

ACHIEVE ACADEMY MATH HUB EXAM SOLUTIONS

ZIMSEC O'LEVEL

MATHEMATICS

4004/2

J2025P2 MARKING GUIDE

REMEMBER:

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise

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INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each answer.

This Marking Guide consists of 22 printed pages

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[Turn over]

1. (a) $\frac{1,98+8,75 \times 6,05}{6,89}$

Tip: First round off to the nearest whole number

$$= \frac{2 + 9 \times 6}{7}$$

BODMAS

$$= \frac{2 + 54}{7}$$

$$= \frac{56}{7}$$

$$\underline{\underline{8}} \quad [3 \text{ Marks}]$$

(b) Least possible volume

First you have to find least possible value

$$8,7\text{cm} = 8,65\text{cm}$$

$$V = S^3$$

$$V = 8,65^3$$

$$V = 647,214625\text{cm}^3$$

$$\underline{\underline{V = 647, 21\text{cm}^3}} \quad (\text{to 2 D.P}) \quad [3 \text{ Marks}]$$

(c) $2\frac{1}{2} \div 3\frac{3}{4} + 1\frac{1}{5}$

First change mixed fraction to improper fraction

$$= \frac{5}{2} \div \frac{15}{4} + \frac{6}{5}$$

BODMAS

$$= \left(\frac{5}{2} \div \frac{15}{4}\right) + \frac{6}{5}$$

$$= \left(\frac{5}{2} \times \frac{4}{15}\right) + \frac{6}{5}$$

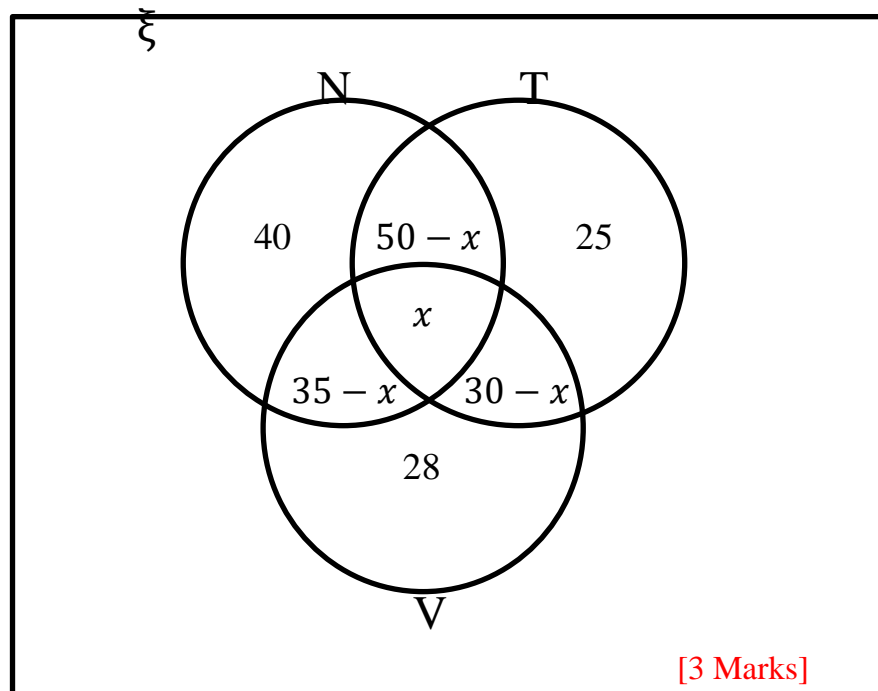
$$= \frac{2}{3} + \frac{6}{5}$$

$$= \frac{10+18}{15}$$

$$= \frac{28}{15}$$

$$= 1\frac{13}{15} \text{ (or equivalent) [3 Marks]}$$

2. (a)



(ii) Value of x

$$40 + 25 + 28 + (50 - x) + (35 - x) + (30 - x) + x = 160$$

$$208 - 2x = 160$$

$$2x = 208 - 160$$

$$\frac{2x}{2} = \frac{48}{2}$$

$$\therefore x = 24 \quad [3 \text{ Marks}]$$

$$(b) A = \{1; 3; 5; 7; 9\}$$

(Odd numbers \rightarrow are numbers that can be divided by 2 but leaving a remainder)

$$B = \{1; 2; 5\}$$

(Factors of 10 \rightarrow number that divide 10 without leaving a remainder)

$$(i) \quad A = \{1; 3; 5; 7; 9\} \quad [2 \text{ Marks}]$$

$$(ii) \quad N(A^1 \cap B) = \{2\} = 1 \quad [2 \text{ Marks}]$$

3 (a) (i) Area covered by the reservoir

Area of a circle = πr^2

$$A = \frac{22}{7}(1, 4)^2$$

$$A = 6, 16m^2 \quad [2 \text{ Marks}]$$

(ii) Total garden Area = $50,7 \times 30,5$

$$= 1546.35m^2$$

Vegetable area = total Area – Reservoir Area

$$= 1546, 35 - 6, 16$$

$$= 1540, 19m^2$$

$$\text{Cost per square metre} = \frac{\$38\,507}{1540,19m^2}$$

$$= \$25 /m^2 \quad [3 \text{ Marks}]$$

(b) (i) Length of an arc = $\frac{\theta}{360} \times 2\pi r$

$$11 = \frac{60}{360} \times 2 \times \frac{22}{7} r$$

$$11 = \frac{1}{6} \times \frac{44}{7} \times r$$

$$11 = \frac{44r}{42}$$

$$11(42) = 44r$$

$$\frac{462}{44} = \frac{44r}{44}$$

$$10.5 = r$$

\therefore Radius = 10.5 cm (or equivalent) [3 Marks]

(ii) Area of the sector = $\frac{\theta}{360} \times \pi r^2$

$$= \frac{60}{360} \times \frac{22}{7} (10.5)^2$$

$$= \frac{1}{6} \times \frac{22}{7} (110.25)$$

$$= \frac{(22 \times 110.25)}{42}$$

$$= \frac{2425.5}{42}$$

$$= 57.75 \text{ cm}^2$$

\therefore Area = 57.75 cm² (or equivalent) [2 Marks]

4. (a) (i) $C = h + kn$ [1 Mark]

(ii) $C = 700, n = 5 \rightarrow 700 = h + 5k$

$C = 1340, n = 13 \rightarrow 1340 = h + 13k$

[Using Elimination Method]

$$700 = h + 5k \quad \textcircled{1}$$

$$- 1340 = h + 13k \quad \textcircled{2}$$

$$\frac{-640}{-8} = \frac{-8k}{-8}$$

$$k = 80$$

$$700 = h + 5k$$

$$h = 700 - 5k$$

$$h = 700 - 5(80)$$

$$h = 700 - 400$$

$$h = 300$$

$$\therefore h = 300 \text{ \& } k = 80 \text{ [4 Marks]}$$

$$\text{(iii) } C = 300 + 80n$$

$$C = 300 + 80(25)$$

$$C = 300 + 2000$$

$$\therefore \underline{C = \$2\,300} \quad \text{[2 Marks]}$$

$$\text{(b) (i) } P \propto Q$$

$$P = kQ$$

$$12 = k5$$

$$\frac{12}{5} = \frac{5k}{5}$$

$$k = \frac{12}{5}$$

$$\therefore P = \frac{12}{5}Q \quad \text{[3 Marks]}$$

(ii) Value of Q

$$P = \frac{12}{5}Q$$

$$42 = \frac{12}{5}Q$$

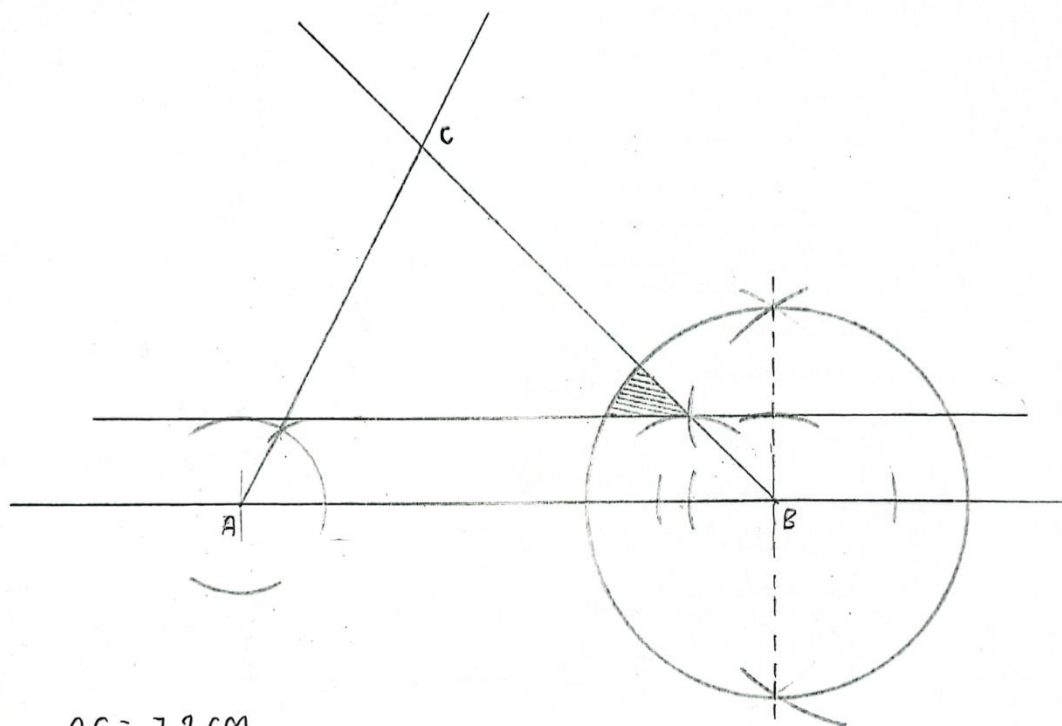
$$42(5) = 12Q$$

$$\frac{210}{12} = \frac{12Q}{12}$$

$$17,5 = Q$$

$\therefore Q = 17.5$ (or equivalent) [2 Marks]

5.



$$AC = 7,2 \text{ cm}$$

SECTION B

$$6. (a) \quad \frac{2a+3}{4} + \frac{a-5}{3} = 1$$

$$\frac{3(2a+3)+4(a-5)}{12} = 1$$

$$\frac{6a+9+4a-20}{12} = 1$$

Tip: cross multiply

$$6a + 9 + 4a - 20 = 12$$

$$10a - 11 = 12$$

$$10a = 12 + 11$$

$$10a = 23$$

$$\frac{10a}{10} = \frac{23}{10}$$

$$a = 2.3$$

$\therefore a = 2.3$ (or equivalent) [3 Marks]

(b) (i) value of M when N = 60 & P = 45

$$M = \frac{N}{N+P}$$

$$M = \frac{60}{60+45}$$

$$M = \frac{60}{105}$$

$$M = \frac{4}{7} \quad [2 \text{ Marks}]$$

(ii) $M = \frac{N}{N+P}$

$$M(N + P) = N$$

$$MN + MP = N$$

$$MN - N = MP$$

$$N(M - 1) = MP$$

$$\frac{N(M-1)}{(M-1)} = \frac{MP}{(M-1)}$$

$$N = \frac{MP}{(M-1)} \quad [3 \text{ Marks}]$$

(c) $\log_3(x-2)^2 = 2$

$$(x-2)^2 = 3^2$$

$$(x-2)^2 = 9$$

$$\sqrt{(x-2)^2} = \sqrt{9}$$

$$(x-2) = \sqrt{9}$$

$$(x-2) = \pm 3$$

$$x = \pm 3 + 2$$

$$x = 3 + 2 \quad \text{or} \quad -3 + 2$$

$$\therefore \underline{x = 5 \text{ or } -2} \quad [4 \text{ Marks}]$$

7. (a) mean age

First we have to find the midpoint of each age group and multiply it by the frequency.

$$50 \leq x < 55 \rightarrow \frac{50+55}{2} = 52.5$$

$$55 \leq x < 60 \rightarrow \frac{55+60}{2} = 57.5$$

$$60 \leq x < 65 \rightarrow \frac{60+65}{2} = 62.5$$

$$65 \leq x < 70 \rightarrow \frac{65+70}{2} = 67.5$$

$$70 \leq x < 75 \rightarrow \frac{70+75}{2} = 72.5$$

$$75 \leq x < 80 \rightarrow \frac{70+75}{2} = 77.5$$

$$\text{Mean age} = \frac{(52.5 \times 6) + (57.5 \times 10) + (62.5 \times 22) + (67.5 \times 32) + (72.5 \times 20) + (77.5 \times 10)}{100}$$

$$= \frac{6650}{100}$$

$$= 66.5$$

$\therefore \text{Mean Age} = 66.5$ (or equivalent) [3 Marks]

(b) Value of P $\rightarrow 38 + 32 = \underline{70}$ [1 Mark]

(c) Answer on a graph below

(d) (i) median = $((100 \times 50\%) + 1)$

$$= 50 + 1$$

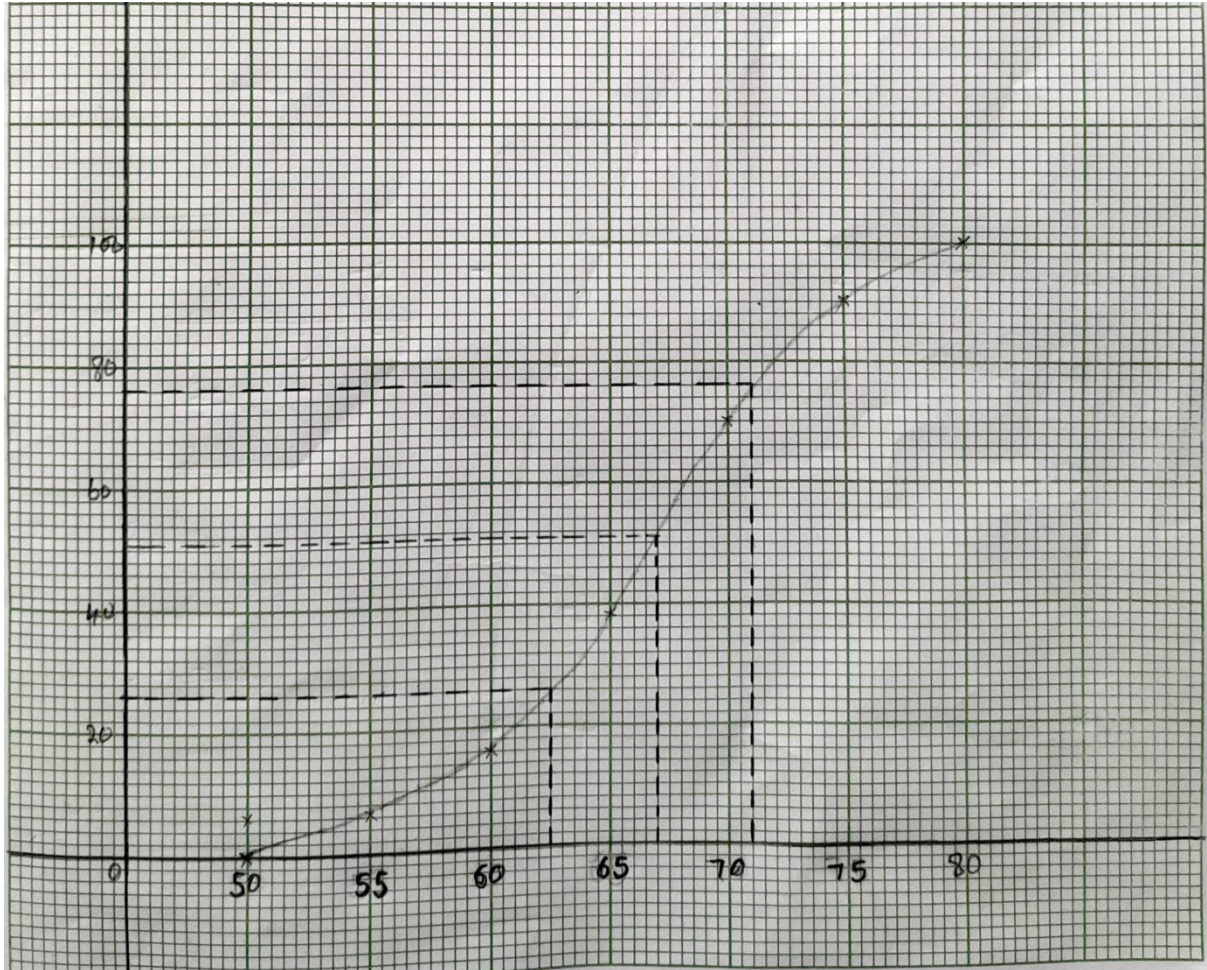
$$= 51$$

$\therefore \text{Final answer} = 67 \text{ years}$ [1 Mark]

(ii) Inter-Quartile range = upper Quartile – lower Quartile

$$= 71 - 62.5$$

$$= \underline{8.5 \text{ years}}$$
 (or equivalent) [3 Marks]



8. (a) (i) $x + y \leq 5$

(ii) $2x + 4y \leq 16$

(iii) $x \geq 1.5$

(iv) $y \geq 1$ [4 Marks]

(b) On a graph below

workings (i) $x + y \leq 5$

When $x = 0$, $y = 5$ (0; 5)

When $y = 0$, $x = 5$ (5; 0)

Working (ii) $2x + 4y \leq 16$

When $x = 0$, $y = 4$ (0; 4)

$$2(0) + 4y = 16$$

$$\frac{4y}{4} = \frac{16}{4}$$

$$y = 4$$

When $y = 0$, $x = 8$ (8; 0)

$$2x + 4(0) = 16$$

$$\frac{2x}{2} = \frac{16}{2}$$

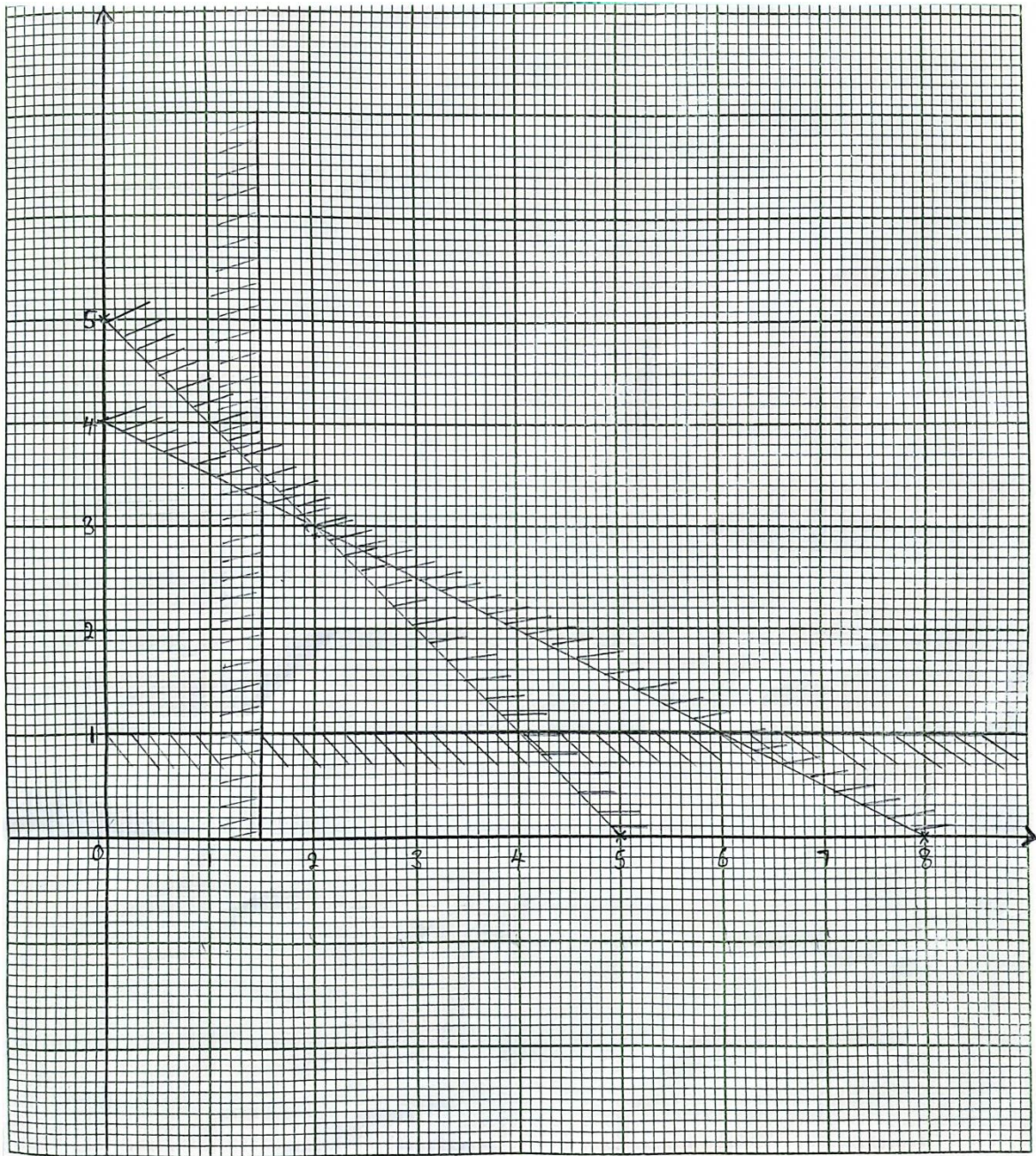
$$x = 8$$

(C) The maximum possible profit he can get

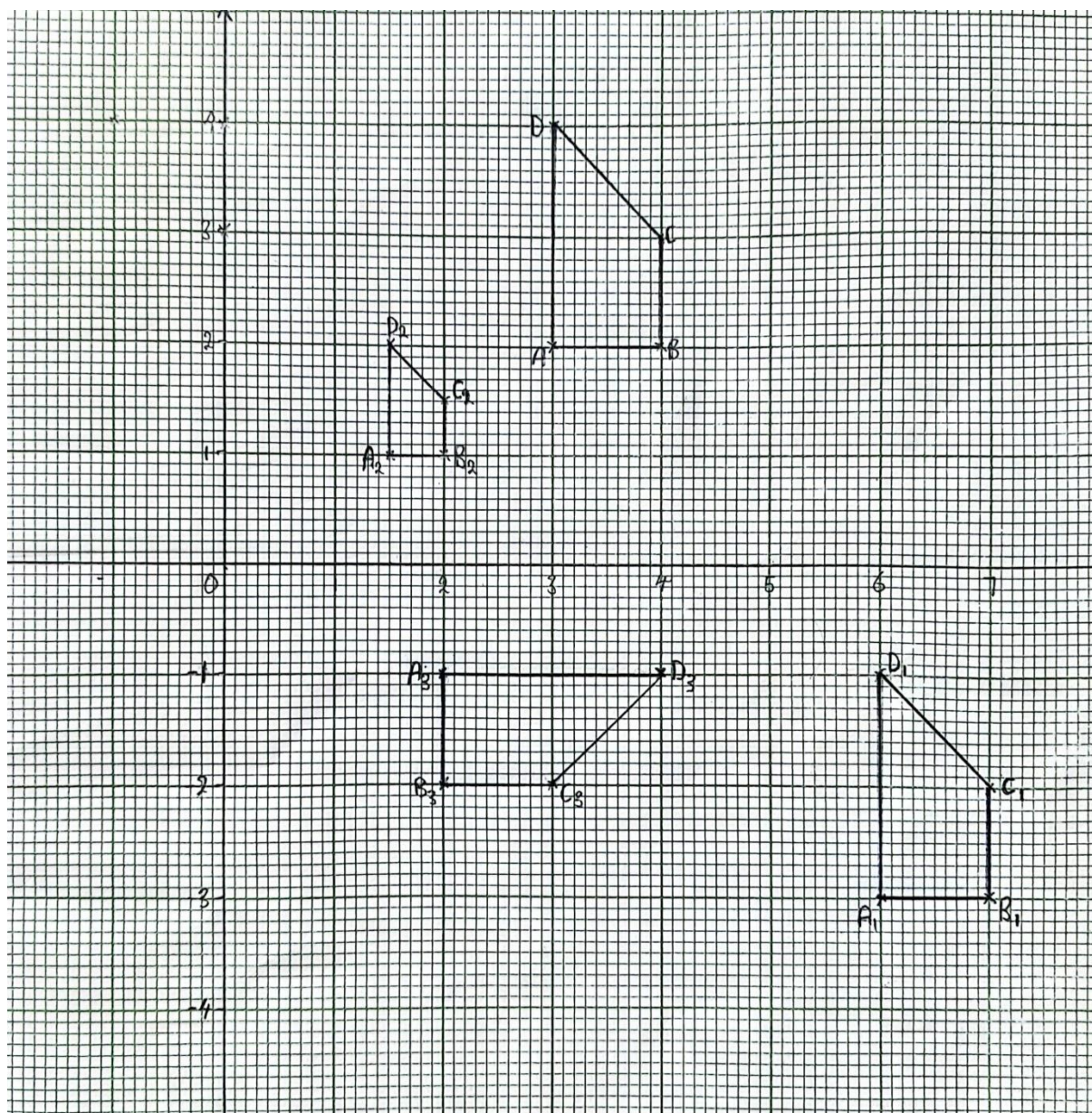
$$= \$30\,000x + \$40\,000y$$

$$= \$30\,000(1.9) + \$40\,000(3)$$

$$\underline{\underline{= \$177\,000}} \quad [2 \text{ Marks}]$$



9.



9. (c) (ii) Describe transformation

Single transformation is an enlargement with scale factor $\frac{1}{2}$ in the x-direction (parallel to x-axis) centre (0;0) [3 Marks]

(e) matrix representing a stretch parallel to the x-axis with a stretch factor of 3

$$= \begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} \quad [2 \text{ Marks}]$$

$$10. A = \begin{pmatrix} -3 & 4 \\ -2 & 1 \end{pmatrix}, B = \begin{pmatrix} 4 & -1 \\ 2 & 5 \end{pmatrix}, C = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

$$(i) \quad 3A - B$$

$$\begin{aligned} &= 3 \begin{pmatrix} -3 & 4 \\ -2 & 1 \end{pmatrix} - \begin{pmatrix} 4 & -1 \\ 2 & 5 \end{pmatrix} \\ &= \begin{pmatrix} -9 & 12 \\ -6 & 3 \end{pmatrix} - \begin{pmatrix} 4 & -1 \\ 2 & 5 \end{pmatrix} \\ &= \begin{pmatrix} -9 - 4 & 12 + 1 \\ -6 - 2 & 3 - 5 \end{pmatrix} \\ &= \begin{pmatrix} -13 & 13 \\ -8 & -2 \end{pmatrix} \quad [3 \text{ Marks}] \end{aligned}$$

$$(ii) \quad BC$$

$$\begin{aligned} &= \begin{pmatrix} 4 & -1 \\ 2 & 5 \end{pmatrix} \begin{pmatrix} -2 \\ 3 \end{pmatrix} \\ &= \begin{pmatrix} (4 \times -2) + (-1 \times 3) \\ (2 \times -2) + (5 \times 3) \end{pmatrix} \\ &= \begin{pmatrix} -8 - 3 \\ -4 + 15 \end{pmatrix} \\ &= \begin{pmatrix} -11 \\ 11 \end{pmatrix} \quad [2 \text{ Marks}] \end{aligned}$$

(b) Inverse of matrix A

$$A = \begin{pmatrix} -3 & 4 \\ -2 & 1 \end{pmatrix}$$

First you have to find the Determinant

$$\text{Det} = ad - bc$$

$$\text{Det} = -3 - 4(-2)$$

$$\text{Det} = 5$$

$$\therefore \text{Inverse} = \frac{1}{5} \begin{pmatrix} 1 & -4 \\ 2 & -3 \end{pmatrix} \quad [3 \text{ Marks}]$$

(c) Hence or otherwise solve the simultaneous equation

Hence part

$$-3x + 4y = 11$$

$$-2x + y = 4$$

$$\begin{pmatrix} -3 & 4 \\ -2 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 11 \\ 4 \end{pmatrix}$$

$$\frac{1}{5} \begin{pmatrix} 1 & -4 \\ 2 & -3 \end{pmatrix} \begin{pmatrix} -3 & 4 \\ -2 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5} \begin{pmatrix} 1 & -4 \\ 2 & -3 \end{pmatrix} \begin{pmatrix} 11 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5} \begin{pmatrix} 1 & -4 \\ 2 & -3 \end{pmatrix} \begin{pmatrix} 11 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5} \begin{pmatrix} (1 \times 11) + (-4 \times 4) \\ (2 \times 11) + (-3 \times 4) \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5} \begin{pmatrix} 11 - 16 \\ 22 - 12 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5} \begin{pmatrix} -5 \\ 10 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

$$\therefore \underline{x = -1 \ \& \ y = 2} \quad [4 \text{ Marks}]$$

Otherwise part

$$-3x + 4y = 11 \quad \textcircled{1}$$

$$-2x + y = 4 \quad \textcircled{2}$$

Using substitution method

Make y subject of formula on equation $\textcircled{2}$

$$-2x + y = 4$$

$$y = 2x + 4$$

Then substitute it on equation ①

$$-3x + 4y = 11$$

$$-3x + 4(2x + 4) = 11$$

$$-3x + 8x + 16 = 11$$

$$5x = 11 - 16$$

$$5x = -5$$

$$\frac{5x}{5} = \frac{-5}{5}$$

$$x = -1$$

Now substitute the value of x on equation you make y subject of formula

$$y = 2x + 4$$

$$y = 2(-1) + 4$$

$$y = -2 + 4$$

$$y = 2$$

$$\underline{\therefore x = -1 \text{ \& } y = 2}$$

$$11. (a) (i) \quad \overrightarrow{RS} = -\overrightarrow{PQ}$$

$$\underline{\overrightarrow{RS} = -3\overrightarrow{p}} \quad [1 \text{ Mark}]$$

$$(ii) \quad \overrightarrow{SQ} = -\overrightarrow{PS} + \overrightarrow{PQ}$$

$$\overrightarrow{SQ} = \overrightarrow{PQ} - \overrightarrow{PS}$$

$$\underline{\overrightarrow{SQ} = 3\overrightarrow{p} - 3\overrightarrow{q}} \quad (\text{or equivalent}) \quad [1 \text{ Mark}]$$

$$(iii) \quad \overrightarrow{XQ}$$

$$QS = 3XS$$

$$XS = \frac{1}{3} QS$$

$$\overrightarrow{XQ} = \frac{2}{3} \overrightarrow{SQ}$$

$$\overrightarrow{XQ} = \frac{2}{3} (3\overrightarrow{p} - 3\overrightarrow{q})$$

$$\overrightarrow{XQ} = 2(\overrightarrow{p} - \overrightarrow{q})$$

$$\underline{\overrightarrow{XQ} = 2\overrightarrow{p} - 2\overrightarrow{q}} \quad (\text{or equivalent}) \quad [2 \text{ Marks}]$$

$$(iv) \quad \overrightarrow{XP} = \overrightarrow{XQ} - \overrightarrow{PQ}$$

$$\overrightarrow{XP} = 2\overrightarrow{p} - 2\overrightarrow{q} - 3\overrightarrow{p}$$

$$\underline{\overrightarrow{XP} = -2\overrightarrow{q} - \overrightarrow{p}} \quad [2 \text{ Marks}]$$

$$(b) \quad \overrightarrow{NP} = h\overrightarrow{XP}$$

$$\overrightarrow{NP} = h(-2\overrightarrow{q} - \overrightarrow{p})$$

$$\underline{\overrightarrow{NP} = -2h\overrightarrow{q} - h\overrightarrow{p}} \quad [1 \text{ Mark}]$$

$$(c) (i) \quad \overrightarrow{NS} = k\overrightarrow{RS}$$

$$\overrightarrow{NS} = -3k\overrightarrow{p}$$

$$\overrightarrow{NP} = \overrightarrow{NS} - \overrightarrow{PS}$$

$$\underline{\overrightarrow{NP} = 3k\overrightarrow{p} - 3\overrightarrow{q}} \quad (\text{or equivalent}) \quad [1 \text{ Mark}]$$

(ii) Value of the constants h & k

$$\overrightarrow{NP} = -2h\vec{q} - h\vec{p}$$

$$\overrightarrow{NP} = 3k\vec{p} - 3\vec{q}$$

$$\overrightarrow{NP} = \overrightarrow{NP}$$

$$-2h\vec{q} - h\vec{p} = 3k\vec{p} - 3\vec{q}$$

$$\vec{q}: -2h = -3 \quad \textcircled{1}$$

$$\vec{p}: -h = 3k \quad \textcircled{2}$$

Using substitution method

$$-2h = -3$$

$$\frac{-2h}{-2} = \frac{-3}{-2}$$

$$h = \frac{3}{2}$$

Substitute on equation $\textcircled{2}$

$$-h = 3k$$

$$-\left(\frac{3}{2}\right) = 3k$$

$$-\frac{1}{2} = k$$

$$\therefore k = -\frac{1}{2} \text{ \& } h = \frac{3}{2} \quad (\text{or equivalent}) \quad [3 \text{ Marks}]$$

(d) Ratio $\frac{NS}{RS}$

$$= \frac{kNS}{RS}$$

$$= \frac{-3k\vec{p}}{-3\vec{p}}$$

$$= \frac{k}{1}$$

$$= -\frac{1}{2}$$

$$\therefore \text{Ratio} = \frac{-1}{2} \quad [1 \text{ Mark}]$$

12. (i) $Q\hat{P}R = \underline{50^\circ \text{ or } 34^\circ}$ [1 Mark]

(ii) $P\hat{R}Q = \underline{56^\circ}$ [1 Mark]

NB: Using angle QPR as 34°

(iii) $R\hat{Q}S = \underline{54^\circ}$ [1 Mark]

(iv) $P\hat{Q}S = 90^\circ - 54$
 $= \underline{36^\circ}$ [2 Marks]

(v) $P\hat{X}Q = 180^\circ - (34^\circ + 36^\circ)$
 $= \underline{110^\circ}$ [2 Marks]

(b) (i) $P\hat{X}S \equiv Q\hat{X}R$ [1 Mark]

(ii) Length of RX

$$\frac{PS}{QR} = \frac{XS}{XR}$$

$$\frac{12}{8} = \frac{9}{RX}$$

$$12RX = 9(8)$$

$$\frac{12RX}{12} = \frac{72}{12}$$

$\underline{RX = 6cm}$ [2 Marks]

(iii) ratio of the Area of triangle QRX : Area of triangle PSX

$$= \left(\frac{8}{12}\right)^2$$

$$= \left(\frac{2}{3}\right)^2$$

$$= \frac{4}{9}$$

$\underline{\therefore \text{Ratio} = 4:9}$ [2 Marks]

CONSTRUCTIVE
FEEDBACK ON THE
LAYOUT AND ANY
ERRORS AND
OMISSIONS IS ALWAYS
WELCOME

Enjoy your STUDIES

Stay Tuned for upcoming Maths &
Principle of Accounting Seminars!

But Jesus beheld them, &
said unto them, "with men
this is impossible; but with
GOD all things are possible"
MATTHEW 19:26 (KJV)

MATTHEW 19:26 (KJV)
"GOD all things are possible"
"this is impossible" are words