MARKING SCHEME MATHEMATICS PAPER 1(121/1)

MARKING SCHEME	MARKS	COMMENTS
1. Numerator		
$= (-8) \times 4 + 156 \div 2$ of $(-43+30)$		
~~B O D M A S~~		
$= -8 \times 4 + 156 \div (2$ of $-13)$		
$= -8 \times 4 + 156 \div (2 \times -13)$		
$= -8 \times 4 + (156 \div -26)$		
$= (-8 \times 4) + -6$		
$= -32 + -6$		
$= -32 - 6$	M_1	For $-32-6$
$= -38.$		
Denominator		
$= (-3) - (-8) \times 2 + 6$		
$= -3 + (8 \times 2) + 6$		
$= -3 + (16+6)$		
$= -3 + 22$	M_1	For $-3+22$
$= 19.$		
$\therefore \frac{N}{D} = \frac{-38}{19} = -2.$	A_1	For Correct answer.
2. $= 3.045^2 + \frac{1}{\sqrt{49.24}}$		
$= 9.272 + \frac{1}{7.0171}$	M_1	Correct Square of 3.045 and Square root of 49.24.
$= 9.272 + 0.1426$		
$= 9.4146.$	M_1	Correct reciprocal of 7.0171
	A_1	Correct Answer.

3. $\angle AOB = 80 \times 2 = 160^\circ$

$\angle OAB = \angle OBA = \frac{180 - 160}{2} = \frac{20}{2} = 10^\circ$ B_1

$\angle$ In Quadrilateral OACB, $\angle AOB = 360 - 160$

$= 200^\circ$. — Obtuse

$\therefore \angle OAC = 360 - (200 + 10 + 80)$ B_1

$= 360 - 290$

$= 70^\circ$.

$\therefore \angle CAB = \angle OAB + \angle OAC$

$= 10 + 70$

$= 80^\circ$. B_1

4. (i) 1 Swiss Franc = 1.28 Deutsche Marks

? = 52 Deutsche Marks

$= \frac{1 \text{ Swiss Franc} \times 52 \cancel{\text{Deutsche Marks}}}{1.28 \cancel{\text{Deutsche Marks}}}$ M_1

$= 40.625$ Swiss Francs

$\simeq 41$ Swiss Francs. A_1

(ii) 1 Swiss ~~Franc~~ = 45.21 Kshs.

41 Swiss Francs = ?

$= \frac{41 \cancel{\text{Swiss Francs}} \times 45.21 \text{ Kshs}}{1 \cancel{\text{Swiss Franc}}}$ M_1

$= 1853.61$ Kshs.

$\simeq 1854$ Kshs. A_1

5. $= \frac{243^{-2/5} \times 125^{2/3}}{9^{-3/2}} = \frac{(3^5)^{-2/5} \times (5^3)^{2/3}}{(3^2)^{-3/2}}$ — B1 — Evidence of factorisation i.e. 243 & 125.

243 = 3 × 81, 81 = 3 × 27, 27 = 3 × 9, 9 = 3 × 3, 3 = 3 × 1

125 = 5 × 25, 25 = 5 × 5, 5 = 5 × 1

$= \frac{3^{-2} \times 5^2}{3^{-3}}$

$= 3^{(-2--3)} \times 5^2$ — M1 — Writing in prime factors.

$= 3^1 \times 5^2$

$= 3 \times 25$

$= 75.$ — A1

6. $4y + 2y = 90$ — M1

$\frac{6y}{6} = \frac{90}{6}$ 15

$y = 15°.$ — A1

7. Numerator

$= 3x^2 + 2xy - y^2$

$S = 2$, $P = -3$ → $3, -1$

$= 3x^2 + 3xy - xy - y^2$

$= 3x(x+y) - y(x+y)$

$= (3x - y)(x + y)$ — M1

Denominator

Difference of 2 sq. $= (3x - y)(3x + y)$ — M1

$\frac{N}{D} = \frac{(3x - y)(x + y)}{(3x - y)(3x + y)}$

$= \frac{x + y}{3x + y}.$ — A1

8. $\overrightarrow{PQ} = Q - P = \begin{pmatrix}4\\3\end{pmatrix} - \begin{pmatrix}3\\4\end{pmatrix} = \begin{pmatrix}1\\-1\end{pmatrix}$

$\overrightarrow{PR} = R - P = \begin{pmatrix}1\\6\end{pmatrix} - \begin{pmatrix}3\\4\end{pmatrix} = \begin{pmatrix}-2\\2\end{pmatrix}$

$\overrightarrow{PR} = -2\begin{pmatrix}1\\-1\end{pmatrix} = -2\overrightarrow{PQ}$ B1

$\therefore \overrightarrow{PR} = -2PQ$. B1

$\therefore \overrightarrow{PR} \parallel \overrightarrow{PQ}$ and point P(3,4) is a common point. B1

9. Distance by P in 2hrs = 60x2 = 120km

Relative speed = 100 − 60 = 40km/hr M1 Relative speed

Time to overtake = $\frac{120}{40}$ = 3hrs.

9.30
+3.00
12.30pm. M1 Time add

A1

10. Area of Sector $= \frac{\theta}{360} \pi r^2$.

$\therefore \frac{72}{360} \times \pi \times r^2 = 5\pi$. M1

$r^2 = \frac{5\cancel{\pi} \times 360}{72 \times \cancel{\pi}}$

$r = \sqrt{25} = 5\text{cm}$. A1

Area of shaded part $= 5\pi - \frac{1}{2} \times 5^2 \sin 72^\circ$ M1

$= 5\pi - 11.89$

$= 3.818\text{cm}^2$. A1

11. L.S.F $= \sqrt{\frac{108}{12}} = 3$. M1

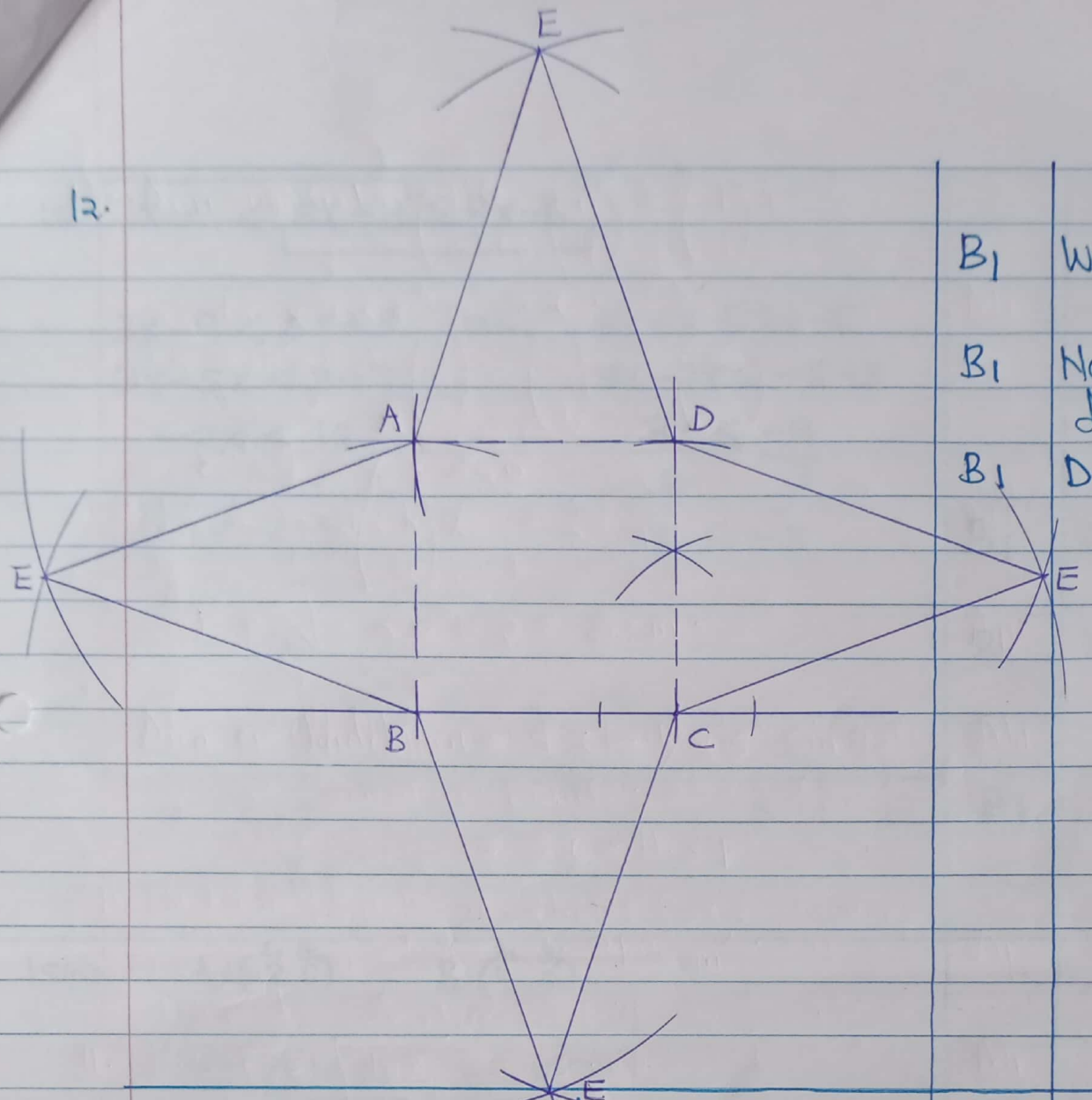
V.S.F $= \left(\frac{3}{1}\right)^3 = \frac{27}{1}$

$\therefore \frac{27}{1} = \frac{810}{S}$ M1

$= \frac{\cancel{27}S}{\cancel{27}} = \frac{810 \times 1}{27}$

$S = 30\text{cm}^3$. A1

12.



B1 Well labelled

B1 Not Correctly drawn.

B1 Dotted lines

13. GCD of 234, 270 and 324

2	234	270	324
3	117	135	162
3	39	45	54
	13	15	18

B1

$\therefore$ GCD $= 2 \times 3 \times 3$

$= 18$ cm. A1

Length of longest piece $= 18$ cm.

Total no. of pieces $= \frac{234}{18} + \frac{270}{18} + \frac{324}{18}$ M1

$= 13 + 15 + 18$

$= 46$ pieces. A1

14. $3x-9 < 5x+3 \leq 2x-6$

$3x-9 < 5x+3$ and $5x+3 \leq 2x-6$

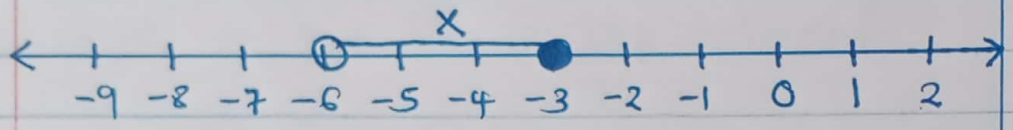
$3x-5x < 3+9$ $\quad$ $5x-2x \leq -6-3$

$-2x < 12$ $\quad$ $\frac{3x}{3} \leq \frac{-9}{3}$

$\therefore x > \frac{12}{-2}$ $\quad$ $x \leq -3$ $\quad$ B1 $\quad x > -6$

$x > -6$. $\quad$ B1 $\quad x \leq -3$

$-6 < x \leq -3$



B1

$x = -5, -4, -3$.

15(a) A $(\overset{x_1}{-2}, \overset{y_1}{6})$ $\quad$ B $(\overset{x_2}{4}, \overset{y_2}{2})$

$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$M = \left(\frac{-2+4}{2}, \frac{6+2}{2}\right) = (1, 4)$ $\quad$ M1

$M(1, 4)$ $\quad$ A1

(b) Gradient of $AB = \frac{2-6}{4--2} = \frac{-4}{6} = -\frac{2}{3}$.

$(1, 4)$ (x, y) $\quad$ $M_1 M_2 = -1$ $\quad$ $\frac{3x-9}{2} \times M_2 = -1 \times \frac{3}{2}$ $\quad$ M1

$\frac{y-4}{x-1} = \frac{-3}{2}$ $\quad$ $M_2 = -\frac{3}{2}$

$2(y-4) = -3(x-1)$

$2y - 8 = -3x + 3$

$\frac{2y}{2} = \frac{-3x}{2} + \frac{11}{2}$

$y = -\frac{3}{2}x + \frac{11}{2}$. $\quad$ A1

16(a) Let the exterior $\angle$ be x

$\therefore x + x + 120 = 180$ M1

$2x = 180 - 120$

$\frac{2x}{2} = \frac{60}{2}$

$x = 30°$

No. of sides $= \frac{360}{30} = 12$ sides A1

(b) Length of the side $= \frac{120}{12} = 10\,cm$. B1

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17 (a)(i) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$\overrightarrow{AB} = -\underset{\sim}{a} + \underset{\sim}{b}$. B1

(ii) $\overrightarrow{ON} = \overrightarrow{OA} + \overrightarrow{AN}$

$\overrightarrow{ON} = \underset{\sim}{a} + \frac{1}{3}\overrightarrow{AB}$

$\overrightarrow{ON} = \underset{\sim}{a} + \frac{1}{3}(-\underset{\sim}{a} + \underset{\sim}{b})$

$\overrightarrow{ON} = \underset{\sim}{a} - \frac{1}{3}\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}$

$\overrightarrow{ON} = \frac{2}{3}\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}$. B1

(iii) $\overrightarrow{BM} = \overrightarrow{BO} + \overrightarrow{OM}$

$\overrightarrow{BM} = -\underset{\sim}{b} + \frac{2}{5}\underset{\sim}{a}$. B1

(b) $\overrightarrow{OX} = k\overrightarrow{ON}$

$\overrightarrow{OX} = k\left(\frac{2}{3}\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}\right)$

$\overrightarrow{OX} = \frac{2}{3}k\underset{\sim}{a} + \frac{1}{3}k\underset{\sim}{b}$ ..... equ (i) B1

$\overrightarrow{OX} = \overrightarrow{OB} + \overrightarrow{BX}$

$\overrightarrow{OX} = \underset{\sim}{b} + h\,BM$

$\overrightarrow{OX} = \underset{\sim}{b} + h\left(-\underset{\sim}{b} + \frac{2}{5}\underset{\sim}{a}\right)$

$\overrightarrow{OX} = \underset{\sim}{b} - h\underset{\sim}{b} + \frac{2}{5}h\underset{\sim}{a}$

$\overrightarrow{OX} = (1-h)\underset{\sim}{b} + \frac{2}{5}h\underset{\sim}{a}$ ..... equ (ii) B1

$\frac{2}{3}k\underset{\sim}{a} + \frac{1}{3}k\underset{\sim}{b} = (1-h)\underset{\sim}{b} + \frac{2}{5}h\underset{\sim}{a}$ M1

$\frac{2}{3}k\underset{\sim}{a} = \frac{2}{5}h\underset{\sim}{a}$ and $\frac{1}{3}k\underset{\sim}{b} = (1-h)\underset{\sim}{b}$

$15\left(\frac{2}{3}k\right) = \left(\frac{2}{5}h\right)15$ $\quad 3 \times \frac{1}{3}k = (1-h)3$

$10k = 6h$ $\quad k = 3-3h$

$10k - 6h = 0$ $\quad k + 3h = 3$.

$k = 3-3h$

$10(3-3h) - 6h = 0$. $\quad k = 3 - 3\left(\frac{5}{6}\right)$ M1

$30 - 30h - 6h = 0$

$\frac{-36h}{-36} = \frac{+30}{+36}$ $\quad k = \frac{3}{1} - \frac{15}{6} = \frac{18-15}{6}$

$h = \frac{5}{6}$ $\quad k = \frac{3}{6_2} = \frac{1}{2}$ M1

$h = \frac{5}{6}$, $k = \frac{1}{2}$ A1

(c) $OX : XN = 1 : 1$ B1

18.

Age group	F	M.P(x)	Fx	C.F	Fd		
1-5	4	3	12	4	0.8	B_1	Correct Column of Fx
6-10	12	8	96	16	2.4		
11-20	9	15.5	139.5	25	0.9		
21-30	6	25.5	153	31	0.6		
31-50	18	40.5	729	49	0.9	B_1	For C.F
51-55	4	53	212	53	0.8		
56-65	2	60.5	121	55	0.2		
	$\Sigma F = 55$		$\Sigma FX = 1462.5$				

a (i) Mean $(\bar{x}) = \frac{\Sigma FX}{\Sigma F} = \frac{1462.5}{55}$ M_1

$= 26.59$ A_1

(ii) Median Value $= \frac{55+1}{2} = 28^{th}$ value.

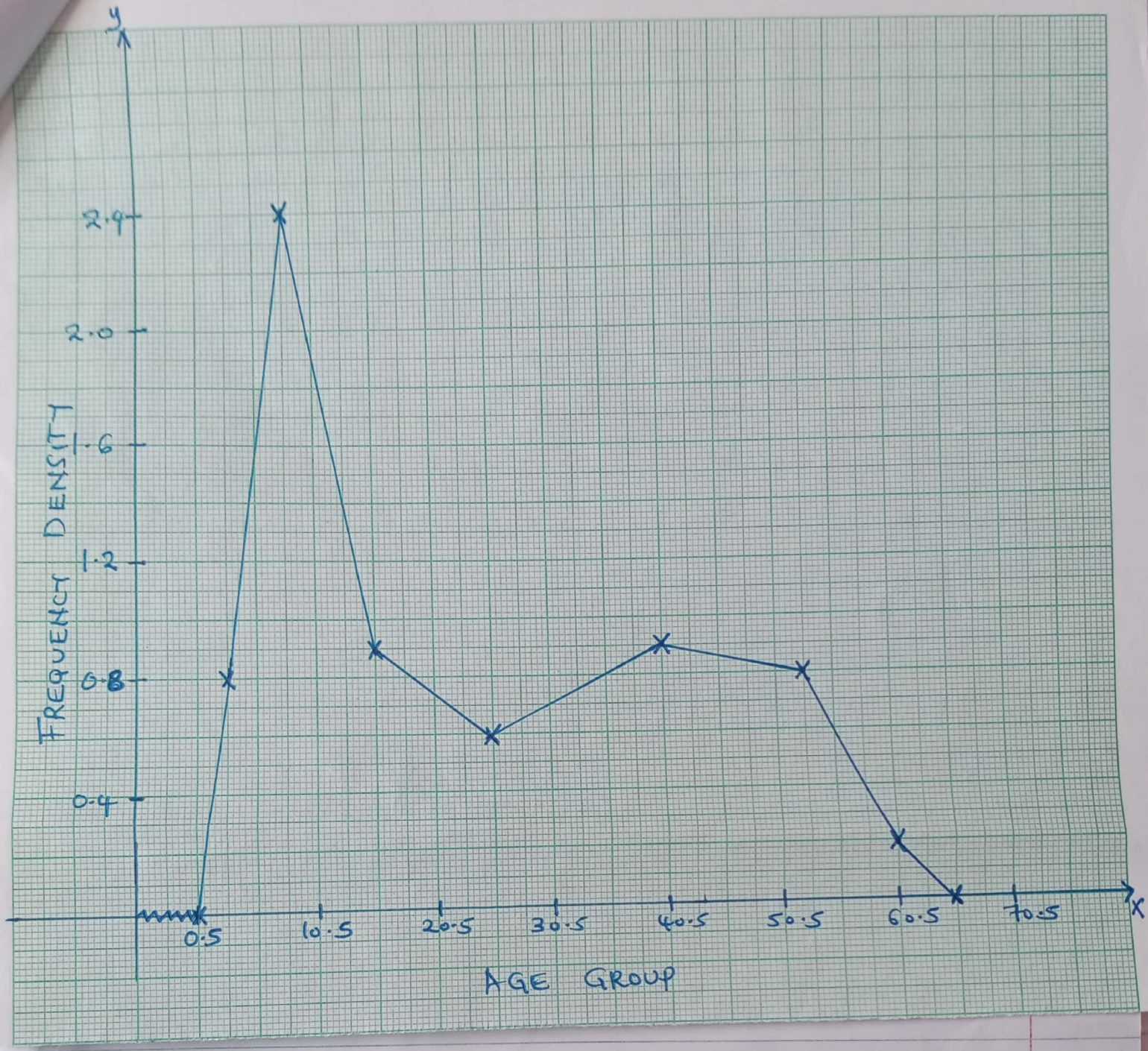
28^{th} value $= 20.5 + \left(\frac{28-25}{6}\right)10$ M_1

$= 20.5 + \left(\frac{3}{6}\right)10$

$= 20.5 + 5$

$= 25.50.$ A_1

(b) Frequency polygon


y
2·9
2·0
1·6
1·2
0·8
0·4
FREQUENCY DENSITY
0·5
10·5
20·5
30·5
40·5
50·5
60·5
70·5
x
AGE GROUP

19.

a(i) $\begin{matrix} & A & B & C & D \end{matrix}$ $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 6 & 6 & 2 \\ 1 & 2 & 6 & 6 \end{bmatrix} = \begin{matrix} A' & B' & C' & D' \end{matrix} \begin{bmatrix} 1 & 2 & 6 & 6 \\ -1 & -6 & -6 & -2 \end{bmatrix}$

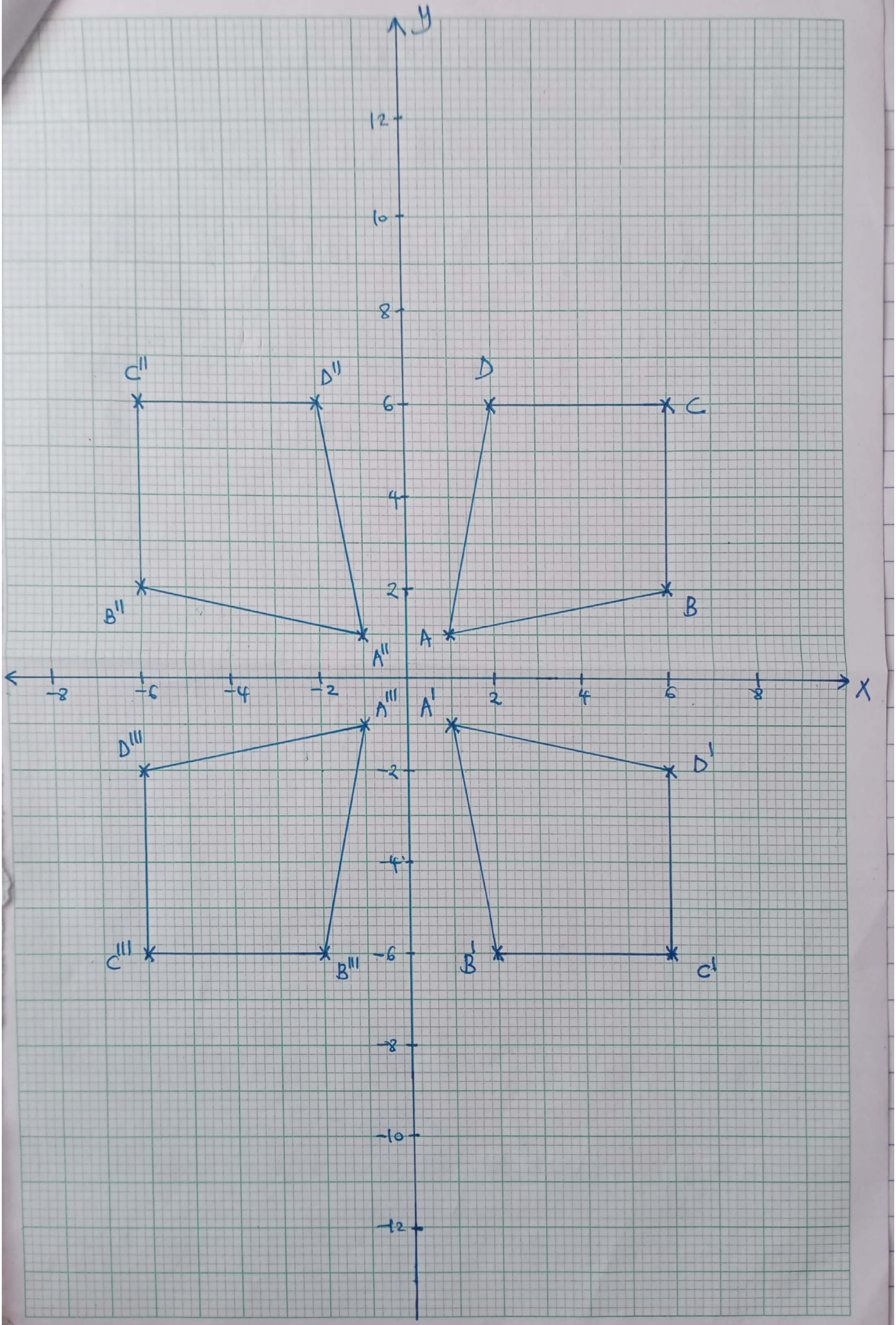
$A'(1,-1)$, $B'(2,-6)$, $C'(6,-6)$, $D'(6,-2)$

(ii) $\begin{matrix} & A' & B' & C' & D' \end{matrix}$ $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 & 6 & 6 \\ -1 & -6 & -6 & -2 \end{bmatrix} = \begin{matrix} A'' & B'' & C'' & D'' \end{matrix} \begin{bmatrix} -1 & -6 & -6 & -2 \\ 1 & 2 & 6 & 6 \end{bmatrix}$

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

(iii) $\begin{matrix} & A'' & B'' & C'' & D'' \end{matrix}$ $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -1 & -6 & -6 & -2 \\ 1 & 2 & 6 & 6 \end{bmatrix} = \begin{matrix} A''' & B''' & C''' & D''' \end{matrix} \begin{bmatrix} -1 & -2 & -6 & -6 \\ -1 & -6 & -6 & -2 \end{bmatrix}$

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


y
x
12
10
8
6
4
2
-2
-4
-6
-8
-10
-12
-8
-6
-4
-2
2
4
6
8
C''
D''
D
C
B''
B
A''
A
A'''
A'
D'''
D'
C'''
B'''
B'
C'

2(a) Let the Cows be x
Goats y

$2c + 9g = 98200$ B1
$3c + 4g = 96000$ B1

(b) $\begin{bmatrix} 2 & 9 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} c \\ g \end{bmatrix} = \begin{bmatrix} 98200 \\ 96000 \end{bmatrix}$

$Det = (2 \times 4) - (9 \times 3)$
$= 8 - 27$
$= -19.$

$Inverse = \frac{1}{-19} \begin{bmatrix} 4 & -9 \\ -3 & 2 \end{bmatrix}$

Pre-multiply both sides by the inverse

$= \frac{1}{-19} \begin{bmatrix} 4 & -9 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} 2 & 9 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} c \\ g \end{bmatrix} = \frac{1}{-19} \begin{bmatrix} 4 & -9 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} 98200 \\ 96000 \end{bmatrix}$

$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} c \\ g \end{bmatrix} = \frac{1}{-19} \begin{bmatrix} -471,200 \\ -102,600 \end{bmatrix}$

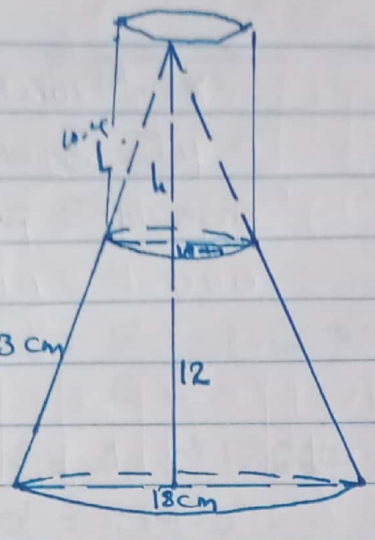
$\begin{bmatrix} c \\ g \end{bmatrix} = \begin{bmatrix} 24800 \\ 5400 \end{bmatrix}$

1 Cow Costs Sh. 24800
1 goat Costs Sh. 5400.

C(i) $= \left(\frac{130}{100} \times 24800\right) 2 + \left(\frac{140}{100} \times 5400\right) 9$
$= (32240)\,2 + (7560)\,9$
$= 64480 + 68040 = Sh. 132,520.$

(ii) % Profit $= \left(\frac{132520 - 98200}{98200}\right) \times 100$
$= \underline{34.95\%}.$

21. (a)



$\frac{9}{4} = \frac{13+L}{L}$

$9L = 52 + 4L$

$9L - 4L = 52$

$\frac{5L}{5} = \frac{52}{5}$

$L = 10.4\text{cm}$. M1 For L

M1 S.A Cylinder

M1 S.A Cone

M1 S.A Base

~~A1~~ ~~Total~~

$S.A = (\pi \times 8 \times 10) + (\pi \times 9 \times 23.4 - \pi \times 4 \times 10.4) + \pi \times 9^2$

$= 80\pi + 169\pi + 81\pi$.

$= 330\pi\ \text{cm}^2$. A1 Total

(b) Height of Frustum $= \sqrt{(23.4^2 - 9^2)} - \sqrt{(10.4^2 - 4^2)}$

$= 21.6 - 9.6$

$= 12$.

$h = \sqrt{10.4^2 - 4^2} = 9.6$. M1

Volume $= \left(\frac{1}{3} \times \pi \times 9^2 \times 21.6 - \frac{1}{3} \times \pi \times 4^2 \times 9.6\right) + (\pi \times 4^2 \times 10)$ M1 M1

$= (583.2\pi - 51.2\pi) + 160\pi$

$= 532\pi + 160\pi$ M1

$= 692\pi\ \text{cm}^3$. A1

22. (a) $DC = \sqrt{3^2 + 5^2}$ M1

$= \sqrt{34}$

$= 5.8\,cm.$ A1

(b) $\tan \alpha = \frac{5}{6} = 1.667.$ M1

$\alpha = \tan^{-1} 1.667.$

$\alpha = 59.0°.$ A1

(c) $c^2 = a^2 + b^2 - 2ab \cos \theta$

$\cos \theta = \frac{8^2 + 5^2 - 11^2}{2 \times 8 \times 5}$ M1

$\cos \theta = -0.4$

$\theta = \cos^{-1}(-0.4)$ M1

$\theta = 113.6°.$ A1

(d) $\text{Area} = \left(\frac{1}{2} \times 3 \times 5\right) + \left(\frac{1}{2} \times 5 \times 8 \sin 113.6\right)$ M1 M1

$= 7.5 + 18.3$

$= 25.8\,cm^2.$ A1

23. (a) $S = (4^3) - 5(4^2) + 4(4) + 3$ — M1

$= 3m$. — A1

(b) $V = \frac{ds}{dt} = 3t^2 - 10t + 4$ — M1

$= 3(4^2) - 10(4) + 4$ — M1

$= 12 m/s$ — A1

(c) $3t^2 - 10t + 4 = 0$. — M1

$t = \frac{10 \pm \sqrt{100 - 48}}{6}$ — M1

$\therefore t = 2.87$ and $t = 0.46$ — A1

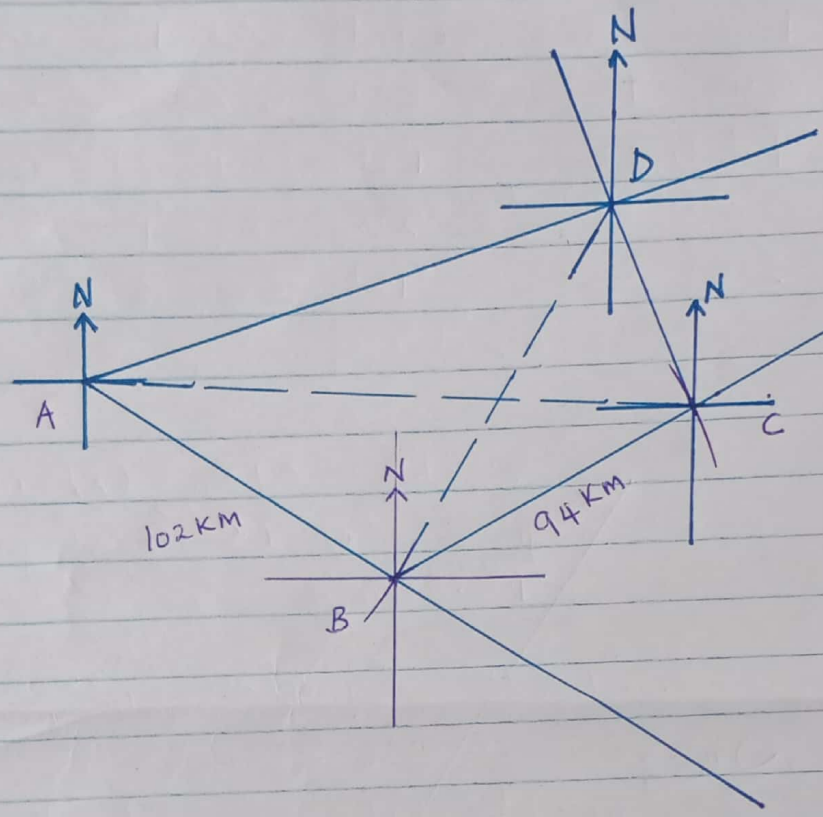
(d) $a = \frac{dv}{dt} = 6t - 10$

$= 6(3) - 10$ — M1

$= 18 - 10$

$= \underline{8 m/s^2}$. — A1

24 (a)



B1 B Correctly located

B1 C Correctly located

B1 D Correctly located

B1 Complete diagram ABCD

(b) (i) Bearing of B from D = 211°

B1B1

(ii) Distance AD = 7.6 x 20 = 152 km

B1B1

(iii) Bearing of A from C = 273°.

B1

(iv) Distance BD = 5.8 x 20 = 116km.

B1