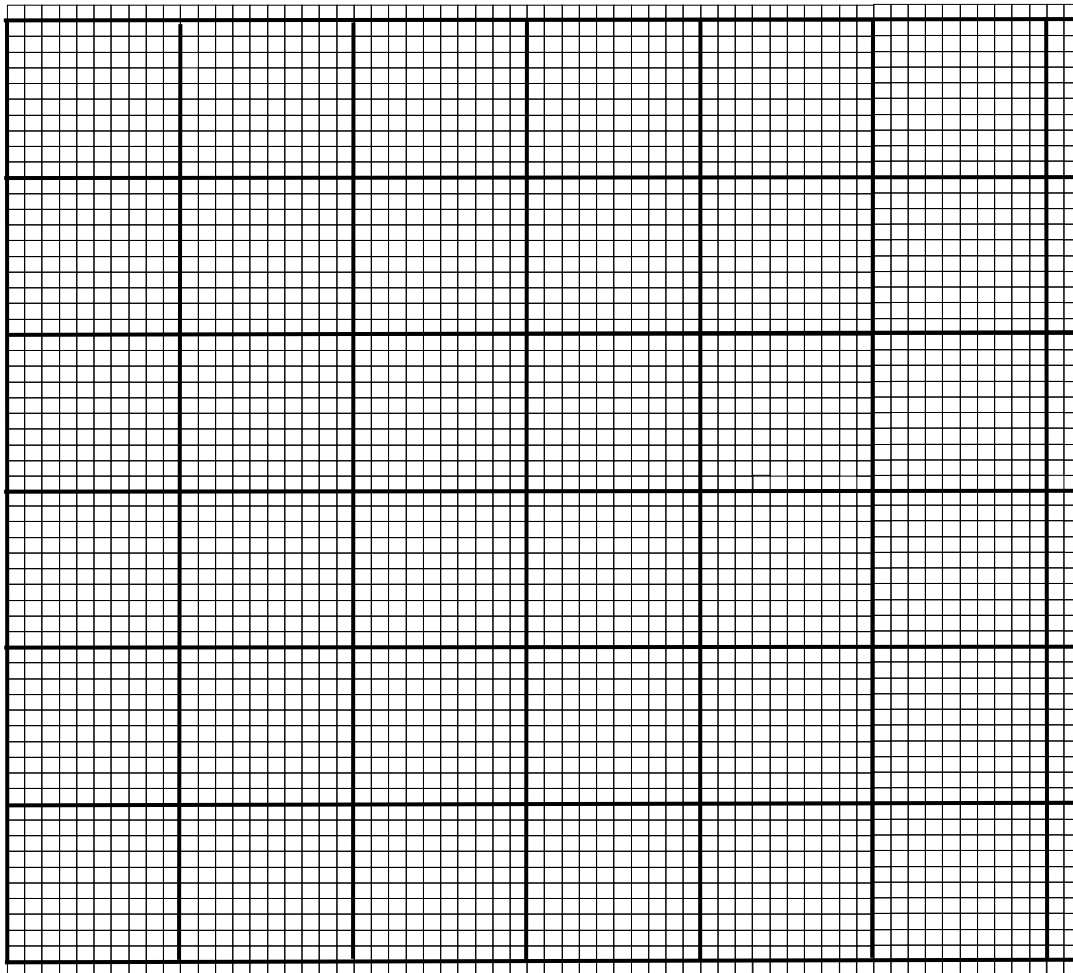
21. The table below shows values of x and some values of y for the curve. $y = x^3 + 3x^2 - 4x - 12$ in the range $-4 \leq x \leq 2$.

(a) Complete the table by filling in the missing values of y . (2 marks)

| | | | | | | | | | | | | |
|-----|----|------|------|----|------|----|------|---|-------|---|------|-----|
| x | -4 | -305 | -2.5 | -2 | -1.5 | -1 | -0.5 | 0 | 0.5 | 1 | 1.5 | 2.0 |
| y | | -4.1 | 1.1 | | -2.6 | | -9.4 | | -13.1 | | -7.9 | |

(b) On the grid provided, draw the graph of $y = x^3 + 3x^2 - 4x - 12$ for $-4 \leq x \leq 2$.

Use the scale: horizontal axis 2 cm for 1 unit and vertical axis 2 cm for 5 units. (3 marks)



(c) By drawing a suitable straight line, on the same grid as (b) above, solve the equation. (5 marks)

$$x^3 + 3x - 5x - 6 = 0$$

22. A circle with centre C has equation $x^2 + y^2 + 2x - 12y + 12 = 0$.

(a) By completing the square, express this equation in the form

$$(x - a)^2 + (y - b)^2 = r^2. \quad (2 \text{ marks})$$

(b) Write down

(i) the coordinate of C (1 mark)

(ii) the radius of the circle (1 mark)

(c) The line with the equation $x + y = 4$ intersect the circle at the points P and Q.

(i) Show that the x-coordinates of P and Q satisfies the equation

$$x^2 + 3x - 10 = 0 \quad (3 \text{ marks})$$

(ii) Given that P has coordinates (2, 2), find the coordinates of Q. (2 marks)

(iii) Hence find the midpoint of PQ. (1 marks)

23. A project is planned to supply water to all families in an estate. A water pipe of 20 cm diameter is needed to distribute water and it will be operating 12 hours in a day. Water will flow through the pipe at the rate of 2.1 metres per second. It is expected that each family will consume an average of 5 m³ per day.

(a) Calculate the amount of water in litres, supplied in one hour. (3 marks)

$$\left(\text{Take } \pi = \frac{22}{7} \right)$$

(b) Estimate the minimum number of families in this estate. (3 marks)

(b) If each family will pay a flat rate of Ksh 375 per month towards the cost of water, how much will the estate pay per month? (2 marks)

(d) The rate of paying for water per month will be increased in the ratio 3:5 from the start of next month. Calculate the new cost of water per month for the estate. (2 marks)

24. Using a ruler and a compasses only construct triangle ABC such that $AB = 4$ cm, $BC = 5$ cm and angle $ABC = 120^\circ$. Measure AC.

(3 marks)

On the diagram, construct a circle which passes through the vertices of the triangle ABC. Measure the radius of the circle. (4 marks)

Measure the shortest distance from the centre of the circle to the line BC (1 mark)

Determine the length of arc BC. (2 marks)