SECTION 50 MARKS

Answer ALL the questions in the spaces provided.

1. Evaluate: (3mks)

$$\frac{2\frac{3}{4} \times \frac{8}{33}}{3+\left(5\frac{2}{5} \div \frac{9}{25}\right)}$$

$\frac{11}{4} \times \frac{8}{33} = \frac{2}{3}$ M_1

$3+\left(\frac{27}{5} \times \frac{25}{9}\right) = 18$ M_1

$\frac{2}{3} \times \frac{1}{18} = \frac{1}{27}$ A_1

M_1 for $\frac{2}{3}$

M_1 for 18

A_1 for $\frac{1}{27}$

2. Three similar pieces of timber of length 240cm, 320cm and 380cm are cut into equal pieces. Find the largest possible area of a square which can be made from any of the three pieces (2mks)

GCD $|240|\ 320|\ 380| = 20$ B_1

$= 20.$

$L \times L = 20 \times 20$

$= 400\ cm^2$ A_1

3. Solve the inequalities; $x-7 < -3x+1 \leq -2x+4$ and show your solution on a number line. (3mks)

$x - 7 < -3x + 1$

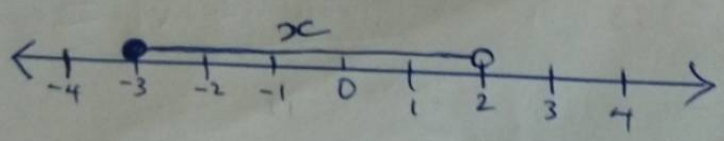
$x + 3x < 1 + 7$

$x < 2$ B_1

$-3x + 1 \leq -2x + 4$

$-3x + 2x \leq 4 - 1$

$x \geq -3$ B_1



A_1

4. Simplify: (4mks)

$$\frac{-6+x+x^2}{x^2-4}$$

$\frac{(x+3)(x-2)}{(x+2)(x-2)}$ M_1 M_1 M_1

$\frac{x+3}{x+2}$ A_1

4

M_1 factorizing the Numerator
M_1 factorizing denominator.
M_1 simplifying the fraction

5. The interior angle of a regular polygon is 120^0. Find the number of sides of the polygon. (2mks)

Ext $= 180 - 120 = 60^\circ$ M_1

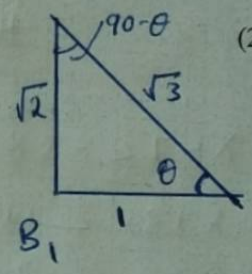
M^o sides $= \frac{360}{Ext} = \frac{360^\circ}{60^\circ}$

$= 6$ sides A_1

6. $\cos\theta = \frac{1}{\sqrt{3}}$ where θ is an acute angle. Without using mathematical tables, find;

(a) $\tan(90^\circ - \theta)$ (2mks)

$= \frac{1}{\sqrt{2}}$ A_1



B_1

(b) $\sin\theta$ in the form $\frac{\sqrt{a}}{\sqrt{b}}$ where a and b are integers. (1mk)

$\frac{\sqrt{2}}{\sqrt{3}}$ A_1

7. The length of a rectangle is 8cm and its area 48 cm^2. Find the length of a similar rectangle whose area is 192 cm^2 (3mks)

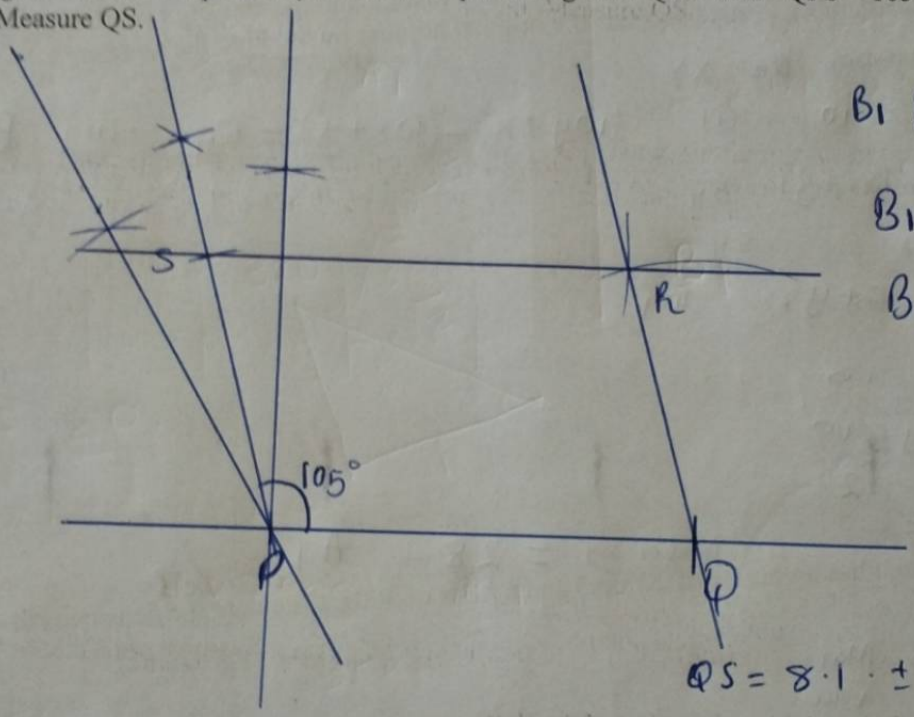
ASF $= \frac{48}{192} = \frac{16}{64}$ m_1

LSf $= 4/8$ m_1

Length $= \frac{8 \times 8}{4} = 16cm$ A_1

03

8. Using a ruler and compass only, construct a parallelogram PQRS with <QPS = 105^0, PQ = 6 cm and PS = 4 cm. Measure QS. (4mks)



B_1 for construction of 105°

B_1 locating R

B_1 complete diagram

QS = 8.1 ± 0.1 cm A_1

9. Find the value of x which satisfies the equation. (3mks)

$$\frac{81^{2x} \times 27^{x}}{9^{x}} = 729$$

$\frac{3^{8x} \times 3^{3x}}{3^{2x}} = 3^6$ m_1 attempt to have a commo base

$8x + 3x - 2x = 6$ m_1

$x = 2/3$ A_1

10. Jane is a sales executive earning a salary of Ksh 20,000 and a commission of 8% for the sales in excess of Ksh 100,000. If in January 2020 she earned a total of Ksh 48,000 in salaries and commissions. Determine the amount of sales she made in that month. (3mks)

commission = 48000 − 22000 = 28,000 M_1

$\frac{100}{8} \times 28\,000 = 350,000$ M_1

Sales = 350000 + 100000 = 450,000/= A_1

11. A two digit number is such that the sum of the ones digit and the tens digit is 10. If the digits are reversed, the number formed exceeds the original number by 54. Find the number. (3mks)

let the number be xy

$x + y = 10$ --- (i) , $(10y + x) - (10x + y) = 54$ --- (ii) B_1

$(10y + x) - (10x + y) = 54$

$9y - 9x = 54$

$y = 6 + x$ M_1

Eqn (i) $x + y = 10$

$x + 6 + x = 10$

$x = 2$

$y = 8$

number xy = 28 − A_1 /03

12. A piece of metal has a volume of 200cm3 and a mass of 300g. Calculate the density of the metal in kg/m^3. (3mks)

$\text{Density} = \frac{\text{Mass}}{\text{volume}}$

$= \frac{300}{200}$ M_1

$= 1.5 g/cm^3$

$1 g/cm^3 = 1000 kg/m^3$

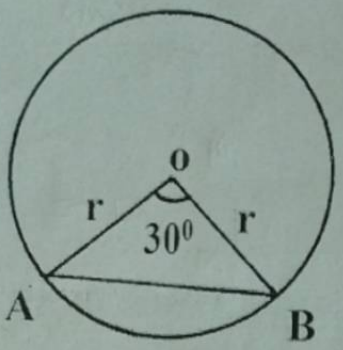
$1.5 g/cm^3 = ?$

$\frac{1.5 \times 1000}{1}$ M_1

$= 1500 kg/m^3$ A_1

/03

13. The figure below shows a circle centre O. Chord AB subtends 30^0 at the centre. If the area of the minor segment is $5.25cm^2$, find the radius of the circle. (3mks)



$\frac{\theta}{360} \times \frac{22}{7} \times r^2 - \frac{1}{2} ab\sin\theta = 5.25cm^2$ — m_1

$\frac{30}{360} \times \frac{22}{7} \times r^2 - \frac{1}{2} r^2 \sin 30 = 5.25$

$\Rightarrow \frac{11}{42} r^2 - \frac{1}{4} r^2 = 5.25$

$\frac{1}{84} r^2 = 5.25$ — m_1

$r = 21\,cm$ A_1

14. Solve the simultaneous equations (3mks)

3x-2y =7

5x + y=3

$5(3x-2y=7)$

$3(5x+y=3)$

$= 15x - 10y = 35$

$15x + 3y = 9$ m_1

$-13y = 26$

$y = -2$

$3x - 2y = 7$

$3x + 4 = 7$ m_1

$3x = 3$

$x = 1$ A_1

03

check the students work for varied methods (matrix)

15. A solid in the shape of a right pyramid on a square base of side 8cm and height 15cm is cut at 6cm height from the base. Find the volume of the frustum formed. (4mks)

$\frac{8}{x} = \frac{15}{9}$ m_1

$x = \frac{8 \times 9}{15}$

$= 4.8cm$

Volume of a frustum = Volume of the larger pyramid − Volume of the smaller pyramid.

$= \frac{1}{3} ABx h_1 - \frac{1}{3} abx h_2$

$= \frac{1}{3} \times 8 \times 8 \times 15 - \frac{1}{3} \times 4.8 \times 4.8 \times 9$ m_1 attempt to solve for volume

$= 320 - 69.12$ — m_1

$= 250.88\,cm^3$ — A_1

04

16. Use table of reciprocals, squares and cubes to solve the following and give your answer to 2 d. places. (4mks)

$$\frac{5}{0.0829} + 0.4927^2 - \sqrt[3]{6479}$$

Reciprocal

$$\frac{5}{0.0829} = 5 \times \frac{1}{0.0829}$$

$$= 5 \times \frac{1}{8.29 \times 10^{-2}} \quad m_1 \text{ --- indication reciprocals is used}$$

$$= 5 \times 0.1206 \times 10^{2}$$

$$= 60.3$$

Squares

$$0.4927^2 = (4.927 \times 10^{-1})^2 - m_1$$

$$= 24.275 \times 10^{-2}$$

$$= 0.24275$$

Cube roots

$$\sqrt[3]{6479} = (6.479 \times 10^{3})^{\frac{1}{3}} - m_1$$

$$= 1.871 \times 10$$

$$= 18.71$$

$$\Rightarrow 60.3 + 0.24275 - 18.71$$

$$= 41.833 \text{ —— } A_1$$

SECTION II (50 Marks)

Answer ONLY FIVE Questions in the spaces provided.

17 . The results of a mathematics test that a hundred students took are as shown below:-

Marks	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
No. of students	4	6	10	14	x	24	14	6

(a) Determine ;

(i) The value of **X** $100 - 78 = 22$ B_1 (1mk)

(ii) The modal class

$55 - 59$ B_1 (1mk)

(b) Calculate ;

i. The mean marks. (5mks)

class	x	f	fx
30-34	32	4	128
35-39	37	6	222
40-44	42	10	420
45-49	47	14	658
50-54	52	22	1144
55-59	57	24	1368
60-64	62	14	868
65-69	67	6	402
		$\Sigma f = 100$	$\Sigma fx = 5210$

B_1 B_1 B_1

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{5210}{100} \quad M_1$$

$= 52.1$ marks A_1

N/B B1 for Σfx
B1 for x column.
B1 for fx column

ii. the median (3mks)

$$L + \frac{\left(\frac{n}{2} - cf\right)i}{f} \quad \ldots M_1$$

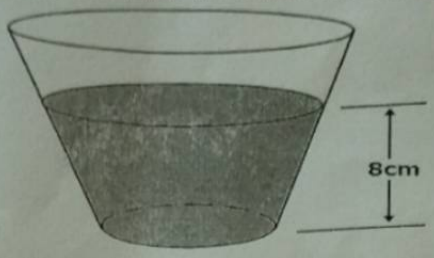
$$49.5 + \frac{\left(\frac{100}{2} - 34\right)5}{22} \quad M_1$$

$$\Rightarrow 49.5 + \left(\frac{16}{22}\right)5$$

$= 53.14$ mark A_1

10

18. The diagram below represents a glass in form of a frustum of a cone, with milk to a depth of 8cm. the internal radius of the glass bottom is 3cm while the radius of a circular surface of milk is 5cm.



a) How many litres of milk correct to 2 significant figures are in the glass? (3mks)

$\frac{x+8}{x} = \frac{5}{3}$

$x = 12$

$\frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

$\frac{1}{3} \times \frac{22}{7} \times 5^2 \times 20$ M_1

$= 523.81$

$\frac{1}{3} \times \frac{22}{7} \times 3^2 \times 12$ M_1

$= 113.14$

$523.81 - 113.14$

$= 410.67 \text{ cm}^3$

$\frac{410.67}{1000}$

$= 0.41$ lit A_1

b) A metallic hemisphere solid accidentally drops inside the milk. The level of glass in milk then rises by 6mm. if no milk splashed out of the glass when the solid dropped in, find

(i) The volume of the hemisphere solid (4mks)

$H = 20 + 0.6 = 20.6$

$\frac{R}{3} = \frac{20.6}{12}$ B_1

$R = 5.15$

$\frac{1}{3} \times \frac{22}{7} \times 5.15^2 \times 20.6$ M_1

$= 572.38 \text{ cm}^2$

$572.38 - 523.81$ M_1

$= 48.57 \text{ cm}^3$ A_1

(ii) The radius of the hemisphere solid (3mks)

$48.57 = \frac{2}{3} \times \frac{22}{7} \times r^2$ M_1

$r = \left(48.57 \times \frac{3}{2} \times \frac{7}{22}\right)^{1/3}$ M_1

$= 2.85 \text{ cm}$ A_1

19. Kinyua spent $\frac{1}{4}$ of his salary on school fees .He spent $\frac{1}{4}$ of the remainder on electricity and water bills He spent $\frac{1}{9}$ of what remained on transport .If he finally had sh.3400, calculate

a) His net salary. (5mks)

Fees $\frac{1}{4}$

electricity $(\frac{1}{4} \times \frac{3}{4}) = \frac{3}{16}$ B_1

transport $\frac{1}{9}(\frac{9}{16}) = \frac{1}{16}$, B_1

total spent.

$\frac{1}{4} + \frac{3}{16} + \frac{1}{16} = \frac{1}{2}$ m_1

$\frac{1}{2} = 3400$ m_1

$1 = ? = 6800/=$ A_1

b) Money spent on school fees. (1mk)

$\frac{1}{4} \times 6800$

$= 1700/=$ B_1

c) Money spent on transport. (2mks)

$\frac{1}{16} \times 6800$ m_1

$= 425/=$ A_1

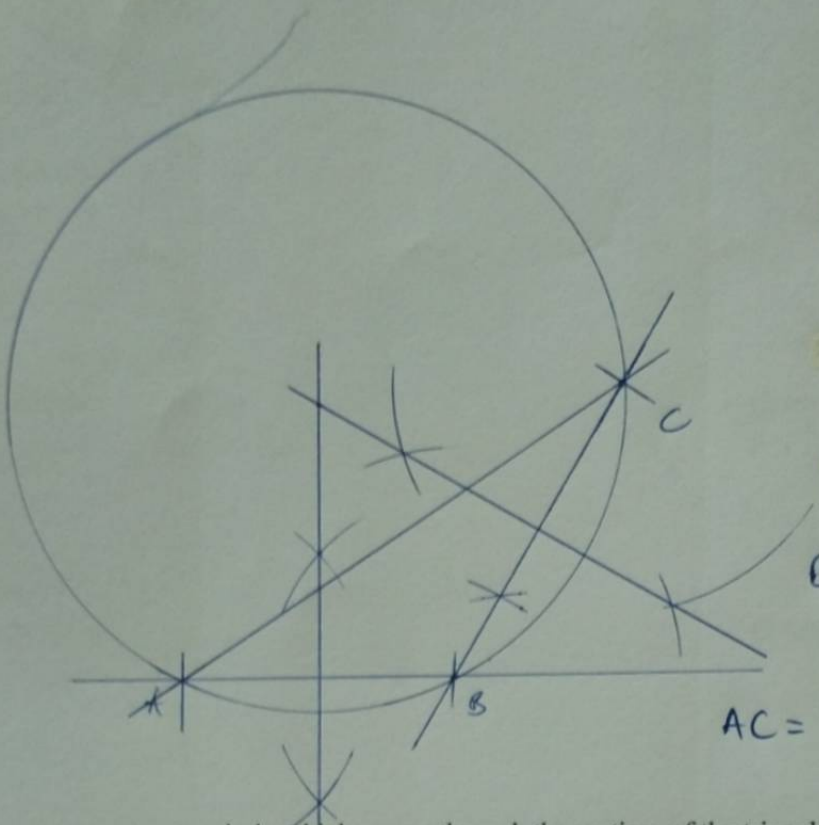
d) Money spent on electricity and water bills. (2mks)

$\frac{3}{16} \times 6800$ m_1

$= 1275/=$ A_1

10

20. Using a ruler and a pair of compasses only construct triangle ABC such that AB = 4 cm, BC = 5 cm and $\angle ABC = 120^0$. Measure AC. (3mks)



B_1 for point C
B_1 for construction of ABC
B_1 for complete Δ ABC

B_1 for bisecting any two sides of the triangle
B_1 for locating center of the circle
B_1 for correct circle

AC = 7·8 cm ± 0·1 cm

(b) On the diagram, construct a circle which passes through the vertices of the triangle ABC. Measure the radius of the circle. (4 mks)

R = 4·5 ± 0·1 cm B_1

(c) (i) Measure the shortest distance from the centre of the circle to the line BC. (1 mk)

3·7 ± 0·1 cm B_1

(ii) Calculate the area of the triangle to 2 d.p. (2 mks)

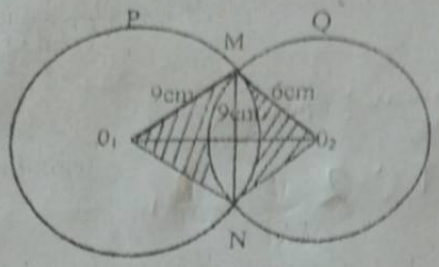
$A = \pi r^2$

$= \frac{22}{7} \times 4.5^2$ M_1

$= 63.62 cm^2$ A_1

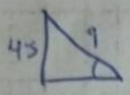
A_1 for correct evaluation of the Area using the students radius ± 3 cm^2

21. The following figure shows two circles P and Q with centre O1 and O2 respectively and their radii ar 9 cm and 6 cm respectively. The common chord MN is 9 cm long. (Not drawn to scale).



a) Find the value of

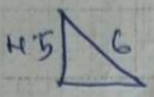
i. Angle MO_1N. (2 marks)



$\sin\theta = \frac{4.5}{9}$ m_1

$2\theta = 30° \times 2 = 60°$ A_1

ii. Angle MO_2N (2 marks)



$\sin\theta = \frac{4.5}{6}$ $m_1 \Rightarrow \theta = 48.6°$

$2\theta = 97.2°$ A_1

b) Find the area of:

i) Triangle MO_1N (2 marks)

$A = \frac{1}{2}ab\sin\theta$

$= \frac{1}{2} \times 9 \times 9 \times \sin 60°$ m_1

$= 35.07 cm^2$ A_1

ii) Triangle MO_2N (1 marks)

$A = \frac{1}{2}ab\sin\theta$

$= \frac{1}{2} \times 6 \times 6 \sin 97.2$ m_1

$= 17.85 cm^2$ A_1

c) Find the area of the shaded region. (4marks)

Area Shaded part

$\left(\frac{\theta}{360}\pi r^2 - \frac{1}{2}ab\sin\theta\right) + \left(\frac{\alpha}{360}\pi R^2 - \frac{1}{2}ab\sin\alpha\right)$

$\Rightarrow \frac{60}{360} \times \frac{22}{7} \times 9^2 - \frac{1}{2} \times 9^2 \sin 60$ m_1

$= 42.42 - 35.07 = 7.35.$

$\frac{97.2}{360} \times \frac{22}{7} \times 6^2 - \frac{1}{2} \times 6^2 \sin 97.2$ m_1

$= 30.55 - 17.86 = 12.69$

$12.69 + 7.35 = 20.04$

Area of MO_1MO_2 = Two Triangles.

$35.07 + 17.86 = 52.93$ m_1

$52.93 - 20.04 = 32.89 cm^2$ A_1

10

22. Three business people kamau, Gachui, and Maina agreed to contribute Ksh .1,210, 000 to start a business. The ratio of Kamau's contribution to Gachui's contribution is 3: 2 while that of Gachui to Maina is 1:3.

(a) Determine the ratio of Kamau's contribution to Maina's contribution. (2mks)

Kamau : Gachui : Maina

$\begin{matrix}1\\2\end{matrix}\begin{pmatrix}3 & : & 2\\ & & 1 & : & 3\end{pmatrix}$

3 : 2 : 6 M_1

Kamau : maina

1 : 2 A_1

(b) Determine the amount of money contributed by Kamau (2mks)

$\frac{3}{11} \times 1,210,000$ M_1

= ksh 330, 000 A_1

(c) They agreed to share their profits as follows 50% to be shared in the ratio of their contributions 40% to be for the running of the business 10% to be set aside for emergencies. If their total profit for the year 2021 was sh. 704 000, determine the ;

(i) Amount of money retained for the running the business. (2mks)

$\frac{40}{100} \times 704,000$ M_1

= sh 281,600 A_1

(ii) The amount of money set aside for emergencies. (2mks)

$\frac{10}{100} \times 704,000$ M_1

= sh 70,400 A_1

(iii) The amount of money received by Gachui. (2mks)

$\frac{2}{11} \times \frac{50}{100} \times 704,000$ M_1

= 64,000 A_1

10

23. Two friends Jane and Tom live 40km apart. One day Jane left her house at 9:00am and cycled towards Tom's house at an average speed of 15km/hr. Tom left his house at 10.30am on the same day and cycled towards Jane's house at an average speed of 25km/hr.

a. Determine:

i. The distance from Jane's house to where the two friends met. (4mks)

Distance between them at 10:30 =

= 40km − (15 × 1·5 hour) M_1

= 40 − 22·5

= 17·5 km

R·S = 25 + 15 = 40 km/h.

Time = D/S = $\frac{17.5}{40}$ M_1

= $\frac{35}{80}$ hrs.

Distance for Jane in $\frac{35}{80}$ hrs.

$15 \times \frac{35}{80} = 6.5625$

total distance

22·5 + 6·5625 M_1

= 29·0625

≈ 29·06 km A_1

follow through the student's work for varied methods

ii. The time they met (2mks)

$\frac{35}{80}$ hrs + 10:30 M_1

= 10:56 am A_1

iii. How far Jane was from Tom's house when they met. (2mks)

40 km − 29·06 km M_1

= 10·94 km A_1

b. The two friends took 10 minutes at the meeting point and then cycled to Tom's house at an average speed of 12km/hr. Find the time they arrived at Tom's house. (2mks)

T = D/S = $\frac{10.94 \text{ km}}{12 \text{ km/h}}$ = 54 min. M_1

10:56 am + 54 min + 10 min

= 12:50 noon. A_1

24. A kite ABCD has vertices at A(1,1), B(6,2), C(6,6) and D(2,6). B_1

a) On the axes draw the image and state its coordinates;

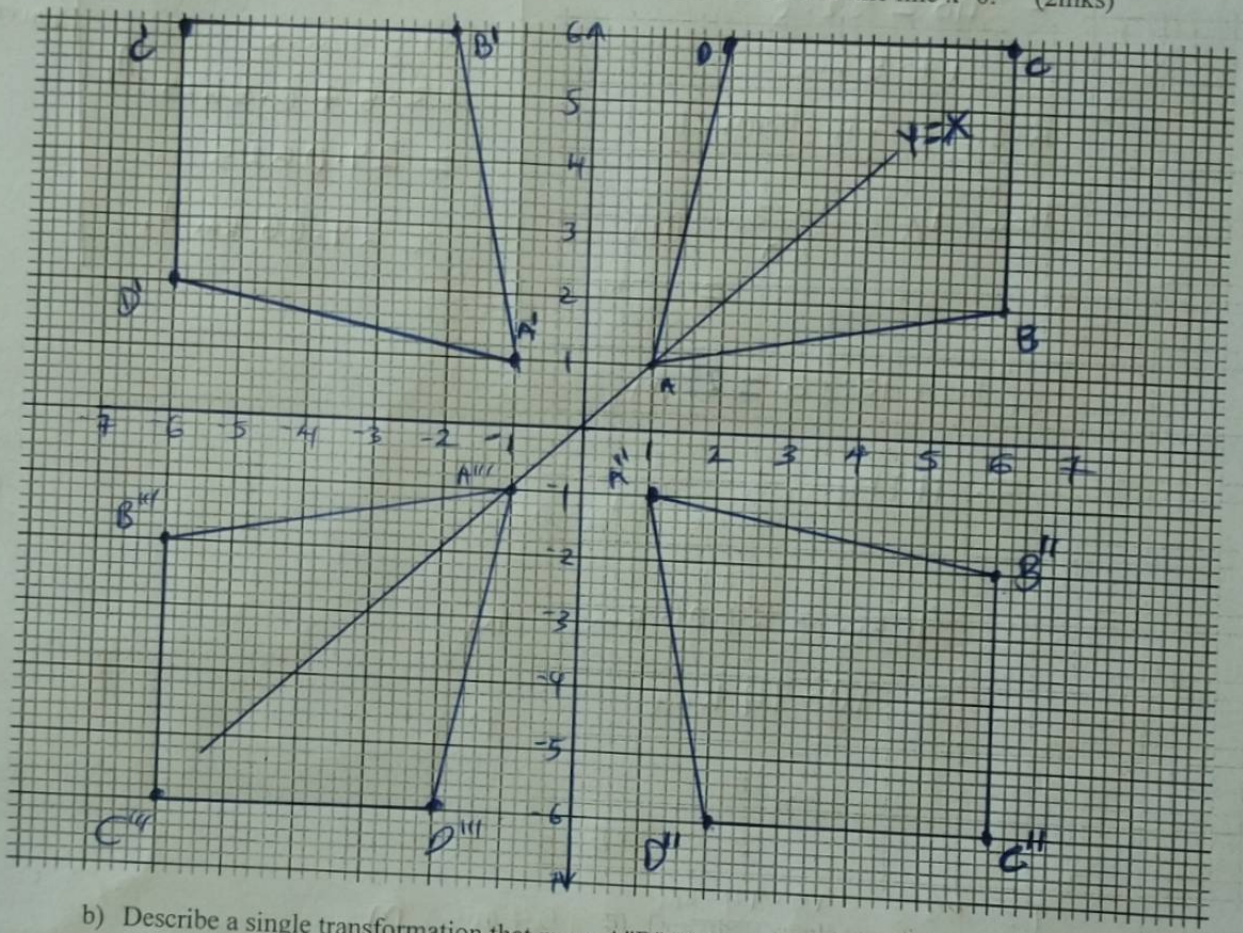
i) A'B'C'D' of ABCD under a rotation of 90^0 about the origin. (3 mks)

A'(-1,1) B'(-2,6) C'(-6,6) D'(-6,2) B_1

ii) A''B''C''D'' of A'B'C'D' under a reflection in the line y=x. (3mrks)

A''(1,-1) B''(6,-2) C''(6,-6) D''(2,-6) B_1

iii) A'''B'''C'''D''' of A''B''C''D'' under a reflection in the line x=0. (2mks)



b) Describe a single transformation that maps A"B"C"D onto ABCD. (2mks)

Reflection B_1

Line of reflection y=0 A_1

B_2 correct A'B'C'D'
B_1 line of y=x
B_1 correct A''B''C''D''

B_1 for correct A'''B'''C'''D'''
B_1 for coordinates of A'''B'''C'''D'''