

NAME INDEX NUMBER.....

121 /1

Candidate's signature

MATHEMATICS ALT A

Class:

Date.....

TIME: $2\frac{1}{2}$ HRS

KCSE 2023 TOP PREDICTION MASTER CYCLE 6

Instructions to candidates

- (a) Write your **name** and **index** in the spaces provided above.
- (b) Sign and write the date of the examination in the spaces provided above.
- (c) The paper contains **TWO** Sections: **Section I** and **Section II**.
- (d) Answer **ALL** the questions in Section I and **Only five** questions from **Section II**.
- (e) All answers and working must be written on the question paper in the spaces provided below each question.
- (f) **Show all the steps in your calculations, giving your answers at each stage in the spaces 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 except where stated otherwise.
- (i) This paper consists of **15** printed pages.
- (j) **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

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

SECTION I (50 marks)

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

1. All odd numbers from 1 – 10 are arranged in descending order to form a number.

(a)(i) Write the number (1 mark)

(ii) Write the total value of the second digit of the number formed in (a) (i) (1 mark)

(iii) Express the value of the number in (a) (ii) as a product of its prime factors in power form. (2 marks)

2. A shopkeeper bought a bag of sugar. He intends to repack the sugar in 40 g, 250 g and 750 g .
Determine the least mass in grams of sugar that was in the bag. (3 marks)

3. Given that $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$ without using tables or calculator find $\log 0.036$ correct to 4 significant figures. (3 marks)

4. Evaluate $\frac{\frac{1}{2} \text{ of } \frac{3}{2} + 1\frac{1}{2} \left(2\frac{1}{2} - \frac{2}{3} \right)}{\frac{3}{4} \text{ of } 2\frac{1}{2} \div \frac{1}{2}}$

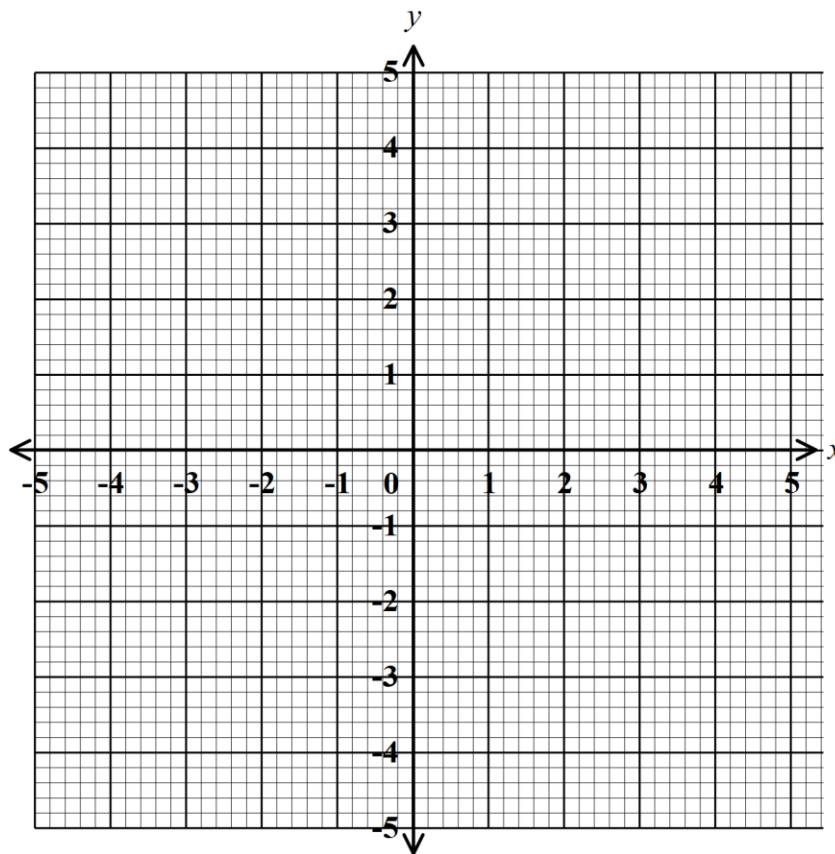
(3 marks)

5. Using the grid provided below, solve the simultaneous equation

(3 marks)

$$3x - 4y = 10$$

$$5x + 7y = 3$$



6. Given that a chord of length 10 cm subtends an angle of 1.2° at the circumference of the circle. Calculate the radius of the circle.

(3 marks)

7. When a shopkeeper sells articles at Ksh 24.05, he makes a 30% profit on the cost price. During a sale, he reduced the price of each article to Ksh 22.95. Calculate the percentage profit on an article sold at the sale price. (3 marks)

8. The size of one interior angle of an irregular polygon is 80° . Each of the other interior angles is 128° . Find the number of sides of the polygon. (3 marks)

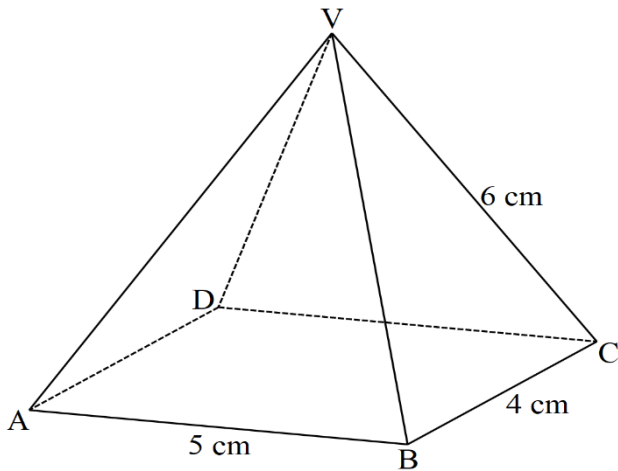
9. Simplify $81^{\frac{3}{4}} - \left(\frac{1}{5}\right)^{-1} - 27^0$ (2 marks)

10. Given the inequalities $x - 6 \leq -3x + 2 < -2x + 9$

(a) Solve the inequality (3 marks)

(b) Represent on a number line (1 mark)

11. The diagram below represents a right rectangular based pyramid of 5 cm by 4 cm. The slant edge of the pyramid is 6 cm. Draw and label the net of the pyramid. (3 marks)



12. Vectors $\mathbf{OA} = 4i + 3j$, $\mathbf{OB} = -2i - j$ and $\mathbf{OC} = -5i - 3j$. Show that points A, B and C are collinear.

(3 marks)

13. Find the period, amplitude and phase angle of the function $2y = 3 \sin\left(\frac{1}{2}x - 60^\circ\right)$ (3 marks)

14. Simplify $\frac{20 - 11x - 3x^2}{16x - 12x^2}$ (3 marks)

15. Write the following ratios in ascending order 2:3, 15:16, 7:6 , 13:15

(3 marks)

16. Under an enlargement, the image of the points A(3,1) and B(1,2) are A'(3,7) and B'(7,5).

Find the centre and scale factor of enlargement.

(4 marks)

SECTION II (50 marks)

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

17. A straight line passes through P(-1,1) and Q(3,4).

(a) Find the length of line PQ (2 marks)

(b) Find the equation of the perpendicular bisector of line PQ, leaving the equation in the form $y = mx + c$ (4 marks)

(c) Determine the equation of line parallel to line PQ and passes through point (2,3), leaving your answer in double intercept form. Hence state the y intercept. (4 marks)

18. The marks scored by 30 students in test were recorded as follows

41 43 34 28 19 22
32 38 22 18 25 33
30 41 36 31 28 37
35 34 19 22 29 23
29 44 26 27 29 36

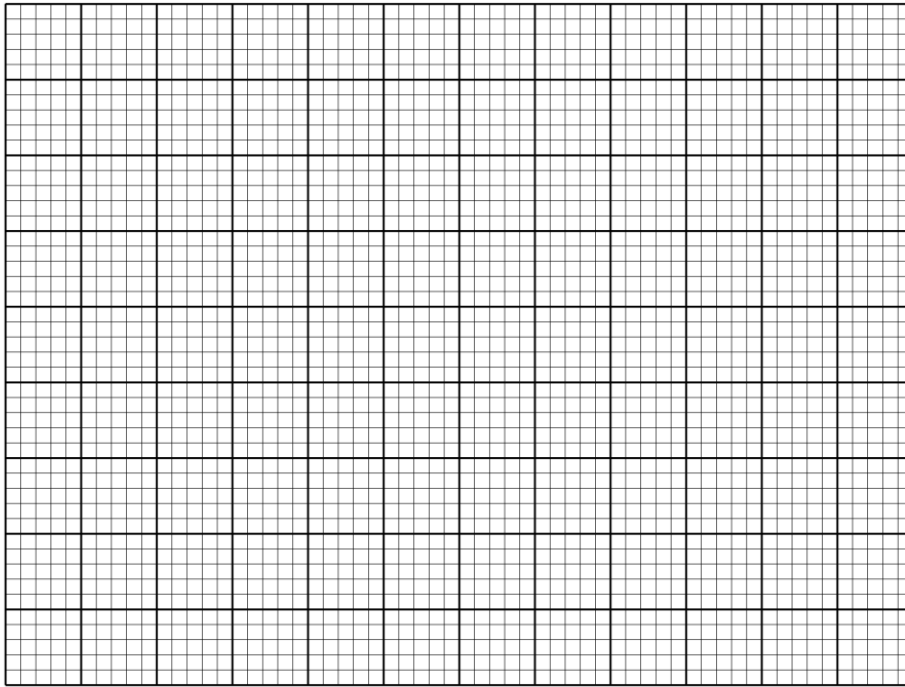
(a) Starting with the class 18–22 , make a frequency distribution table for the data. (2 marks)

(b) Using the frequency distribution in (a) above calculate :

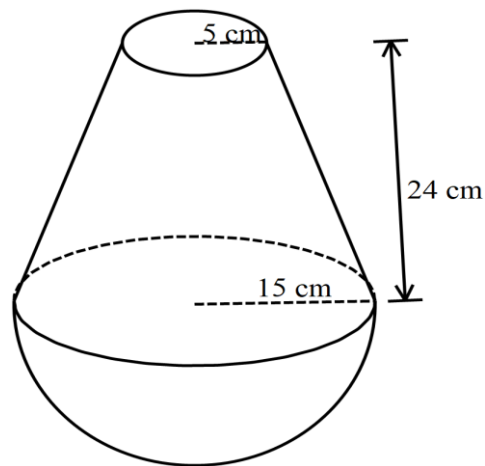
(i) the mean (2 marks)

(ii) the median (3 marks)

(c) Draw a frequency polygon to represent the data. (3 marks)



19. The solid below is made up of hemispherical part and a frustum of cone. The top and bottom radius of the frustum are 5 cm and 15 cm respectively. The vertical height of the frustum is 24 cm .



(a) Determine the vertical height of the cone from which the frustum was cut. (2 marks)

(b) Calculate

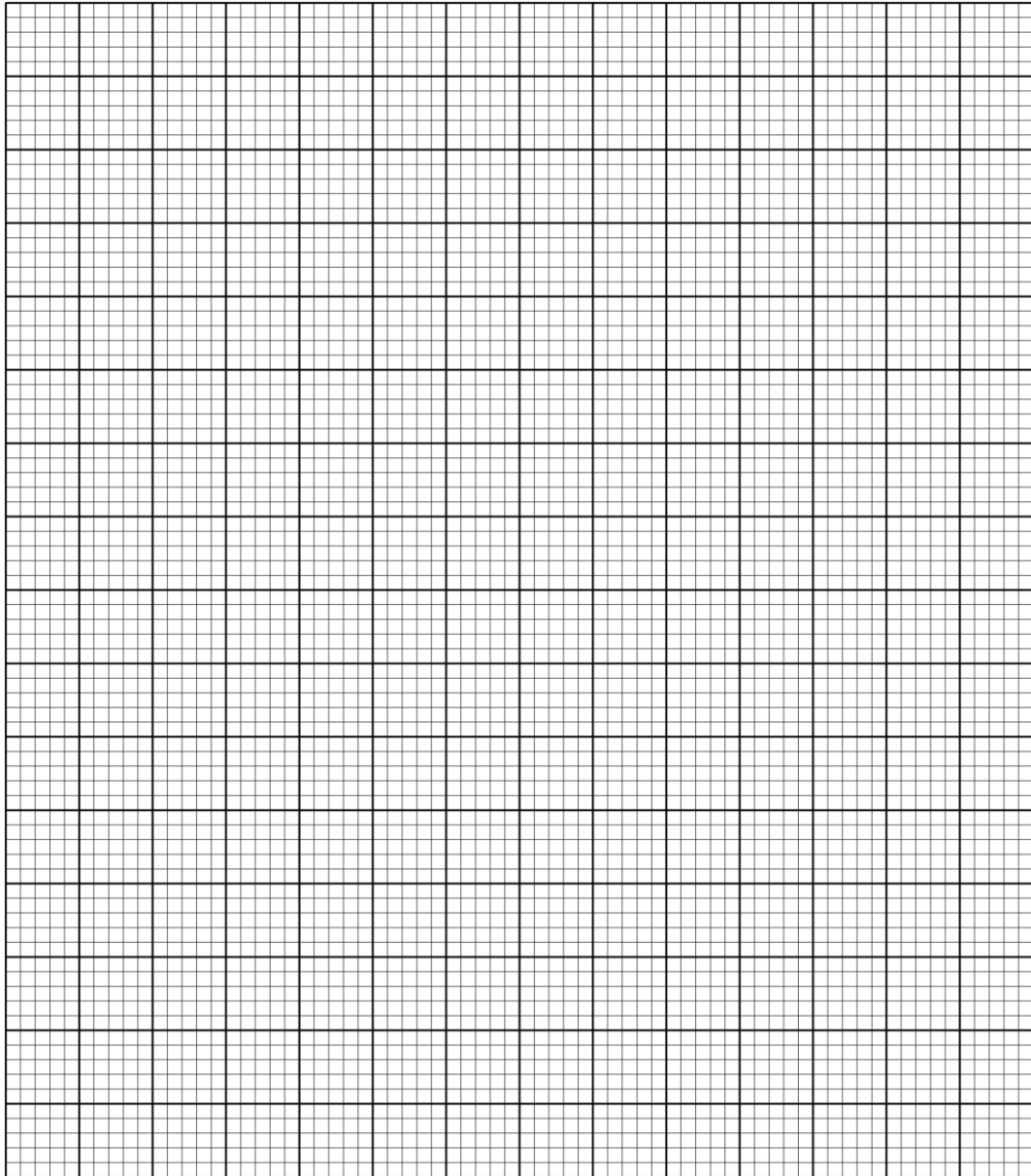
(i) The volume of the solid correct to 2 decimal places (3 marks)

(ii) The surface area of the solid correct to 2 decimal places

(5 marks)

20. (a) (i) Draw the graph of the function $y = 2x^2 - 3x - 5$ for $-2 \leq x \leq 3$

(5 marks)

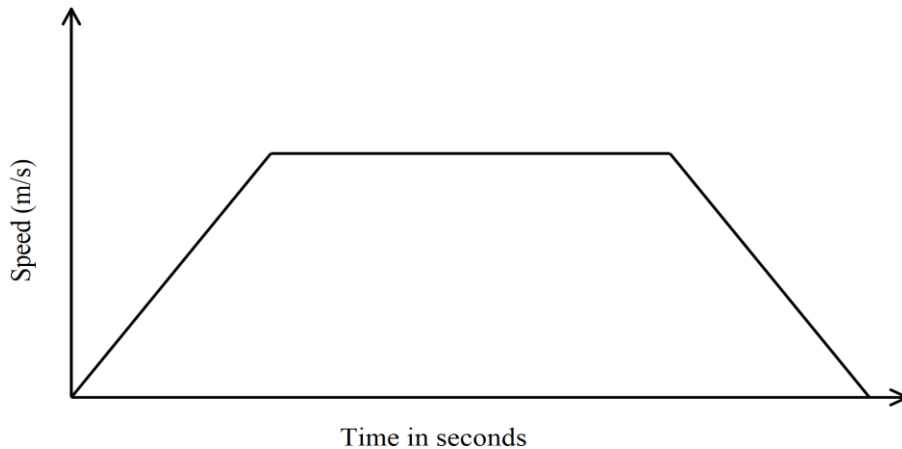


(ii) Use the graph to solve the equation $2x^2 - 3x - 5 = 0$ (1 mark)

(b) Use the graph to solve the simultaneous equation $y = 2x^2 - 3x - 5$ and $y = -2x - 2$ (3 marks)

(c) Write down the quadratic equation which the line $y = -2x - 2$ is solving. (1 marks)

21. The diagram below shows the speed time graph for a bus travelling between two stations, the bus starts from rest and accelerates uniformly for 75 seconds. It then travels at constant speed for 150 seconds and finally decelerates uniformly for 100 seconds.



- (a) Given that the distance between the two stations is 5225 m . Calculate

(i) maximum speed in km/h attained by the bus. (3 marks)

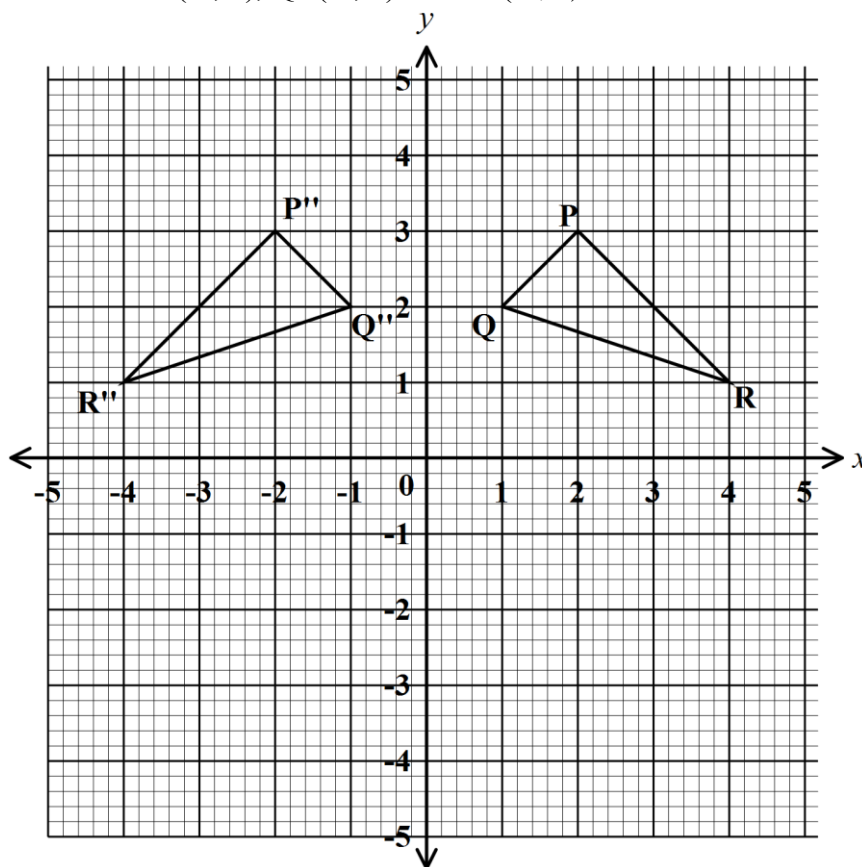
(ii) the acceleration of the bus (2 marks)

- (c) A van left Nairobi at 8.30 a.m and travelled towards Mombasa at an average speed of 80 km/h . At 8.30 am a car left Nairobi and travelled along the same road at an average speed of 120 km/h .

(i) Calculate the distance covered by the car to catch up with the van. (4 marks)

(ii) Find the time of the day when the car caught up with van. (1 mark)

22. On the Cartesian plane below, triangle PQR has vertices P(2, 3), Q(1, 2) and R(4, 1) while triangle P''Q''R'' has vertices P''(-2, 3), Q''(-1, 2) and R''(-4, 1).



- (a) Describe fully the transformation which maps triangle PQR onto triangle P''Q''R''.
(1 mark)
- (b) On the same plane, draw triangle P'Q'R', the image of triangle PQR under a reflection in the line $y = -x$.
(2 marks)
- (c) Describe fully a single transformation which maps triangle P'Q'R' onto triangle P''Q''R''.
(2 marks)
- (d) Draw triangle P'''Q'''R''' such that it can be mapped onto triangle PQR by a positive quarter turn about (0, 0).
(3 marks)
- (e) State a pair of triangles that is
 i) oppositely congruent (1 mark)
 ii) directly congruent (1 mark)

23. The equation of the curve is $y = x^3 - 2x^2 - 1$

(a) Determine

(i) the stationary points

(4 marks)

(ii) the nature of the stationary points in (a) (i) above

(2 marks)

(b) Determine

(i) the equation of the tangent to the curve at $x = 1$

(2 marks)

(ii) the equation of the normal to the curve at $x = 1$

(2 marks)

24. The boundaries of ranch ABCD are straight lines such that B is 075° from A and a distance of 50 km. C is due east of B and a bearing of $N80^{\circ}E$ from A. D is due south of C and a distance of 70 km.

(a) Using a scale of **1 cm** to represent **10 km**, show the relative positions of ABCD.

(3 marks)

(b) From the scale drawing, determine

(i) the distance in kilometres between B and C

(2 marks)

(ii) the bearing of A from D
(2 marks)

(2)

(iii) the shortest distance from A to border CD

(1 mark)

(c) Calculate the area of the ranch in square kilometer.

(2 marks)