

Name: Class: Adm.No.
 School:Index No.
 Date: Sign:

121
MATHEMATICS
Time: 2½ Hours

GIDEONS ELITE BOYS CENTRE OF EXCELLENCE
DECEMBER SELF-ASSESSMENT EXAMINATIONS
FORM THREE
FORM 3- TERM 2
Mathematics
TIME: 2½ HOURS

Instructions

- Write your name, class and admission number in spaces provided above.
- The paper contains **two** sections **A** and **B**.
- Answer **ALL** questions in section **A** and **any five** from section **B** in the spaces provided below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non-programmable silent electronic calculator and KNEC mathematical tables may be used, except where stated or otherwise.

For Examiner’s Use Only

SECTION A

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

SECTION B

17	18	19	20	21	22	23	24	TOTAL

**GRAND
TOTAL**

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SECTION A (50 MARKS)

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

1. Translation T is represented by the column vector $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ and another translation U by column vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$. A point P is mapped to a point Q by T and then Q is mapped to a point R by U. If R has coordinates $(7, -4)$ determine the coordinates of P. **(3 marks)**

2. Solve for x in $\log(2x + 4) - \log(x - 1) = 3\log 2$. **(3 marks)**

3. The average of the first and fourth terms of a GP is 185. Given that the first term is 27, find the common ratio. **(3 marks)**

4. The equation $3x^2 - 8px + 12 = 0$ has real roots. Find the value of P. **(3 marks)**

5. Simplify without using tables or calculators: **(3 marks)**

$$\frac{\sin 480^\circ - \cos 765^\circ}{\tan 225^\circ - \cos(-330)^\circ}$$

6. Solve the inequalities and represent the information on a number line.

(3 marks)

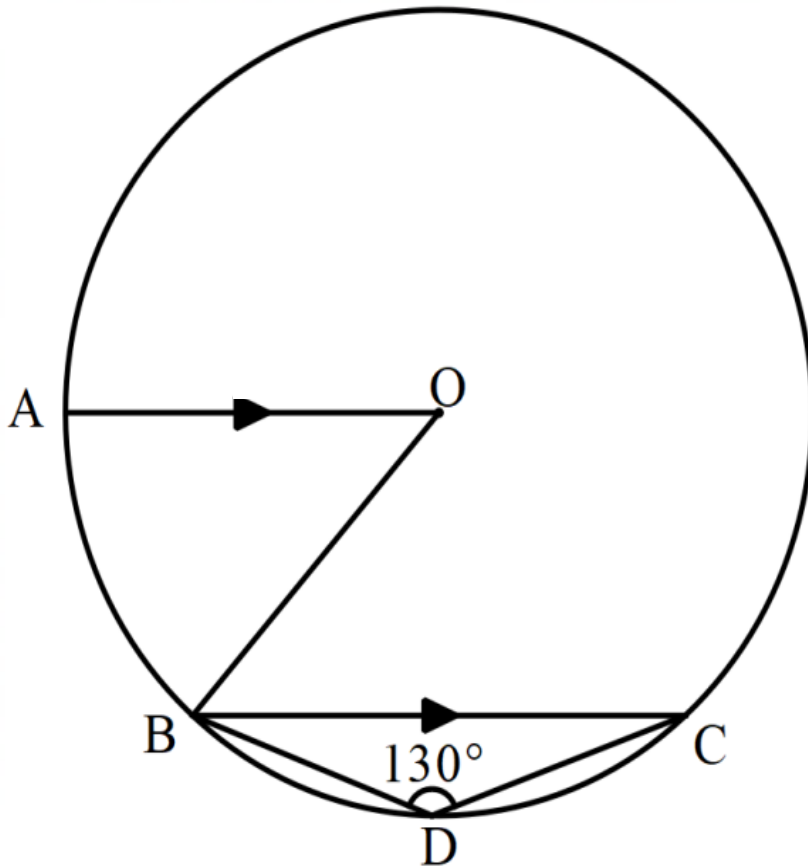
$$-3 + 2x < 3x + 2 < 2(x + 2)$$

7. Make h the subject of the formula $n = \sqrt[3]{\frac{yx^2h}{m-h}}$ **(3 marks)**

8. Given $x = 13.4\text{cm}$ and $y = 4.3\text{ cm}$. calculate the percentage error in $\frac{x}{y}$ correct to 4 d.p **(3 marks)**

9. A hollow cylindrical alloy of length 40mm has a mass of 352g . If its internal radius is 3cm and its 0.01m thick; calculate the density of the metal used to make the alloy in kg/m^3 . Take π as $22/7$. **(3 marks)**

10. In the figure below, O is the centre of the circle. AO is parallel to BC and angle $BDC = 130^\circ$.



A polygon whose exterior angle $\angle AOB$ above is formed. Find;

(a) Sum of interior angles of the polygon. **(3 marks)**

(b) Name of the polygon. **(1 mark)**

11. Solve for x in the equation; **(3 marks)**

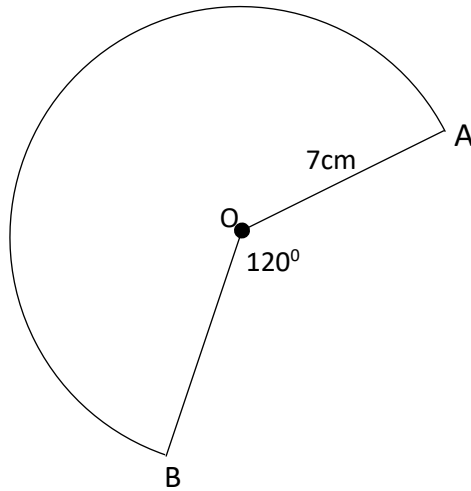
$$25^x - 5^{2x-1} = 500$$

12. Using a ruler and pair of compasses only. Draw parallelogram ABCD in which $AB = 8$ cm, $BC = 5$ cm and $\angle ABC$ is 105° . Construct circle touching edges AB, AD and DC and measure its radius. **(4 marks)**

13. A line L_1 whose equation is $5x - 3y - 15 = 0$ passes through the points A and B. Point A is on the x-axis while point B is equidistant from x and y-axes and lies in the fourth quadrant of a Cartesian plane. Calculate the exact coordinates of points A and B. **(3 marks)**

14. Given that $6 \cos(x + 15)^\circ - 6 \sin(2x - 30)^\circ = 0$, find $\tan(2x - 10)^\circ$ leaving your answer in surd form. **(3 marks)**

15. A cone is made from a sector whose dimensions are given below. Calculate the volume of the cone. (Take $\pi = \frac{22}{7}$). $OA = OB = 7\text{cm}$ radius of the sector and $\angle AOB = 120^\circ$. Give your answer to 3 significant figures. **(3 marks)**



16. The cash price of a music system is kshs. 30,000. It can be bought under hire purchase terms by paying a deposit of kshs. 10,000 and twelve monthly installments of Kshs. 3,200 per month. Determine the percentage rate of interest per month. **(3 marks)**

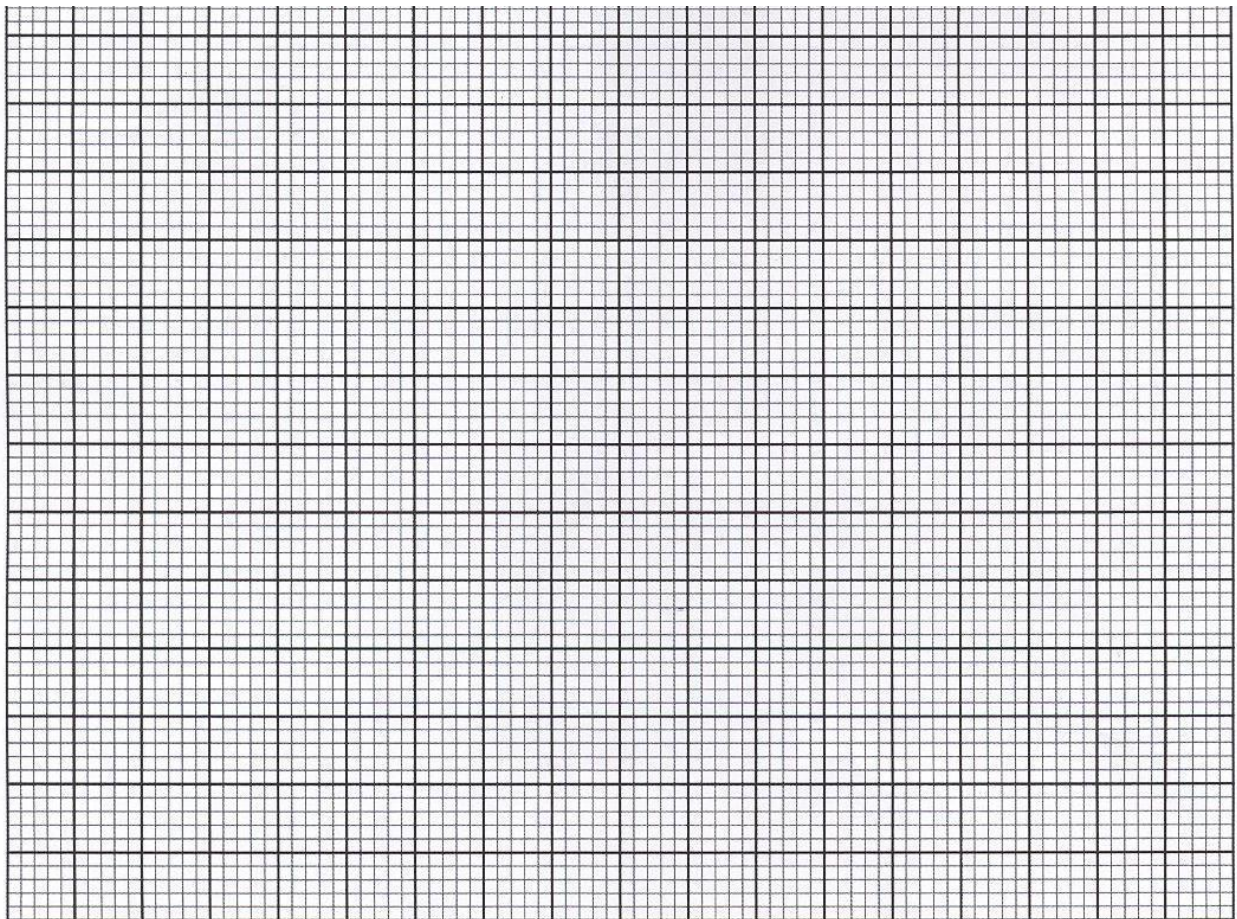
SECTION B (50 MARKS)

Answer any **FIVE** questions from this section in the space provided

17. The frequency distribution table below shows the mass in kilograms (kg) of parcels delivered by a courier company to their office in Lubao.

Mass (kg)	50 – 99	100 – 199	200 – 249	250 - 349
Number of parcels	380	230	160	170
Frequency density				

- (a) Complete the table above to 1dp. **(2 marks)**
- (b) On the grid provided below, draw a histogram to represent the information shown in the table above. **(3 marks)**
- (c) Draw a vertical line in the histogram where the median lies. Show your calculations using the graph. **(3 marks)**
- (d) Use the histogram to determine the number of parcels with a mass of 300kg or more delivered by the courier company. **(2 marks)**



18. Given that $P = \begin{pmatrix} 8 & 5 \\ 6 & 9 \end{pmatrix}$, find P^{-1} (2 marks)

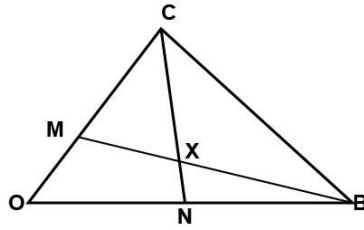
(a) Dayan bought 8 T – shirts and 5 pairs of shorts at a total cost of kshs. 4400. Had he bought 6 T – shirt sand 9 pairs of shorts, he would have spent ksh. 1000 more.

(i) Form two equations to represent the above information. (2 marks)

(ii) Use matrix method to determine the cost of a T – shirt and a pair of shorts. (3 marks)

(b) Three months later the price of a pair of shorts went up. Dayan bought 5 T – shirts and 5 pairs of shorts at a total cost of ksh. 3650. Find the percentage increase in the price of a pair of shorts. (3 marks)

19. The figure below shows a triangle OAB with O as the origin. $OA = \underline{a}$ $OB = \underline{b}$, $OM = \frac{2}{5}\underline{a}$ and $ON = \frac{2}{3}\underline{b}$.



a) Express in terms of \underline{a} and \underline{b} the vectors

(i) \underline{BM} (1 mark)

(ii) \underline{AN} (1 mark)

b) Vector \underline{OX} can be expressed in two ways: $\underline{OB} + k\underline{BM}$ or $\underline{OA} + h\underline{AN}$, where k and h are constants.

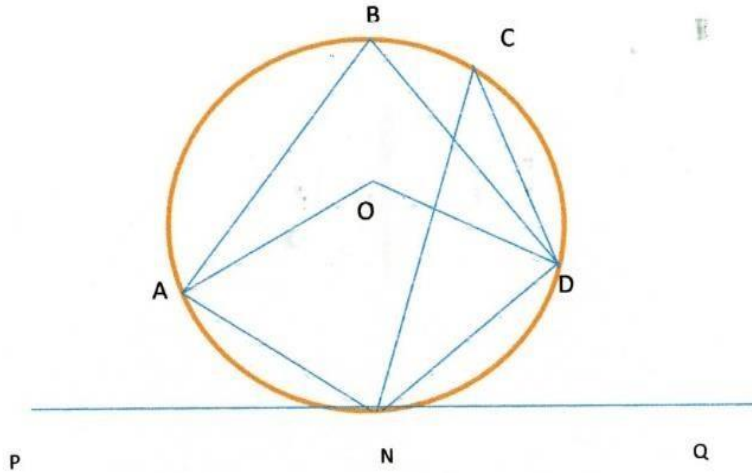
Express \underline{OX} in terms of:

i. \underline{a} , \underline{b} and k . (2 marks)

\underline{a} , \underline{b} and h . (2 marks)

c) Find the values of k and h . (4 marks)

20. In the figure below, O is the center of the circle. PQ is a tangent to the circle at N. Angle NCD is 10° and angle ANP is 30° .



Giving reasons find;

a) Angle DON

(2marks)

b) Angle DNQ

(2marks)

c) Angle DBA

(2marks)

d) Angle ONA

(2marks)

e) Angle ODN.

(2marks)

21. The table below shows the income tax rate for a certain year

Income in Ksh. p.m	Tax rate(%)
1 – 11180	10
11181 – 21714	15
21715 – 32248	20
32249 – 42781	25
42782 and above	30

In a certain month, Mr GenZ paid a net tax of Ksh 26416. He was entitled to a monthly personal relief of Ksh 1648. He also paid insurance premiums amounting to 18200 and was entitled to an insurance relief at 15% of premiums paid, subject to a maximum of Ksh 2000 per month. He also lived in a company house for which he paid a nominal rent of 5200 per month. Other taxable allowances amounted to sh. 22400.

a) Calculate Mr GenZ's monthly gross tax (2 marks)

b) Calculate Mr Genz's total taxable income in that month (4 marks)

c) Calculate Mr Zakayo's net monthly income. (4 marks)

22. Point B is 110km on a bearing of $S60^{\circ}E$ from point A. Point C is 90km on a bearing of 065° from B. Point D is 075 from A and 336° from C.

(a) Using a scale of 1cm to represent 20km, draw a diagram to show the relative positions of A, B, C and D. **(5 marks)**

(b) Use your diagram to determine;

(i) the distance and the bearing of B from D. **(2 marks)**

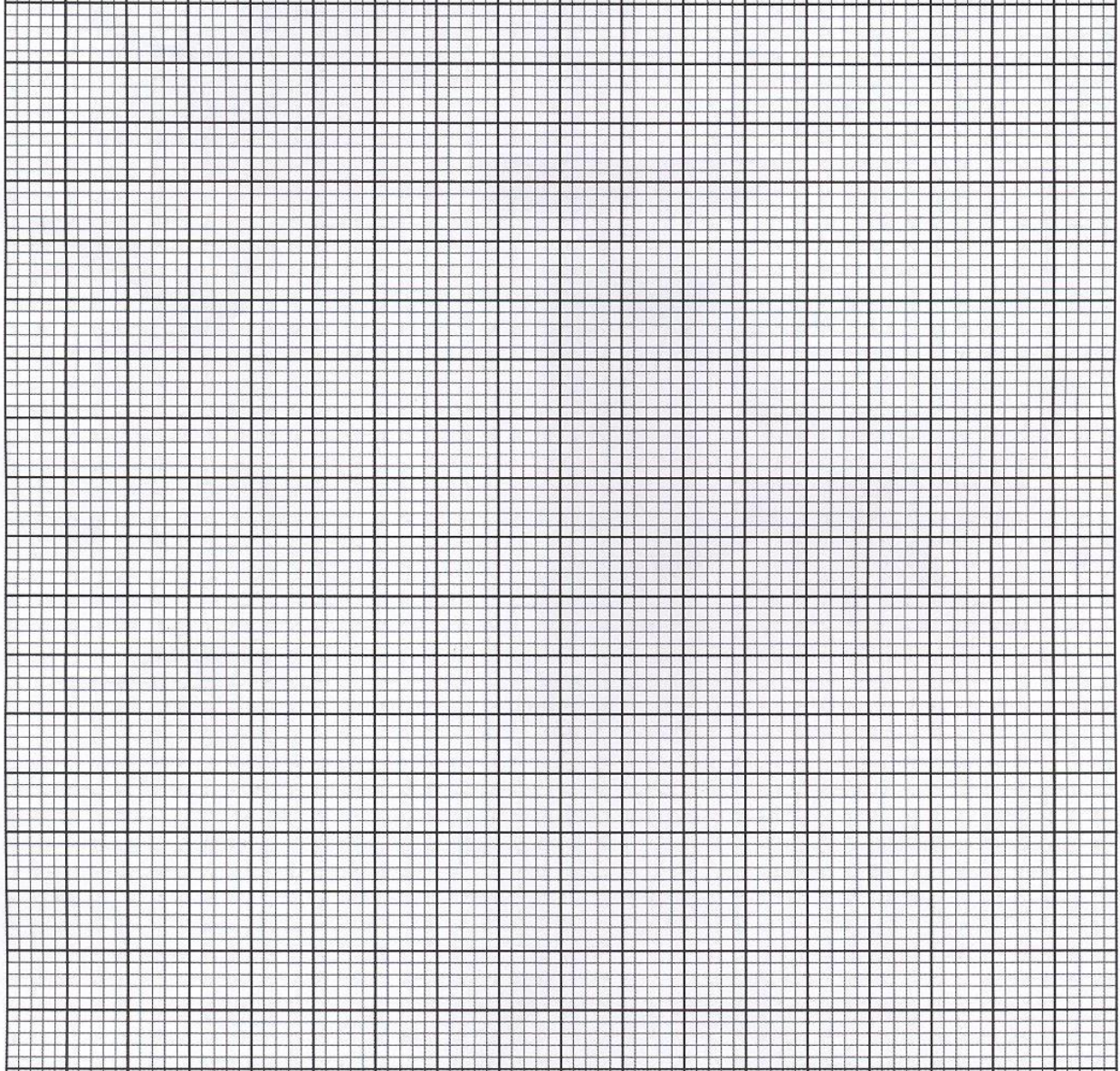
(ii) the distance and compass bearing of A from C. **(3 marks)**

23. (a) A quantity p varies directly as the square of q and inversely as the square root of r . If q increases by 20% and r decreases by 36%, find the percentage change in p .
(3 marks)

(b) The velocity of water flowing through a pipe is inversely proportional to the square of the radius of the pipe. If the velocity of the water is 30cm/s when the radius of the pipe is 2cm. Find the velocity of water when the radius of the pipe is 4cm. **(3 marks)**

(c) Three quantities X and Y and Z are such that X varies partly as Y and partly as the inverse of the square of Z . When $X= 6$, $Y= 3$ and $Z = 2$. When $X = 8$, $Y=5$ and $Z = 1$. Find the value of X when $Y = 10$ and $Z = 8$. **(4 marks)**

24. (a) On the grid provided, draw a square (s) with vertices (6,3), (7, 0), (9, 4) and (10, 1). Draw also two straight lines AB and AC where the coordinates of A, B and C are (1, -2), (3, 2) and (0, 1) respectively. S^1 is the image of S under reflection in the line AB and S^{11} is the image of S^1 under reflection in the line AC. Draw S^1 and S^{11} . **(7 marks)**



- (b) Describe the transformation which maps S onto S^{11} if the transformation is;

(i) Translation **(1 mark)**

(ii) Rotation **(2 marks)**