TRIAL ONE EVALUATION TEST

MATHEMATICS PAPER 2

MARKING SCHEME

1. $\frac{x+1}{2} - \frac{x-3}{3} = 4$

$\frac{3x+3-2x+6}{6} = 4$ M1

$x + 9 = 24$

$x = 15$ A1 (2)

2. $\begin{pmatrix} 5 \\ -2 \end{pmatrix} - \begin{pmatrix} -1 \\ y \end{pmatrix} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$ M1

$\begin{pmatrix} 4 \\ -5 \end{pmatrix} = \begin{pmatrix} -12 \\ y-3 \end{pmatrix}$

$4h = -12$

$h = -3$ A1

$-5h = -12$

$-5h = y - 3$

$15 = y - 3$

$y = 18$ B1 (3)

3. $\frac{12x^2 - 16x}{20 - 11x - 3x^2} = \frac{4x(3x-4)}{20 - 15x + 4x - 3x^2}$ M1

$= \frac{4x(3x-4)}{(4-3x)(5+x)}$

$= \frac{-4x(4-3x)}{(5+x)(4-3x)}$ M1

$= \frac{-4x}{5+x}$ A1 (3)

4. $\frac{10-5}{5-3} = \frac{6+4}{x+5}$ M1

$x + 5 = 4$ M1

$x = -1$ A1 (3)

5. $P_n = \sqrt{\frac{S-t}{t}}$

$(P_n)^2 = \frac{S-t}{t}$ M1

$t(P_n)^2 = S - t$

$t(P_n)^2 + t = S$ M1

$t((P_n)^2 + 1) = S$

$t = \frac{S}{(P_n)^2 + 1}$ A1

3

6. V.S.F = 108 : 256

L.S.F = 4.72 : 6.345

A.S.F = 22.68 : 40.26 = 810 : x

6. $3y = 9x - 5$

$y = 3x - \frac{5}{3}$ B1 (gradient $-\frac{1}{3}$ or used in working)

$\frac{y-7}{x-3} = -\frac{1}{3}$ M1

$y - 7 = -\frac{1}{3}(x - 3)$

$y = -\frac{1}{3}x + 1 + 7$

$y = -\frac{1}{3}x + 8$ A1

3

7 V.S.F = 108 : 256

L.S.F = 4.762 : 6.35 M1

A.S.F = 22.68 : 40.32 = 810 : x M1

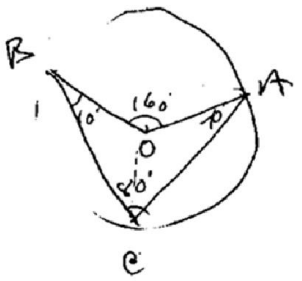
$\frac{22.68}{40.32} = \frac{810}{x}$

$x = \frac{810 \times 40.32}{22.68}$

$= 1440\ cm^2$. A1

3

8



$\angle AOB = 160°$

$\angle OCB = 10°$

$\angle CAO = 70°$

$\angle OAB = 10°$

$\therefore \angle CAB = 70° + 10°$

$= 80°$

B1

B1

B1

3

9 $(1-a)^8 = 1 - 8a^1 + 28a^2 - 56a^3 + 70a^4 - 56a^5 + 28a^6 - 8a^7 + a^8$ M1

$(1-a)^8 = 1 - 8a + 28a^2 - 56a^3 + 70a^4 - 56a^5 + 28a^6 - 8a^7 + a^8$ A1

$0.98^8 = (1 - 0.02)^8$

$0.98^8 = 1 - 8(0.02) + 28(0.02)^2 - 56(0.02)^3 + 70(0.02)^4 - 56(0.02)^5 + 28(0.02)^6 - 8(0.02)^7 + (0.02)^8$ M1

$= 1 - 0.16 + 0.0112 - 0.000448 + 0.000012$

$= 0.8507632$

≈ 0.8508 A1

4

10 $\dfrac{(\sqrt{3} - \sqrt{2})(\sqrt{3} - \sqrt{2})}{(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})}$ M1

$= \dfrac{3 - 2\sqrt{6} + 2}{3 - 2}$ M1

$= 5 - 2\sqrt{6}$ A1

3

11 Actual area $= 12.5 \times 6.75$

$= 84.375$

Maximum area $= 12.55 \times 6.755$

$= 84.77525$

Minimum area $= 12.45 \times 6.745$

$= 83.97525$

M1 (minimum, max, actual)

% error in area $= \dfrac{84.77525 - 83.97525}{2 \times 84.375} \times 100$ (M1 absolute error) (M1 % error)

$= 0.47\%$ A1

4

12 $2x^2+x-15 = 2x^2+6x-5x-15$

$= 2x(x+3)-5(x+3)$

$= (x+3)(2x-5)$. B1

$2x^2+x-15=0$

$(x+3)(2x-5)=0$ M1

$x+3=0$ or $2x-5=0$

$x=-3$ or $2x=5$

$x=\frac{5}{2}$ A1 (both √)

$x=-3, 2.5$. 3

13 $5 \leq 3x+2$; $3x-7 \leq 2$

$3 \leq 3x$ $3x \leq 9$

$1 \leq x$ $x \leq 3$ B1 (both √)

$\therefore \quad 1 \leq x \leq 3$ B1

$x = 1, 2, 3$ B1

3

14 V : Ay : At = 3 : 7 : 9.

$\frac{7}{19}x = 60,000$ M1

$x = \frac{60,000 \times 19}{7}$

$= 162,857$ A1

2

15 $\frac{1}{2}\times\frac{5}{8}\times\frac{4}{7}+\frac{1}{2}\times\frac{3}{8}\times\frac{2}{7}+\frac{1}{2}\times\frac{4}{7}\times\frac{3}{6}+\frac{1}{2}\times\frac{3}{7}\times\frac{2}{6}$ M1M1

$\frac{5}{28}+\frac{3}{56}+\frac{1}{7}+\frac{1}{14} = \frac{10+3+8+4}{56}$ M1

$= \frac{25}{56}$ A1

4

16 L.s.f = 10 : 15

a.s.f = 100 : 225

$\frac{100}{225} = \frac{x}{315}$ M1

$x = \frac{315 \times 100}{225}$ A1

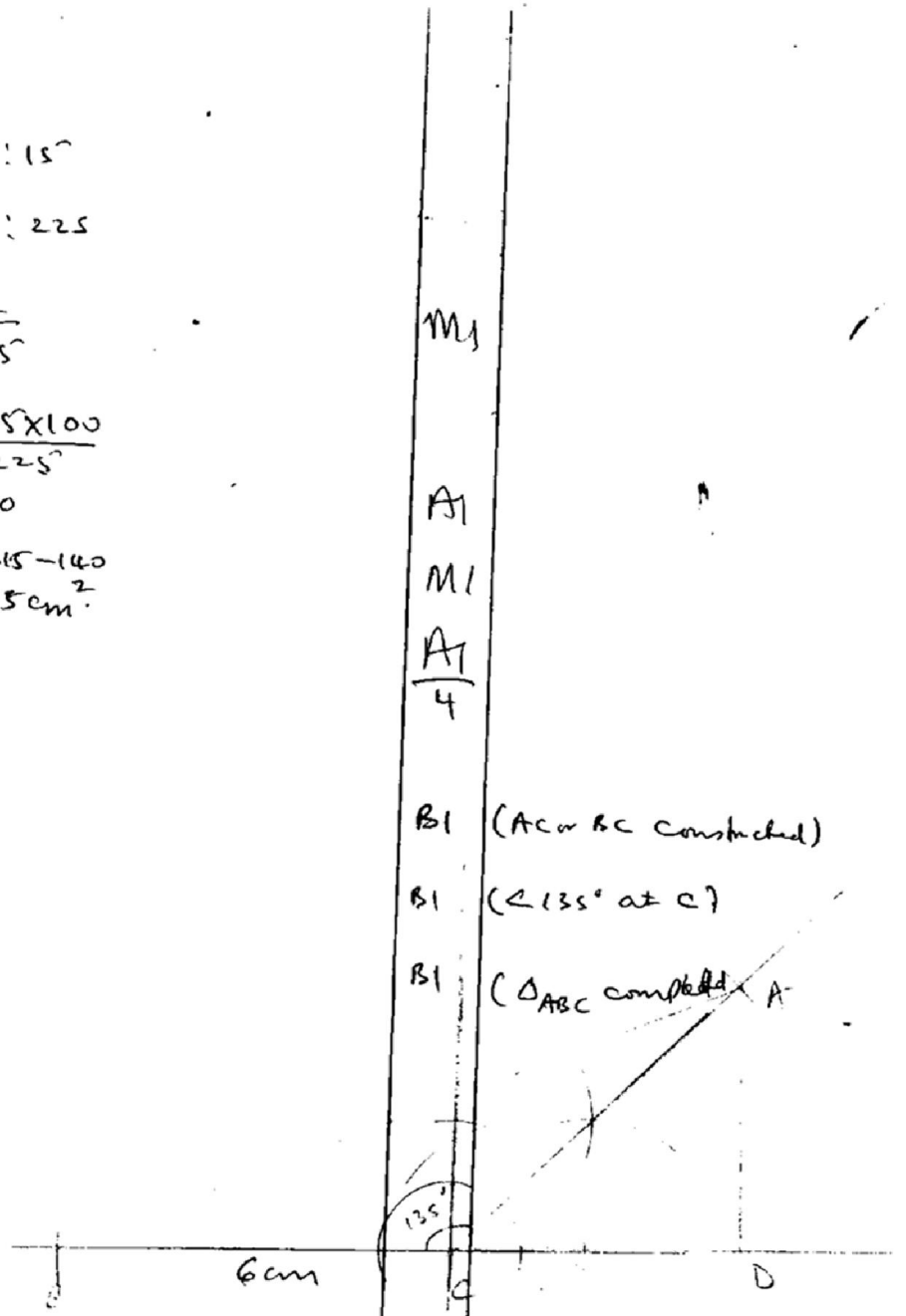
$= 140$

Area QRTS = 315 − 140 M1

$= 175 cm^2$ A1

4

17



B1 (Arc or BC constructed)

B1 (∠135° at C)

B1 (Δ_{ABC} completed)

AB = 11 cm

AD = 4 cm

B1 (arc centre A)

B1 (⊥ at A to BC constructed)

~~A1~~ B1 (AD drawn)

AB B1 (AB measured)

B1 (AD measured)

Area Δ_{ABC} = $\frac{1}{2} \times 6 \times 4 cm^2$ M1

$= 12 cm^2$ A1

20

18

	Class	Tally	Frequency	Midpt	fx	cf	
a)	25-34	///	3	29.5	88.5	3	B1 (✓ class column)
	35-44	////1	6	39.5	237	9	B1 (✓ frequency column)
	45-54	//// ///	8	49.5	396	17	
	55-64	//// //// 1	11	59.5	654.5	28	B1 (✓ midpoint column)
	65-74	//// //	7	69.5	486.5	35	
	75-84	///	3	79.5	238.5	38	
					$\Sigma fx = 2101$		

b) Modal class 55-64 — B1

c) Mean mark $2101 \div 38$ — M1
$= 55.29$ — A1

d) Median mark $= 54.5 + \frac{2.5 \times 10}{11}$ — B1 (cf column), M1
$= 56.77$ — A1

20

19

a)

x	-5	-4	-3	-2	-1	0	1	2
y	-5	15	19	13	3	-5	-5	9

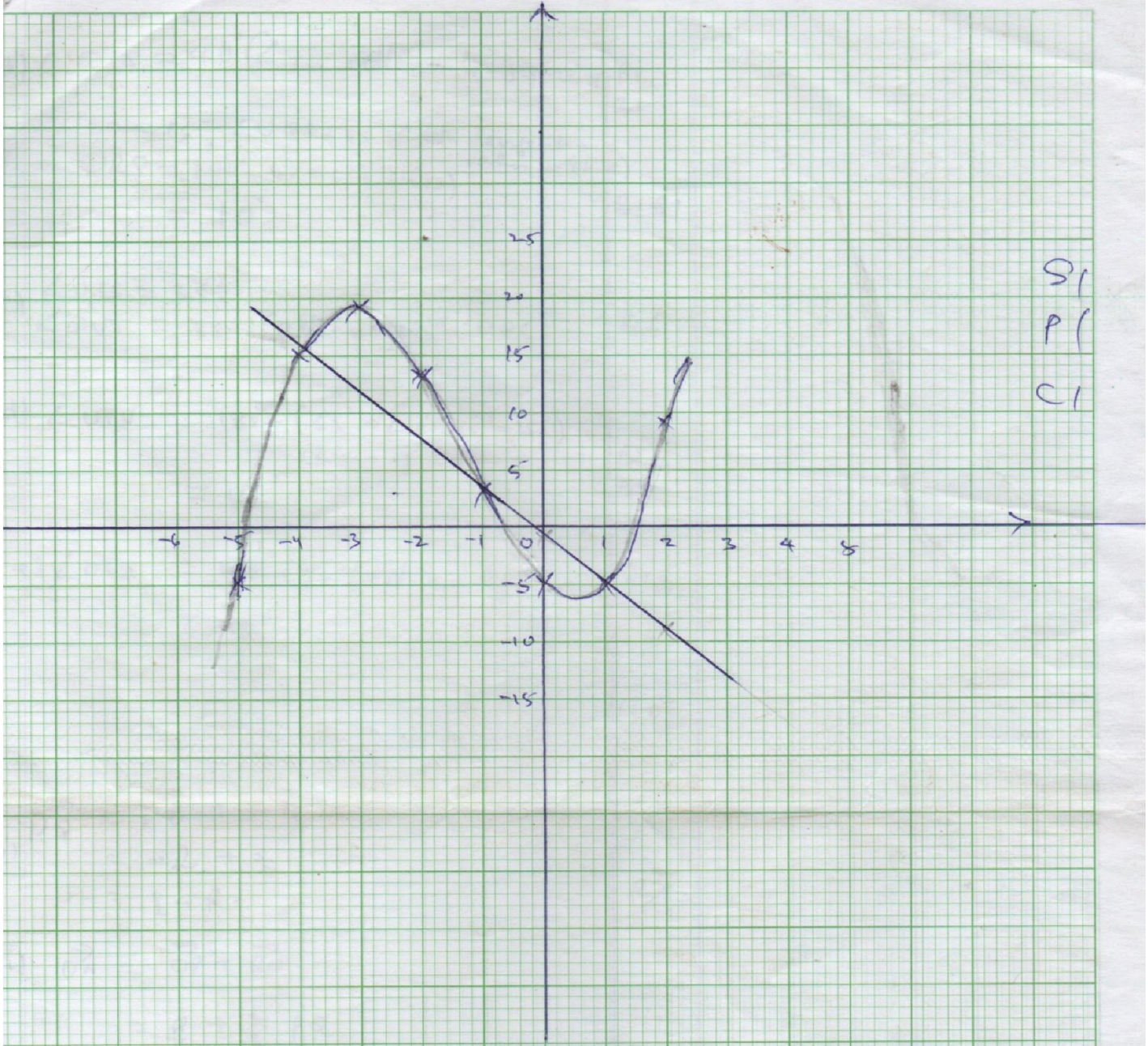
B2 (all 6 ✓)

b) graph paper — B1 (any 4 ✓)

c) i) $x = -4, -0.6, 1.5$ — B2 (allow B1 for any 2 ✓)

ii) $y = -4x - 1$
$(0, -1), (2, -9)$ — B1 ✓ line $y = -4x - 1$
$x = 3.9, -1, 1$ — B2 (all 3 ✓, allow B1 for any 2 ✓)

10



S1
P1
C1

20 a) $\angle QTS = 40°$ ($\angle$ in alternate segment) B1

B1

b) $\angle UQO = 55°$, $\angle UQS = 35°$ ($\angle$ btn tangent and radius $\perp$ to $\angle$)

$\angle QRS = 180° - (40° + 55° + 35° + 40°)$

$= 10°$ B1 B1

c) $\angle UTS = 35°$;

$\angle QVT = 35°$ (alternate with $\angle UQS$ B1 B1

d) $\angle UTV = 180° - (55° + 40° + 35° + 35°)$ ($\angle$ sum of Δ)

$= 15°$ B1

B1

e) $\angle USQ = 180° - 75°$ (opp $\angle$s of cyclic quad) B1 B1

$= 105°$

(10)

21 a) (i) $\vec{PQ} = \vec{PO} + \vec{OQ}$

$= -\underline{r} + \underline{s}$

$= \underline{s} - \underline{r}$. B1

(ii) $\vec{ON} = \vec{OP} + \vec{PN}$

$= \underline{r} + \frac{2}{3}\vec{PQ}$

$= \underline{r} + \frac{2}{3}(\underline{s} - \underline{r})$ M1

$= \underline{r} + \frac{2}{3}\underline{s} - \frac{2}{3}\underline{r}$

$= \frac{1}{3}\underline{r} + \frac{2}{3}\underline{s}$ A1

(iii) $\vec{PT} = \vec{PO} + \vec{OT}$

$= -\underline{r} + \frac{3}{5}\vec{ON}$

$= -\underline{r} + \frac{3}{5}(\frac{1}{3}\underline{r} + \frac{2}{3}\underline{s})$ M1

$= -\underline{r} + \frac{1}{5}\underline{r} + \frac{2}{5}\underline{s}$

$= \frac{2}{5}\underline{s} - \frac{4}{5}\underline{r}$. A1

(iv) $\vec{PM} = \vec{PO} + \vec{OM}$

$= -\underline{r} + \frac{1}{2}\underline{s}$

$= \frac{1}{2}\underline{s} - \underline{r}$. B1

b) P, T, M.

$\overrightarrow{PT} = \frac{2}{5}\underline{r} - \frac{4}{5}\underline{q}$

$\overrightarrow{PM} = \frac{1}{2}\underline{r} - \underline{q}$

$h\left(\frac{2}{5}\underline{r} - \frac{4}{5}\underline{q}\right) = \frac{1}{2}\underline{r} - \underline{q}$ ∴ M1

$\frac{2}{5}h = \frac{1}{2}$ and $\frac{4}{5}h = 1$

$h = \frac{5}{4}$. $h = \frac{5}{4}$. A1

∴ $\overrightarrow{PT} // \overrightarrow{PM}$ and P is a common point Hence P, T, M are collinear B1

PM : MT = PT : TM

MT : TP = 1 : 4 B1

10

22 a) $a = 2$

a(i) $S_8 = \frac{8}{2}(2\times 2 + 7d) = 156$ M1

$4(4 + 7d) = 156$

$16 + 28d = 156$

$28d = 140$

$d = 5$. A1

(ii) $S_n = \frac{n}{2}(2\times 2 + (n-1)5) = 416$ M1

$5n^2 - n - 832 = 0$

$n = \frac{1 \pm \sqrt{(-1)^2 + 4\times 5\times 832}}{10}$

$n = 13$ or -12.8

∴ $n = 13$. A1

b) $3^{rd} = a + 2d$, $5^{th} = a + 4d$, $8^{th} = a + 7d$.

$\frac{a+4d}{a+2d} = \frac{a+7d}{a+4d}$ M1

$(a+4d)^2 = (a+2d)(a+7d)$

b) PTM

~~$P\vec{T} = \frac{2}{3}\underline{q} - \frac{4}{5}\underline{r}$~~

$a^2 + 8ad + 16d^2 = a^2 + 2ad + 7ad + 14d^2$

$ad = 2d^2$

$d = 3, \quad 3a = 18$

$a = 6.$ M1 (one unknown)

A1

(ii) $r = \frac{6 + 4 \times 3}{6 + 2 \times 3}$

$= \frac{18}{12} \longrightarrow 1.5$ B1

$S_8 = \frac{6(1.5^8 - 1)}{1.5 - 1}$ M1

$= \frac{6(25.63 - 1)}{0.5}$

$= 6 \times 24.63 \times 2$

$= 295.6$ A1

(10)

23 $P = \frac{kq}{r^2}$.

a) $q = \frac{k \times 12}{2^2}$ M1

$k = 3.$ A1

$P = \frac{3 \times 15}{5^2}$ M1

$= \frac{45}{25}$

$= 1.8$ A1

b) $P = \frac{3q}{r^2}$

$q = \frac{Pr^2}{3}$ B1

c. $q' = \frac{(1.2p)(0.9r)^2}{3}$ M1

$= 1.2 \times 0.81 \frac{pr^2}{3}$

$q' = \frac{0.972pr^2}{3}$ $\frac{1}{2}$ $0.324pr^2$ M1 A1

(ii) % change in $q = \frac{pr^2 - 0.972pr^2}{pr^2} \times 100\%$ M1

$= \frac{1 - 0.972}{1} \times 100\%$

$= 2.8\%$ A1

(10)

24 a) i) $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} O & A & B & C \\ 0 & 2 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix}$ M1

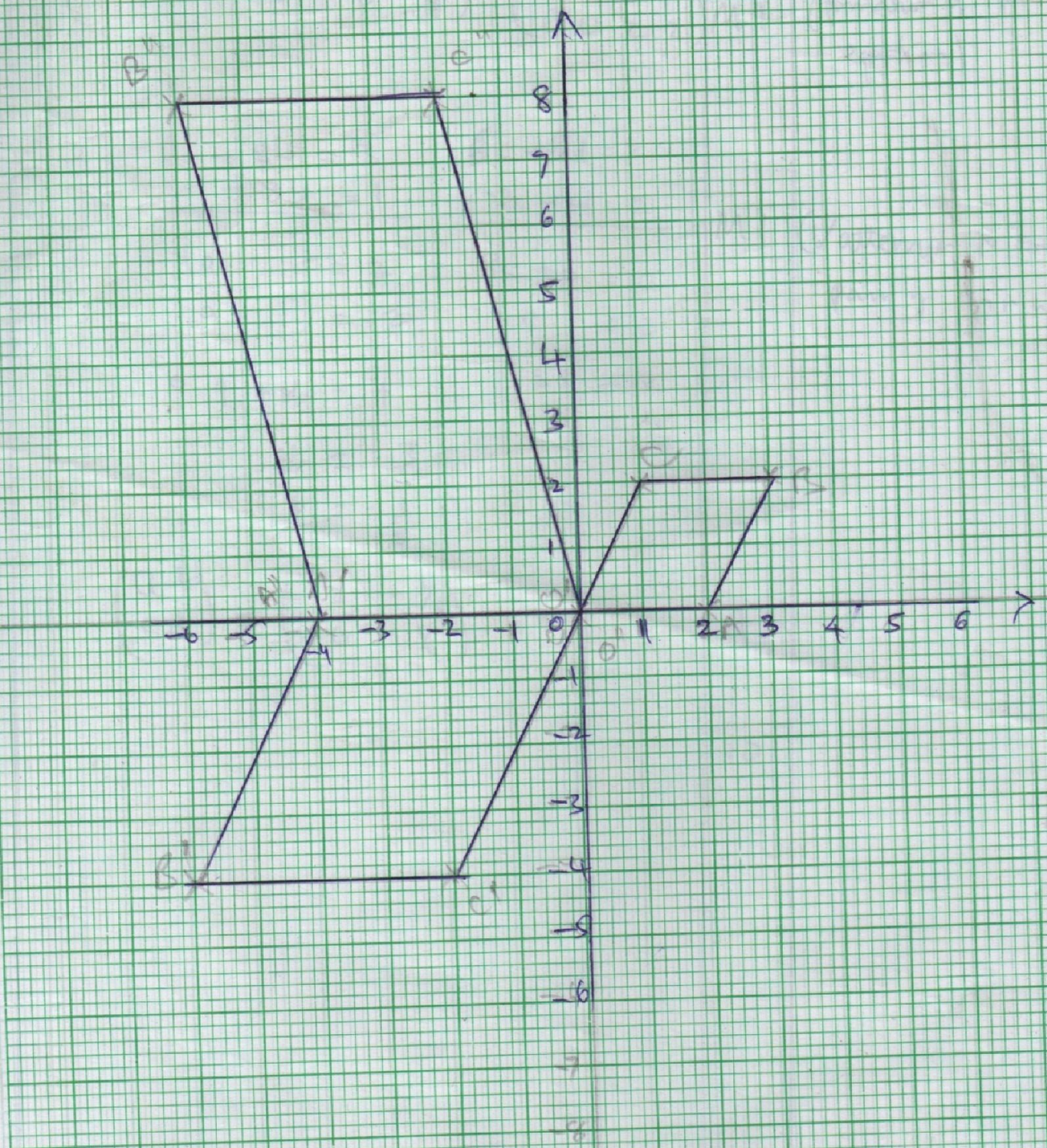
$= \begin{pmatrix} O' & A' & B' & C' \\ 0 & -4 & -6 & -2 \\ 0 & 0 & -4 & -4 \end{pmatrix}$

$O'(0,0)$, $A'(-4,0)$, $B'(-6,-4)$, $C'(-2,-4)$ A1

ii) $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} O' & A' & B' & C' \\ 0 & -4 & -6 & -2 \\ 0 & 0 & -4 & -4 \end{pmatrix}$ M1

$= \begin{pmatrix} O'' & A'' & B'' & C'' \\ 0 & -4 & -6 & -2 \\ 0 & 0 & 8 & 8 \end{pmatrix}$

$O''(0,0)$, $A''(-4,0)$, $B''(-6,8)$, $C''(-2,8)$ A1



B1

B1

B1

c. $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 0'' & A'' & \beta'' & C'' \\ 0 & -4 & -6 & -2 \\ 0 & 0 & 8 & 8 \end{pmatrix} = \begin{pmatrix} 0 & A & B & C \\ 0 & 2 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix}$ M1 (formation of two pairs of equations)

$= -6a + 8b = 3$ $\quad 6c + 8d = 2$

$-2a + 8b = 1$ $\quad -2c + 8d = 2$

$-4a = 2$ $\quad 8c + 0 = 0$ M1 (attempt to solve each pair of simultaneous eqn)

$a = -2$ $\quad c = 0$

$4 + 8b = 1$ $\quad 8d = 2$

$8b = -3$ $\quad d = 1/4$

$b = -\frac{3}{8}$

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} -2 & -3/8 \\ 0 & 1/4 \end{pmatrix}$. A1

10