

# TESO NORTH JOINT EVALUATION TEST

TENJET - 2023

Kenya Certificate of Secondary Education (K.C.S.E.)

## 121/1 - MATHEMATICS PAPER 1

JULY-AUGUST 2023

TIME: 2½ Hours

Name: ..... Index No: .....

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

### Instructions to candidates

- (a) Write your **name** and **index number** in the spaces provided above.
- (b) Sign and write the **date** in the space provided above.
- (c) This paper contains **two** sections: **Section I and II**.
- (d) Answer **all** the questions in **Section 1** and any **five** questions from **Section II**.
- (e) All working and answers **must** be written on the question paper in the spaces provided below each question.
- (f) Show **all** steps in your calculations, giving your answers at each stage in the spaces provided below each question.
- (g) marks) may be given for correct working even if the answer is wrong.
- (h) Non-programmable silent electronic calculators and KNEC mathematical tables may be used
- (i) Candidates will be penalized for **NOT** following the instructions given in this paper
- (j) **This paper consists of 16 printed pages.**
- (k) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

### FOR EXAMINER'S USE ONLY

#### SECTION I

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

#### SECTION II

Question	17	18	19	20	21	22	23	24	Total
Marks									

GRAND   
TOTAL

**SECTION I (50MARKS)**

*Answer ALL questions in this section.*

1. Evaluate (3 marks)

$$\frac{(2\frac{1}{4} - \frac{3}{4}) \times 3\frac{2}{3} \div 2\frac{1}{5}}{1\frac{4}{6} \div 1\frac{1}{4}}$$

2. Use square roots, reciprocal and square tables to evaluate to 4 significant figures the expression;  $(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2$  (4 marks)

3. Three similar 21 inch television sets and five similar 17 inch television cost Ksh.129,250. The difference between the cost of two 21inch television sets and four 17inch television sets is Ksh. 22,000. Calculate the price of a 21- inch television set and that of 17-inch television set. (3 marks)

4. Simplify: (3 marks)

$$\left[ \frac{a^3 - ab^2}{a^4 - b^4} \right]^{-1}$$

5. Solve for x in the equation. (3 marks)

$$9^{(2x-1)} \times 3^{(2x+1)} = 243$$

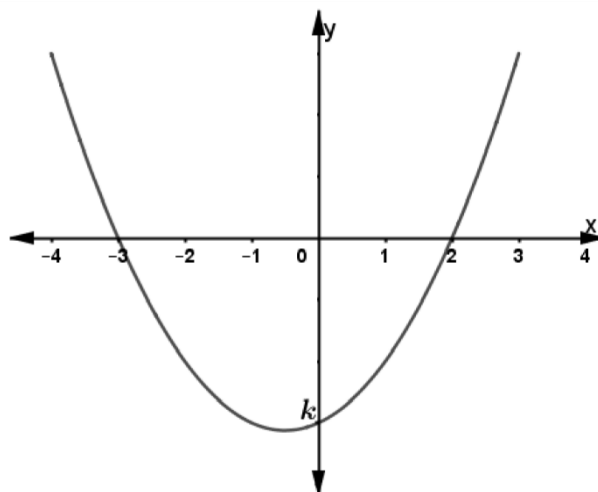
6. A classroom measures ( x + 2 ) m by ( x - 5 )m. If the area of the classroom is 60m<sup>2</sup>.  
Find its length. (3 marks)

7. A straight line  $L_1$  is perpendicular to another line  $L_2$  whose equation is  $3y+4x=12$ . If the two lines meet at point P which lies on the x-axis, find:

(i) The co-ordinate of point P (1 mark)

(ii) The equation of line  $L_1$  in the form of  $y= mx + c$  (2marks)

8. The graph below (not drawn to scale) is a plot for the function  $y = ax^2 + bx + k$  where  $a, b$  and  $k$  are constants.



Determine the values of  $a, b$  and  $k$ . (3 marks)

9. Three camps, P, Q and R shared 875 bags of beans donated by a charitable organization such that the ratio of P to Q was 2: 3 and that of R to Q was 5: 4. Find the number of bags of beans received by camp Q. (3marks)

10. (a) Find the range of values of  $x$  which satisfies the following inequalities simultaneously. (2 marks)

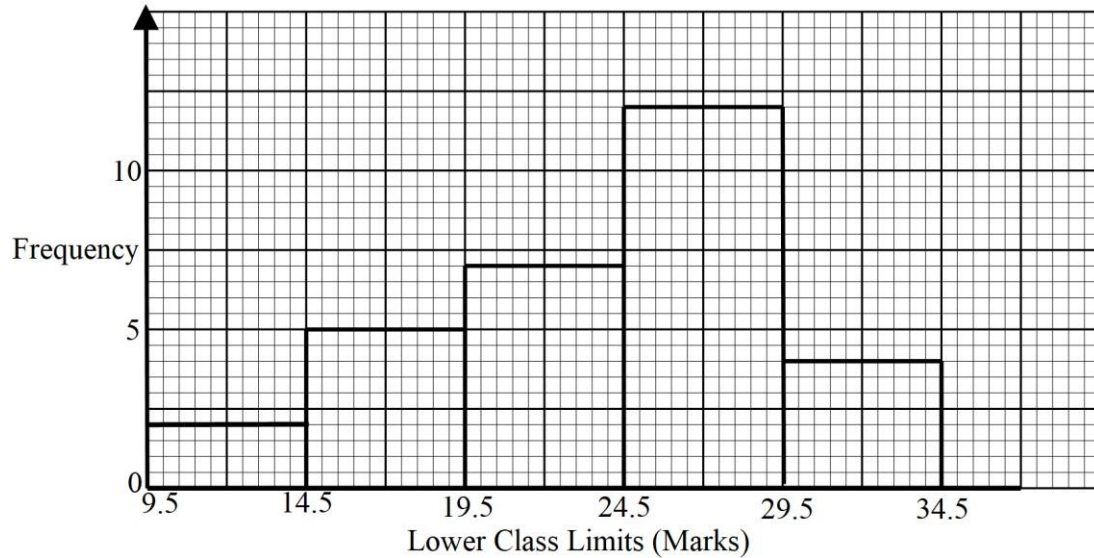
$$4x - 9 \leq x + 6$$

$$4 + x \geq 8 - 3x$$

- (b) Represent the range of values of  $x$  in (a) above on a number line. (1 mark)

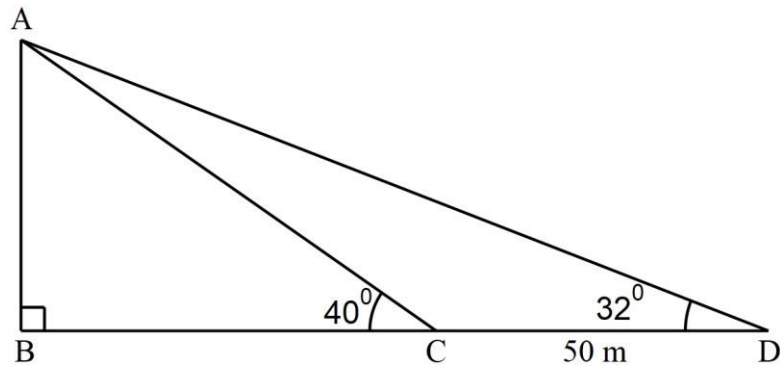
11. The graph below is a histogram showing the marks scored by students in a Mathematics contest.

Prepare a frequency distribution table for the data and hence determine the number of students who did the test (3 marks)



12. A sales lady earns a basic salary of Ksh 12 400 per month. In addition, she gets a 2% commission on the first Ksh 80 000 worth of good and a further 3% commission on goods worth over Ksh 80 000. In a certain month, she earned a total of Ksh 20 000. Calculate the value of the goods sold that month. (3 marks )

13. The figure below shows a vertical mast AB. The angles of elevation of the top of the mast from two points C and D on the level ground are  $40^\circ$  and  $32^\circ$  respectively. The distance CD is 50 metres.



Calculate the distance BC, of the tower correct to 1 decimal place (4 marks)

14. The heights of two similar pails are 12cm and 8cm. The larger pail can hold 2 litres. What is the capacity of the smaller pail? Give your answer to 2 decimal places. (3 marks)

15. Using a ruler and pair of compasses only
- (a) Construct triangle  $ABC$  in which  $BC=8\text{cm}$  angle  $ABC =105^\circ$  and angle  $BAC=45^\circ$ . (2 marks)
- (b) Drop a perpendicular from  $A$  to meet  $CB$  produced at  $P$ . (1 mark)
16. A metal bar  $14\text{cm}$  long and  $5\text{cm}$  in diameter is melted down and cast into circular washers. Each washer has an external diameter of  $4\text{cm}$  and internal diameter of  $1.5\text{cm}$  and is  $0.3\text{cm}$  thick. Calculate the number of complete washers obtained  
Take  $\pi = \frac{22}{7}$  (3 marks)

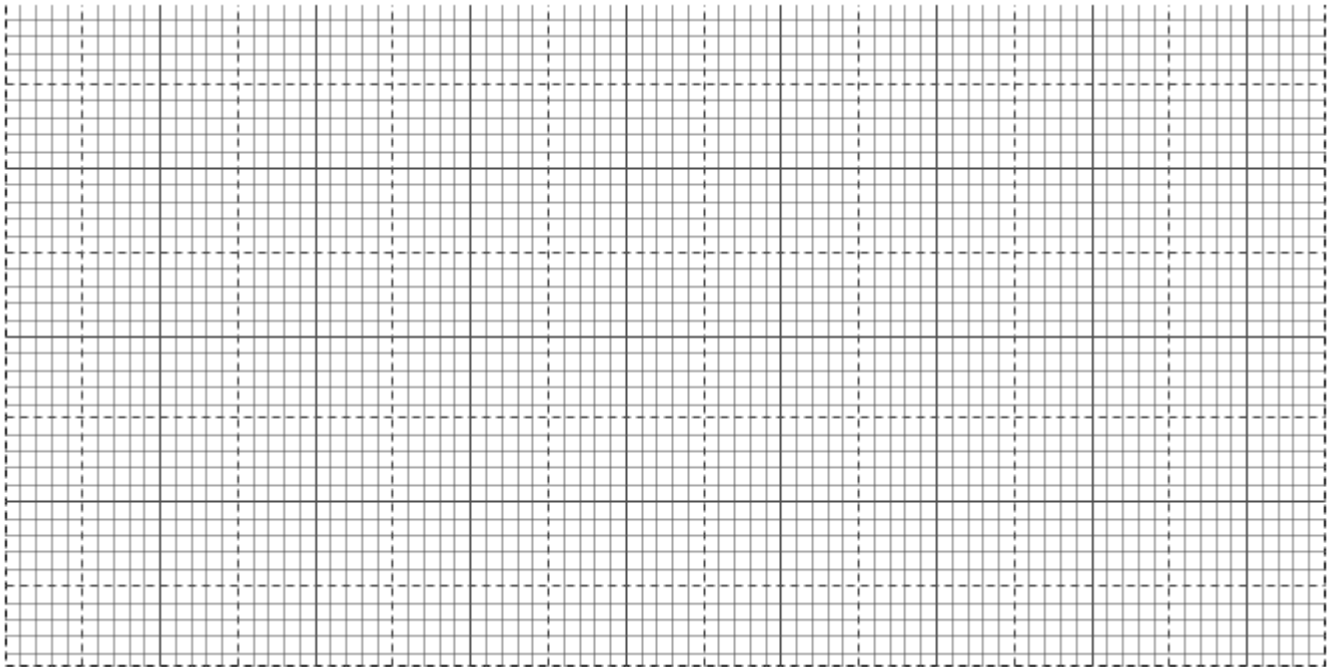


**SECTION II (50 MARKS)**

*Answer any five questions in this section.*

17. Three Kenyan warships *A*, *B* and *C* are at sea such that ship *B* is 450km on a bearing of  $030^\circ$  from ship *A*. Ship *C* is 700km from ship *B* on a bearing of  $120^\circ$ . An enemy ship *D* is sighted 1000km due south of ship *B*.
- (a) Taking a scale of 1cm to represent 100km locate the position of the ships *A*, *B*, *C* and *D*. (4 marks)
- (b) Find the compass bearing of:
- (i) Ship *A* from ship *D* (1 mark)
- (ii) Ship *D* from ship *C* (1 mark)
- (c) Use the scale drawing to determine
- (i) The distance of *D* from *A* (1 mark)
- (ii) The distance of *C* from *D* (1 mark)
- (d) Find the bearing of:
- (i) *B* from *C* (1 mark)
- (ii) *A* from *C* (1 mark)

18. The coordinates of a triangle  $ABC$  are  $A(1, 1)$ ,  $B(3, 1)$  and  $C(1, 3)$ .
- (a) Plot the triangle  $ABC$ . (1 mark)
  - (b) Triangle  $ABC$  undergoes a translation vector  $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ . Obtain the image of  $A'B'C'$  under the transformation, write the coordinates of  $A'B'C'$ . (2 marks)
  - (c)  $A'B'C'$  undergoes a reflection along the line  $X = 0$ , obtain the coordinates and plot on the graph points  $A''B''C''$ , under the transformation (2 marks)
  - (d) The triangle  $A''B''C''$ , undergoes an enlargement scale factor  $-1$ , centre origin. Show its image  $A'''B'''C'''$ . (2 marks)
  - (e) The triangle  $A'''B'''C'''$  undergoes a rotation centre  $(1, -2)$  angle  $120^\circ$  to give  $A^{iv}B^{iv}C^{iv}$ . Show this triangle (2 marks)
  - (f) Name any two triangles which are directly congruent. (1 mark)



19. Water flows through a cylindrical pipe of diameter 7 cm at a rate of 15 m per minute.
- (a) Calculate the capacity of water delivered by the pipe in one minute in litres. Use  $\pi = \frac{22}{7}$ . (3 marks)
- (b) A storage tank that has a circular base and depth 12 m is filled with water from this pipe and at the same rate of flow. Water begins flowing into the empty storage tank at 6.30 a.m. and is full at 1310 hours. Calculate the area of the cross-section of this tank in square metres. (4 marks)
- (c) A school consumes the capacity of this tank in one month. The cost of water is Ksh. 100 for every 1 000 litres and a standing charge of Ksh 1 950. Calculate the cost of the school's water bill for one month. (3 marks)

20. (a) Find  $\mathbf{A}^{-1}$  given that  $\mathbf{A} = \begin{pmatrix} 8 & 12 \\ 9 & 15 \end{pmatrix}$  (1 mark)

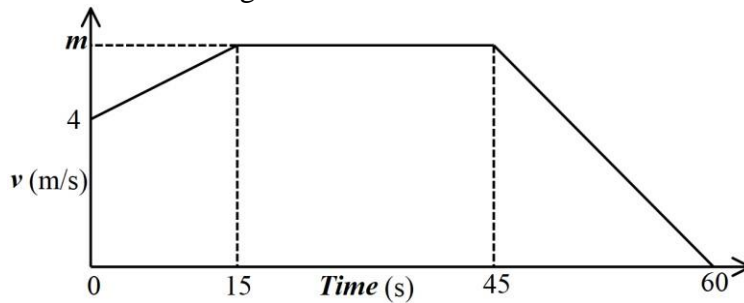
An ICT firm bought 8 printers and 12 copiers for a total of Ksh 294 000. Had the firm bought 1 more printer and 3 more copiers, it would have spent Ksh 43 500 more. Form two equations to represent the information above. (2 marks)

Hence, using  $\mathbf{A}^{-1}$  in (a) above, calculate the cost of each item. (4 marks)

- (b) A two-digit number is such that the difference between tens and ones digit is 1. If the digits are reversed, the sum of the two numbers is 165. Find the original number (3 marks)

21. (a) Two trains, *A* and *B* are such that they are 40 m long and 160 m long respectively. Their speeds are 60 km/hr and 40 km/hr respectively. The two trains are 100m apart and moving towards the same direction in a pair of parallel tracks. Calculate the time in seconds it takes train *B* to completely overtake train *A*. (4 marks)

- (b) The figure below (not drawn to scale) shows a velocity time graph for a robot in a robotic challenge.

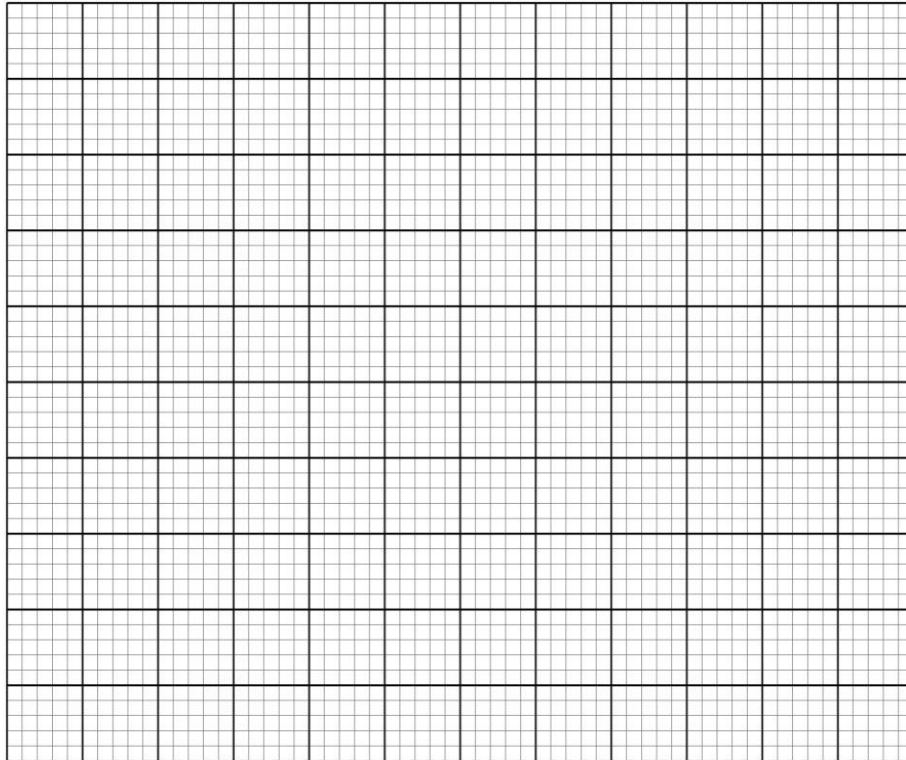


- (i) If the distance covered by the robot in the first 15 seconds was 180 metres, calculate the value of  $m$  (3 marks)
- (ii) Describe the movement of the robot between the 15<sup>th</sup> and 45<sup>th</sup> seconds. (1 mark)
- (iii) Calculate the deceleration of the particle in the last 15 seconds. (2 marks)

22. (a) Complete the table below for the curve  $y = x^3 - 5x^2 + 2x + 9$  for  $-2 \leq x \leq 5$

$x$	-2	-1	0	1	2	3	4	5
$y$			9					

(b) On the grid provided, draw the graph of  $y = x^3 - 5x^2 + 2x + 9$  for  $-2 \leq x \leq 5$ .  
(3 marks)

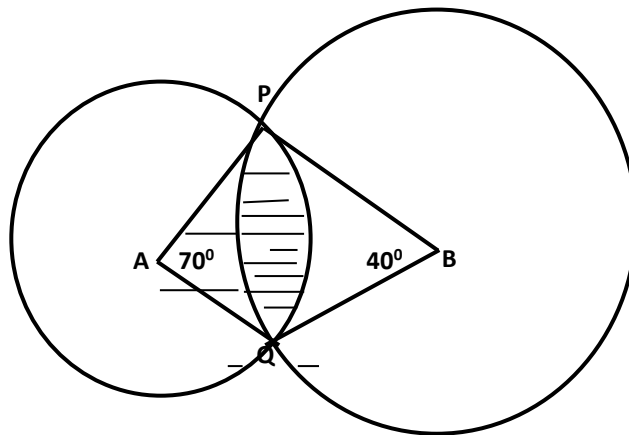


(c) Use the graph in (b) above to find the roots to the following equations:

(i)  $x^3 - 5x^2 + 2x + 9 = 0$  (2 marks)

(ii)  $x^3 - 5x^2 + 6x = -5$  (3 marks)

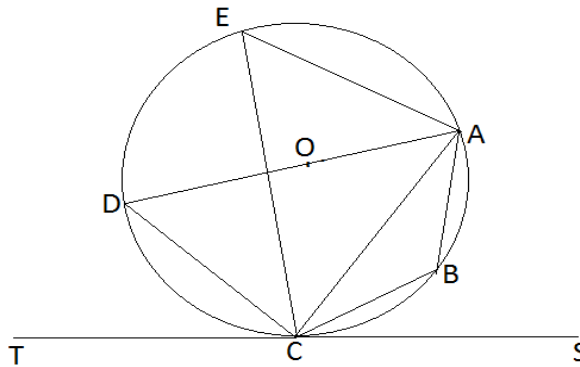
23. The diagram below shows two circles, centre  $A$  and  $B$  which intersect at points  $P$  and  $Q$ .  
 Angle  $PAQ = 70^\circ$ , angle  $PBQ = 40^\circ$  and  $PA = AQ = 8\text{cm}$ .



Use the diagram to calculate

- (a)  $PQ$  correct to 2 decimal places (2 marks)
- (b)  $PB$  correct to 2 decimal places (2 marks)
- (c) Area of the minor segment of the circle whose centre is  $A$  (2 marks)
- (d) Area of the minor segment of the circle whose centre is  $B$  (2 marks)
- (e) Area of the shaded region. (2 marks)

24. In the figure below DA is a diameter of the circle ABCDE centre O. TCS is a tangent to the circle at C,  $AB = BC$  and angle  $DAC = 38^\circ$



Giving reasons, determine the following angles:

- (a)  $\angle DCT$  (2 marks)
  
- (b)  $\angle DEA$  (2 marks)
  
- (c)  $\angle ACB$  (2 marks)
  
- (d)  $\angle BDC$  (2 marks)
  
- (e)  $\angle BOA$  (2 marks)

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