121/2
MATHEMATICS
PAPER 2
Time: $2\frac{1}{2}$ hours

KCSE 2023 TOP PREDICTION MASTER CYCLE 9

Name …….Index Number……...

Candidate's Signature …… Date…….

Instructions to candidates

1. Write your name, admission number and class in the spaces provided above.
2. The paper contains two sections: **Section I** and **Section II**.
3. Answer **ALL** the questions in **Section I** and **ANY FIVE** questions from **Section II**.
4. All working and answers must be written on the question paper in the spaces provided below each question.
5. Marks may be awarded for correct working even if the answer is wrong.
6. Negligent and slovenly work will be penalized.
7. Non-programmable silent electronic calculators and mathematical tables are allowed for use.
8. ***This booklet contains 12 printed pages. Please confirm that all the pages exist and are properly printed before starting the exam.***

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. Use logarithms to evaluate; (4 marks)

$$\left(\frac{6.79 \times 0.3911}{\log 5}\right)^{\frac{3}{4}}$$

2. The equation of a line is $-\frac{3}{5}x + 3y = 6$. Find the

   a) Gradient of the line. (1mk)

   b) Equation of a line passing through point $(-1, 2)$ and perpendicular to the given line. (3mks)

3. Find the circle center and radius whose equation is

   $3x^2 + 3y^2 + 18x - 6y + 18 = 0$ (3mks)

4. Simplify $\frac{\sqrt{11}}{\sqrt{11}-\sqrt{7}}$ (2mks)

5. The length and width of a rectangular signboard are $(3x + 12)\ cm$ and $(x - 4)cm$ respectively. If the diagonal of the signboard is 200 cm, determine its area (4 mk)

6. $3cm^3$ of water is added to $2cm^3$ of a certain medicine which costs sh.12 per cm^3.
The chemist sells the diluted medicine at sh.6 per cm^3. Calculate the percentage profit. (3mks)

7. Use the expansion of $(x - y)^5$ to evaluate $(9.8)^5$ correct to 4 d.p. (3 mks)

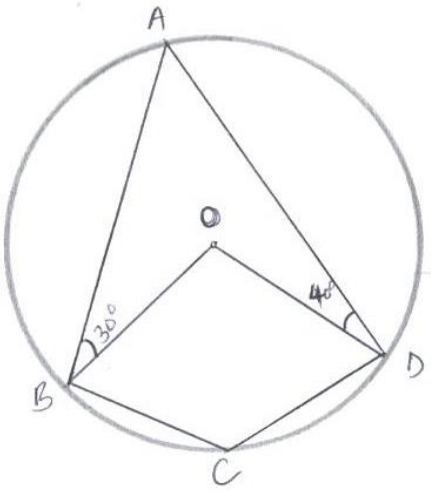
8. Solve for x in the equation

$27^{x-1} \times 3^{x+1} = 729$ (3 mks)

9. Make y the subject of formula: (3 mks)

$$P = \frac{xy}{x - y}$$

10. In the figure below, ABCD is a cyclic quadrilateral. Point O is the centre of the circle. $\angle ABO = 30°$ and $\angle ADO = 40°$.



Calculate the size of angle BCD. (2 marks)

11. Find the number of terms of the series $2 + 6 + 10 + 14 + 18 \ldots$ that will give a sum of 800. (2 mks)

12. A bag contains 10 balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the bell chosen is red. (3mk)

13. The point $(5,2)$ undergoes the transformation $\begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$ followed by a translation $\binom{-6}{11}$. Determine the coordinates of the image. (3 mks)

14. The dimensions of a rectangle are given as 4.1cm by 2.8cm. Calculate the relative error in the area. (3mks)

15. Using a ruler and a pair of compass only;

a) Construct a parallelogram PQRS in which PQ = 6 cm, and QR = 4 cm and $\angle SPQ = 75°$ (3mks)

b) Determine the perpendicular distance between PQ and SR. (1mk)

16. Solve for x in the equation

$2\sin^2 x - 1 = \cos^2 x + \sin x$, where $0^0 \leq x \leq 360^0$. (4Mks)

SECTION II (50 Marks)

Answer any five questions in the spaces provided in this section

17. Two blends of tea costing Ksh. 140 and Ksh.160 per kg respectively are mixed in the ratio 2:3 by mass. The mixture is sold at sh.240 per kg.

i) Find the percentage profit (2 mks)

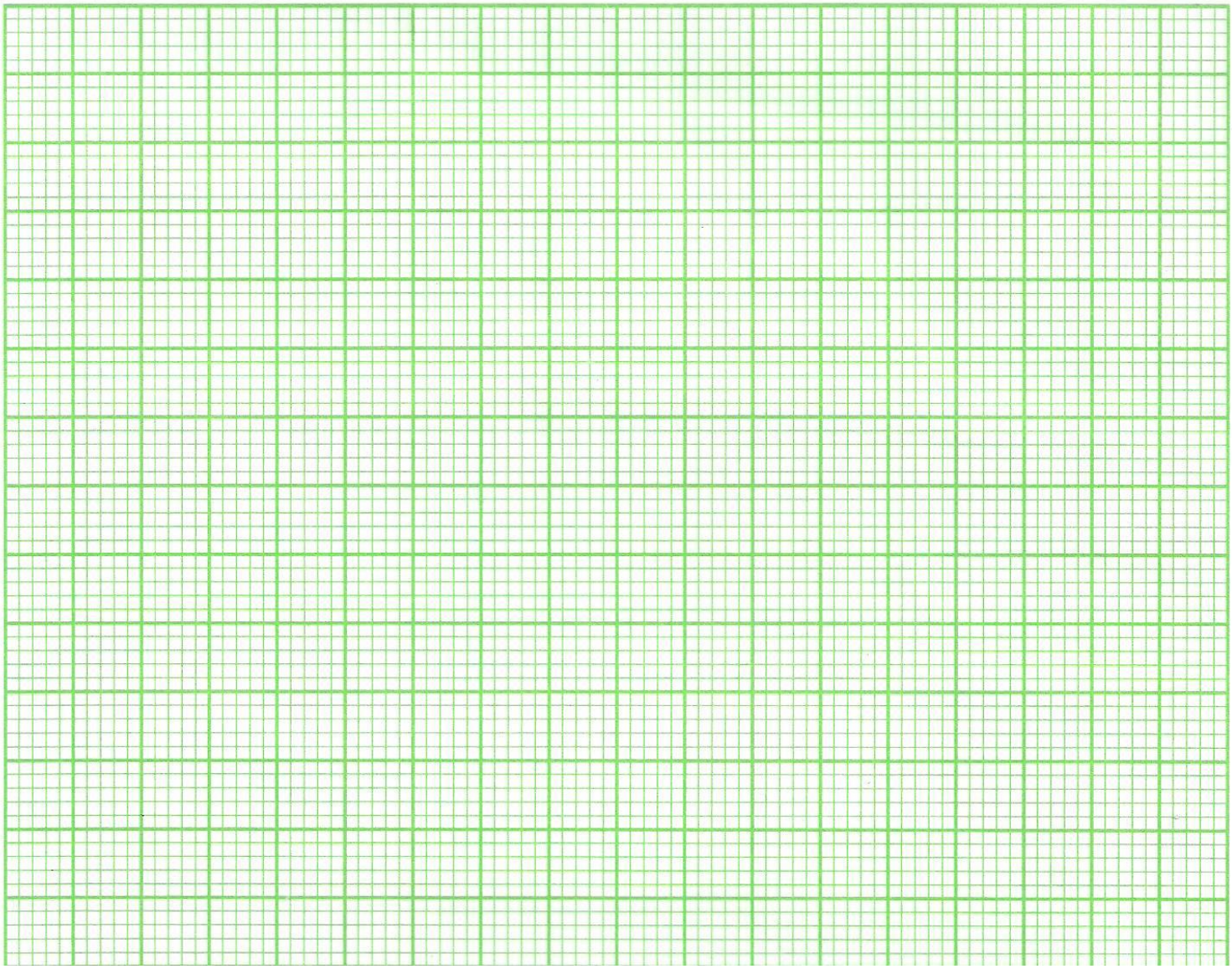
ii) In what ratio should the two blends be mixed to get a mixture that costs sh.148 per kg (2mks)

b) A quantity P is partly constant and partly varies as the cube of Q. when Q = 2, P = 50 and when Q =4, P =330. Find the value of Q when P= 16885 (6 mks)

18. (a) Complete the table for the function $y = \frac{1}{2}Sin\ 2x$, **where $0^0 \leq x \leq 360^0$** (2 mks)

x	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
2x	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0	600^0	660^0	720^0
$\mathbf{Sin\ 2x}$	0^0	0.866			0^0				0.866		-0.866		
$\mathbf{\sin\frac{1}{2}Sin\ 2x}$	0^0	0.433			0^0								

(b) On the grid provided, draw the graph of the function $\mathbf{y = \frac{1}{2}\sin 2x}$ for $\mathbf{0^0 \leq x \leq 360^0}$ using the scale 1 cm for 30^0 on the horizontal axis and 4 cm for 1 unit of axis. (3mks)



(c) Use your graph to determine the amplitude and period of the function $\mathbf{y = \sin \frac{1}{2}\sin 2x}$ (2 mks)

(d) Use the graph to solve

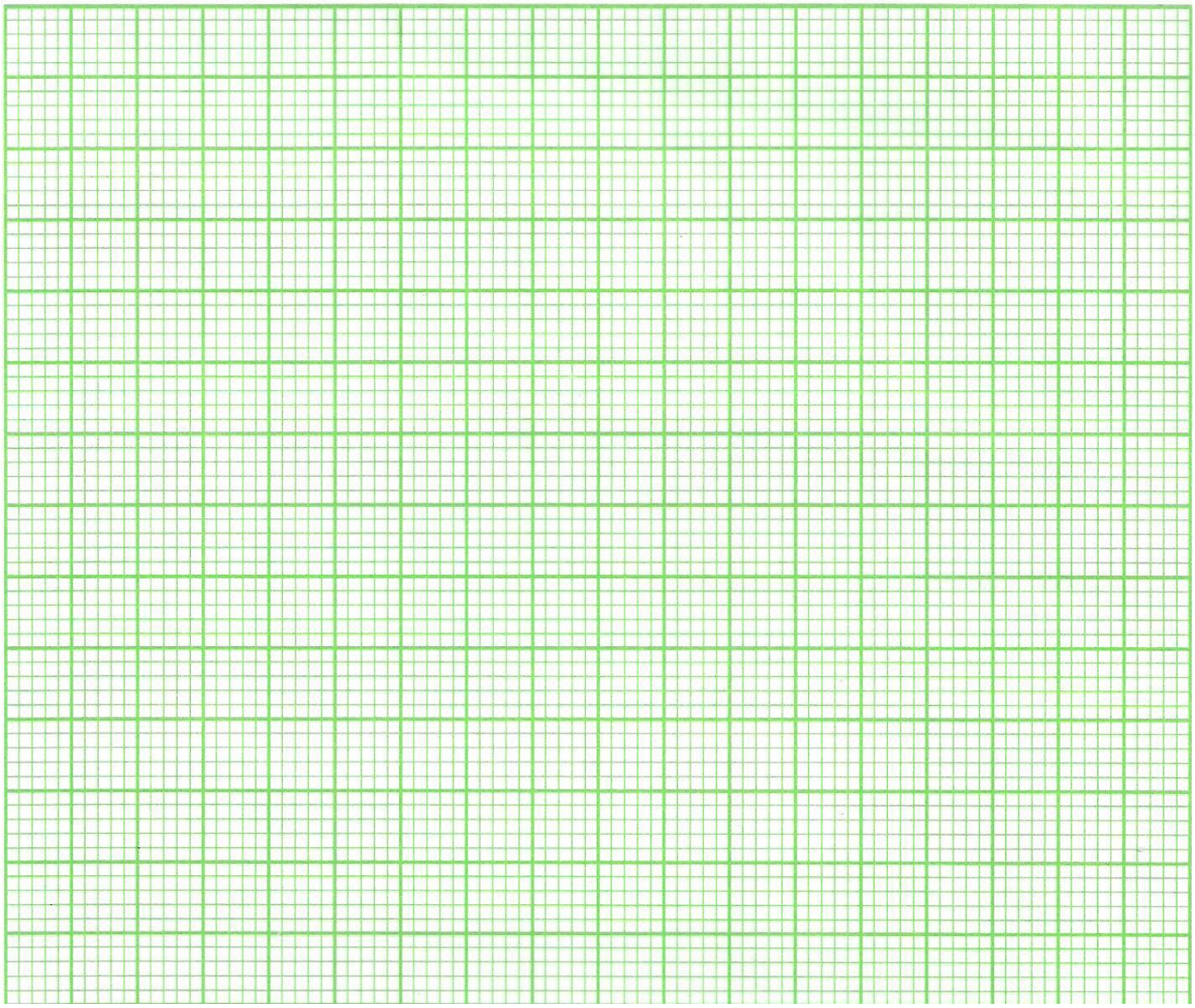
(i) $\frac{1}{2}\text{Sin } 2x = 0$ (1 mk)

(ii) $\frac{1}{2}\text{Sin } 2x - 05 = 0$ (2 mks)

19. The marks of 50 students in a mathematics test were taken from a form 4 class and recorded in the table below.

Mark (%)	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	5	7	9	11	8	5	3

a) On the grid provided, **draw** a cumulative frequency curve of the data. (3mks)



Take: 1cm to represent 5 students on the vertical scale and **1cm to represent 10** marks on the horizontal scale.

b) From your curve in (a) above

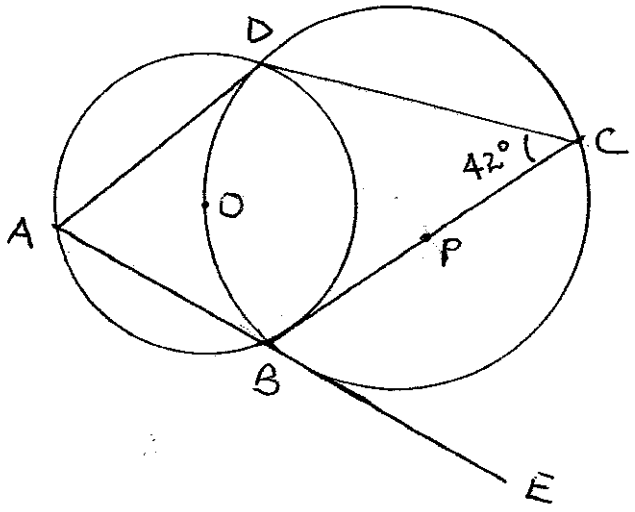
(i) **Estimate** the median mark. (1mk)

(ii) **Determine** the Interquartile deviation. (2mks)

(iii) **Determine** the 10^{th} to 90^{th} percentile range. (2mks)

a) It is given that students who score over 45 marks pass the test. Use graph in (a) above to **estimate** the percentage of students that pass. (2mks

20.



Giving reasons, determine the size of:

a) Angle CBD (2 mks)

b) Angle ODB (2 mks)

c) Angle BAD (2 mks)

d) Angle ABC (2 mks)

e) Angle ODA (2 mk)

21. The gradient function of a curve is given by the expression $2x + 1$. If the curve passes through the point $(-4, 6)$,

a) Find;

i. The equation of the curve. (3 mks)

ii. The values of x at which the curve cuts the x- axis. (3 mks)

b) Determine the area enclosed by the curve and the x- axis. (4 mks)

22. Three consecutive terms of a geometric progression are 3^{2x+1}, 9^x and 81 respectively.

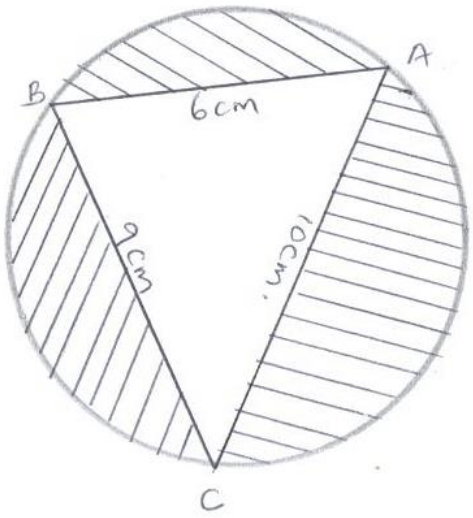
(a) Calculate the value of **x**. (3 mks)

(b) Find the common ratio of the series. (2 mks)

(a) Calculate the sum of the first 10 terms of the series. (2 mks)

(b) Given that the fifth and the seventh terms of this G.P form the first two consecutive terms of an arithmetic sequence. Calculate the sum of the first 20 terms of the arithmetic sequence. (3 mks)

23. The figure below shows a triangle ABC inscribed in a circle (not drawn to scale.) AB = 6 cm, BC = 9 cm and AC = 10 cm.



Calculate;

a) The radius of the circle. (6 mks)

b) The area of the shaded parts. (4 mks)

24. P, Q and R are three villages such that PQ = 10km, QR = 8km and PR = 4km where PQ, QR and PR are connecting roads.

(a) Using a scale of 1cm rep 1 km, locate the relative positions of the three villages (2Mks)

(b) A water tank T is to be located at a point equidistant from the three villages. By construction locate the water tank T and measure its distance from R. (3 Mks)

(c) Determine the shortest distance from T to the road PQ by construction (2 Mks)

(d) Determine the area enclosed by the roads PQ, QR and PR by calculation (3Mks)