

121/2
MATHEMATICS
PAPER 2
TIME: 2 ½ HOURS.

KCSE 2023 TOP PREDICTION MASTER CYCLE 10

Name: Index No.:.....

Candidate's Sign:..... Date:.....

INSTRUCTIONS TO CANDIDATES

- a) Write your **name** and **index number** in the spaces provided above.
- b) Sign and write **date** of examination in the spaces provided above.
- c) This paper consists of **two** sections; **Section I** and **Section II**.
- d) Answer **All** 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
- f) question.
- g) Show all the steps in your calculations giving answers at each stage in the spaces provided below each
- h) question.
- i) Marks may be given for correct working even if the answer is wrong.
- j) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.
- k) This paper consists of 15 printed pages. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.
- m) Candidates should answer questions in **English**.

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 1 (50 MARKS)

Attempt all questions.

1. Factorise $x^2 - y^2$, hence evaluate $3282^2 - 3272^2$ (3mks)
2. Find $\cos x - \sin x$, if $\tan x = \frac{3}{4}$ and $90^\circ \leq x \leq 360^\circ$ (3mks)
3. Expand $\left[1 - 2x\right]^6$ up to the fourth term. Hence use your expansion to evaluate $(1.02)^6$ to four decimal places. (4mks)
4. The average of the first and fourth terms of a GP is 140. Given that the first term is 64. Find the common ratio. (3mks)

$$\frac{\quad}{b^2 - d}$$

6. Two variables P and Q are such that P varies partly as Q and partly as the square root of Q. Determine the equation connecting P and Q. When $Q=16$, $P=500$ and when $Q = 25$, $P = 800$ (4mks)
7. **Calculate** the interest on sh 10,000 invested for $1 \frac{1}{2}$ years at 12 % p.a. Compounded semi-annually. (3 mks)
8. Given that $x=2i+j-2k$, $y= -3i+4j-k$ and $z =5i + 3j+2k$ and that $P= 3x-y+2z$, find the magnitude of vector p to 3 significant figure (4mks)

9. Eighteen labourers dig a ditch 80m long in 5 days. How long will it take 24 labourers to dig a ditch 64 m long? (3mks).

10. The expression $1 + \frac{x}{2}$ is taken as an approximation for $\sqrt{1+x}$. Find the percentage error in doing so if $x = 0.44$

$$\sqrt{1+x} \quad (3\text{mks})$$

11. The matrices $A = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ o & c \end{bmatrix}$

are such that $AB = A + B$
Find a, b, and c.

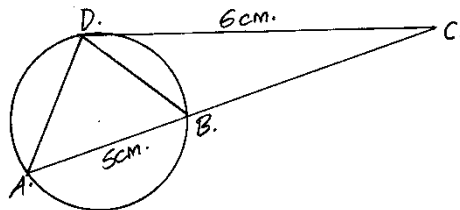
(3mks)

12. Simplify

(3mks)

13. On map of scale 1:25000 a forest has an area of 20cm^2 . What is the actual area in Km^2 (3mks)

14. In the figure below, $DC = 6\text{cm}$, $AB = 5\text{cm}$. Determine BC if DC is a tangent. (3mks).



15. Evaluate without using logarithm tables.

16. A bag contains 10 balls of which 3 are red, 5 are white and 2 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 a ball picked at random from the bag. Find the probability that the ball so chosen is red. (4mks).

SECTION II (50 MARKS)

Answer any five questions in this section.

17. Income tax is charged on annual income at the rates shown below.

Taxable Income K£	Rate (shs per K£)
0 – 1500	1
1501 – 3000	2
3001 – 4500	3
4501 – 6000	4
6001 – 7500	5

Compiled and Distributed by Kenya Educators Consultancy, P.O. BOX 15400-00500, Nairobi.
 Tel 0724333200 E-mail kenyaeducators@gmail.com ORDER MARKING SCHEMES AT
www.kenyaeducators.co.ke or Contact 0724333200/0768321553/0795491185

4501 – 6000	7
6001 – 7500	9
7501 – 9000	10
9001 – 12000	12
Over 12000	13

A certain headmaster earns a monthly salary of Ksh. 8570.. He is entitled to tax relief of Kshs. 150 per month.

(a) How much tax does he pay in a year. (6 mks)

(b) From the headmaster's salary the following deductions are also made every month;

W.C.P.S 2% of gross salary

N.H.I.F Kshs. 1200

House rent, water and furniture charges Kshs. 246 per month.

Calculate the headmaster's net salary. (4 mks)

18. (a) (i) Taking the radius of the earth, $R = 6370$ km and $\pi = \frac{22}{7}$ calculate the shorter distance between the two cities P (60°N , 29°W) and Q (60°N , 31°E) along the parallel of latitude. (3mks)

(ii) If it is 1200Hrs at P, what is the local time at Q. (3mks)

(b) An aeroplane flew due South from a point A (60°N , 45°E) to a point B. The distance covered by the aeroplane was 800km. Determine the position of B. (4mks).

19. Triangle PQR whose vertices are $p(2,2)$, $Q(5,3)$ and $R(4,1)$ is mapped onto triangle $P'Q'R'$ by a transformation whose matrix is
$$\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}$$

- a) On the grid draw PQR and $P^1Q^1R^1$. (4mks)
- b) The triangle $P^1Q^1R^1$ is mapped onto triangle $P^{11}Q^{11}R^{11}$ whose vertices are $P^{11}(-2,-2)$, $Q^{11}(-5,-3)$ and $R^{11}(-4,-1)$
- (i) Find the matrix of transformation which maps triangle $P^1Q^1R^1$ onto $P^{11}Q^{11}R^{11}$. (2mks)
- (ii) Draw the image $P^{11}Q^{11}R^{11}$ on the same grid and describe the transformation that maps PQR onto $P^{11}Q^{11}R^{11}$. (2mks)
- c) Find a single matrix of transformation which will map PQR on to $P^{11}Q^{11}R^{11}$. (2mks)

20. (a) Complete the table for $y = \sin x + 2 \cos x$. (2mks)

X	0	30	60	90	120	150	180	210	240	270	300
Sinx	0			1.0		0.5		-0.5			-0.87
2 cos x	2			0		-1.73		-1.73			1.0
Y	2			1.0		-1.23		-2.23			0.13

(b) Draw the graph of $y = \sin x + 2 \cos x$. (3mks)

(c) Solve $\sin x + 2 \cos x = 0$ using the graph. (2mks)

(d) Find the range of values of x for which $y \leq -0.5$ (3mks).

21. A bag contains 3 red, 5 white and 4 blue balls. Two balls are picked without replacement. Determine the probability of picking.

(a) 2 red balls 2mks

(b) Only one red ball 2mks

(c) At least a white ball 2mks

(d) Balls of same colour. 2mks

(e) Two white balls 2mks

22. (a) Draw the graph of the function 2mks

$$y = 10 + 3x - x^2 \text{ for } -2 \leq x \leq 5$$

(b) use of the trapezoidal rule with 5 stripes, find the area under the curve from $x = -1$ to $x = 4$. 4mks

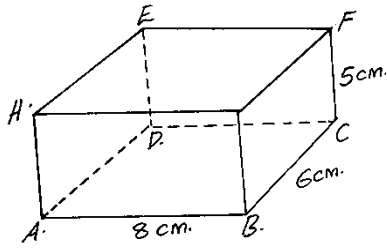
(c) Find the actual area under the curve from $x = -1$ to $x = 4$. 2mks

(d) Find the percentage error introduced by the approximation. 2mks

23. The figure below is a cuboid ABCDEFGH such that $AB = 8\text{cm}$, $BC = 6\text{cm}$ and $CF = 5\text{cm}$.

Determine (a) the length (i) AC (2mks)

(ii) AF (2mks)



(b) The angle AF makes with the plane ABCD. (3mks)

(c) The angle AEFB makes with the base ABCD. (3mks)

24. A manager wishes to hire two types of machine. He considers the following facts.

	<u>Machine A</u>	<u>Machine B</u>
Floor space	2m^2	3m^2
Number of men required to operate	4	3

He has a maximum of 24m^2 of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type B than of type A.

(a) If he hires x machines of type A and y machines of type B, write down all the inequalities that satisfy the above conditions. (3mks)

(b) Represent the inequalities on the grid and shade the unwanted region. (3mks)

(c) If the profit from machine A is sh. 4 per hour and that from using B is kshs8 per hour. What number of machines of each type should the manager choose to give the maximum profit? (4mks)