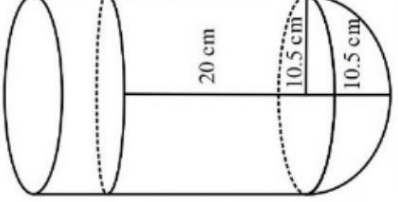
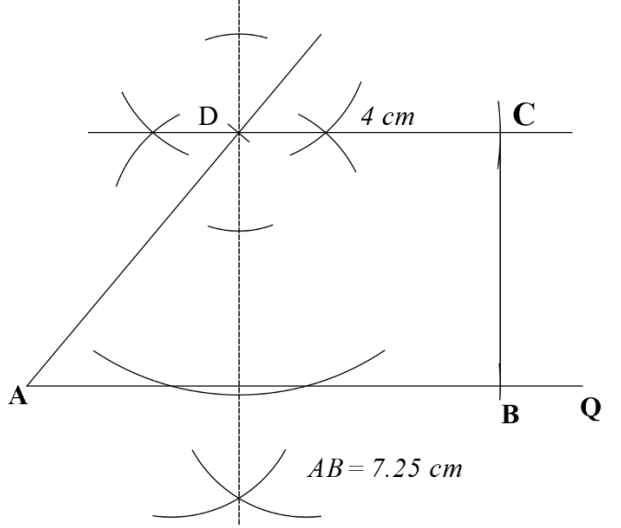
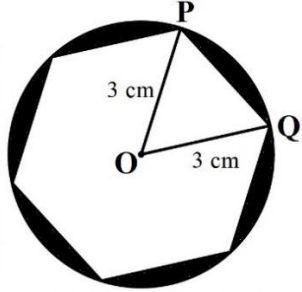
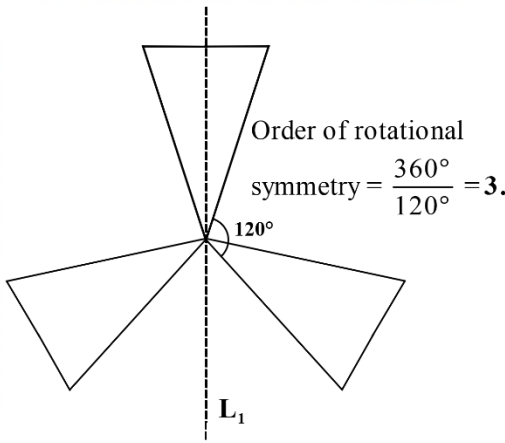
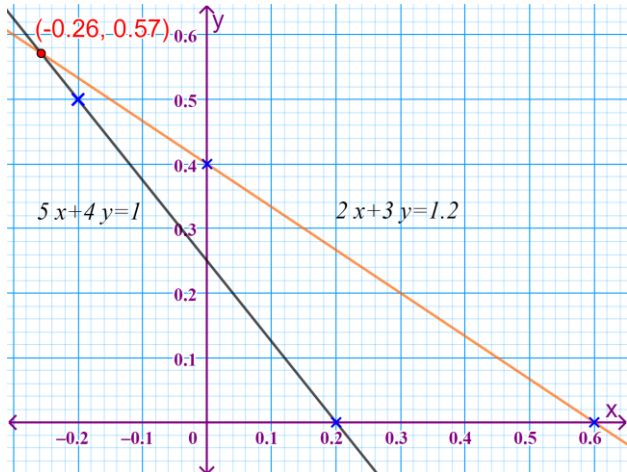
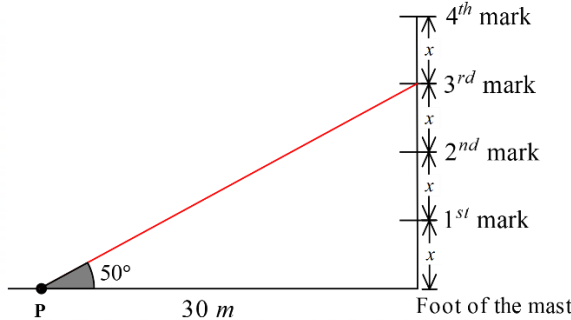


SECTION I (50 marks)

1.	$\frac{0.039 - 0.003}{0.09} = \frac{0.036}{0.09} \times \frac{1000}{1000}$ $= \frac{\cancel{36}^4}{\cancel{9}_1 \times 10} = \frac{4}{10}$ $= 0.4$	6.	$15 = 3^1 \times 5^1, \quad 24 = 2^3 \times 3^1$ Minimum length = LCM of 15 and 24 $LCM = 2^3 \times 3^1 \times 5^1 = 120 \text{ cm}$
2.	$\frac{4x^2 - 9}{2x^2 + x - 6} = \frac{(2x)^2 - 3^2}{2x^2 + 4x - 3x - 6}$ $= \frac{(2x+3)(2x-3)}{2x(x+2) - 3(x+2)}$ $= \frac{\cancel{(2x+3)}^1 (2x-3)}{\cancel{(2x+3)}^1 (x+2)}$ $= \frac{2x-3}{x+2}$	7.	 $SA = \left(2 \times \frac{22}{7} \times 10.5^2 \right) + \left(2 \times \frac{22}{7} \times 10.5 \times 20 \right)$ $= 693 + 1320$ $= 2013 \text{ cm}^2$
3.	Given $y = -\frac{1}{3}x + 2, \Rightarrow Q(0, 2)$. $m_2 = -\left(-\frac{1}{3}\right)^{-1} = -1 \times \frac{-3}{1} = 3$ $y = 3x + c$ At Q, $2 = 3(0) + c$ hence $c = 2$. Equation of L_2 is $\boxed{y = 3x + 2}$.	8.	
4.	 $\angle POQ = \frac{360^\circ}{6} = 60^\circ$ Area of hexagon $6 \times \frac{1}{2} \times 3^2 \times \sin 60^\circ = 23.3827 \text{ cm}^2$ Area of circle $= \frac{22}{7} \times 3^2 = 28.2857 \text{ cm}^2$ Shaded area $= 28.2857 - 23.3827$ $= 4.903 \text{ cm}^2$	9.	$2 \times \frac{22}{7} \times r \times \frac{\theta^c}{2\pi^c} = l$ $2 \times \frac{22}{7} \times r \times \frac{1.25}{2\pi} = 10$ $\frac{44}{7} \times r \times 1.25 \times \frac{7}{44} = 10$ $1.25r = 10$ $\therefore r = \frac{10}{1.25} = 8 \text{ cm}$ $\frac{22}{7} \times r^2 \times \frac{\theta^c}{2\pi^c} = \text{Area}$ $\text{Area} = \frac{22}{7} \times 8^2 \times 1.25 \times \frac{7}{44}$ $= 40 \text{ cm}^2$
5.	$25 = 5^2, \quad 125 = 5^3$ $\therefore 5^{2x} = 5^{\left(\cancel{5}_1 \times \frac{2}{\cancel{5}_1}\right) \cdot (-1)}$ $5^{2x} = 5^3 \Rightarrow 2x = 3$ $x = \frac{3}{2} = 1\frac{1}{2} \text{ or } 1.5$		

10.		14.	<table border="1" data-bbox="861 94 1490 138"><tr><td>cf</td><td>3</td><td>11</td><td>21</td><td>28</td><td>30</td></tr></table> Median position = $\frac{30+1}{2} = 15.5$ Median class is 30 – 39. lcb of median class = 29.5 Median = $29.5 + \left(\frac{(15.5-11)}{10} \times 10 \right)$ = 34	cf	3	11	21	28	30										
cf	3	11	21	28	30														
11.	The bank buys 1 S.A. rand at Ksh. 7.08 $\therefore 7.08 \times 15\ 000 = \text{Ksh.} 106\ 200$ Remainder = Ksh. $(106\ 200 - 53\ 075)$ = Ksh. 53 125 The bank sells Tsh. 100 for Ksh. 21.25 $\therefore \frac{53\ 125}{21.25} \times 100 = \text{Tsh. } 250\ 000$	15.	<table border="1" data-bbox="861 546 1490 624"><tr><td>x</td><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td><td>3</td></tr><tr><td>y</td><td>0</td><td>0.25</td><td>1</td><td>2.25</td><td>4</td><td>6.25</td><td>9</td></tr></table> $h = \frac{3}{3} = 1$ Area = $h(y_1 + y_2 + y_3)$ Area = $1(0.25 + 2.25 + 6.25)$ = 8.75 sq. units	x	0	0.5	1	1.5	2	2.5	3	y	0	0.25	1	2.25	4	6.25	9
x	0	0.5	1	1.5	2	2.5	3												
y	0	0.25	1	2.25	4	6.25	9												
12.	$\mathbf{AB} = \mathbf{OB} - \mathbf{OA} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\mathbf{OM} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} + \frac{5}{2} \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 5 \\ 7.5 \end{pmatrix} = \begin{pmatrix} 7 \\ 8.5 \end{pmatrix}$ $\therefore M(7, 8.5)$ $\frac{x-1}{2} = 7 \Rightarrow x-1=14$ hence $x=15$ $\frac{y+7}{2} = 8.5 \Rightarrow y+7=17$ hence $y=10$ $\therefore D(15, 10)$	16.	$2x + 3y = 1.2$ <table border="1" data-bbox="861 990 1490 1068"><tr><td>x</td><td>0</td><td>0.6</td></tr><tr><td>y</td><td>0.4</td><td>0</td></tr></table> $5x + 4y = 1$ <table border="1" data-bbox="861 1153 1490 1232"><tr><td>x</td><td>-0.2</td><td>0.2</td></tr><tr><td>y</td><td>0.5</td><td>0</td></tr></table>  $x = -0.26$ $y = 0.57$	x	0	0.6	y	0.4	0	x	-0.2	0.2	y	0.5	0				
x	0	0.6																	
y	0.4	0																	
x	-0.2	0.2																	
y	0.5	0																	
13.	 $\tan 50^\circ = \frac{3x}{30}$ $3x = 30 \tan 50^\circ$ $x = \frac{30 \times 1.1918}{3} = 11.918\text{m}$ Height = $4x$ = 11.918×4 = 47.672m																		

SECTION II (50 marks)

17.			
	Farmer	Abdul	Chebet
	Sold	x	$2x$
	Remaining	$32 - x$	$56 - 2x$
	Selling price	$1.05k$	k
(a)	$\frac{32 - x}{56 - 2x} = \frac{3}{5}$ $160 - 5x = 168 - 6x$ $x = 8$ Abdul sold 8 goats Chebet sold $2 \times 8 = 16$ goats		
(b)	$16k + 8(1.05k) = 97600$ $16k + 8.4k = 97600$ $24.4k = 97600 \Rightarrow k = 4000$ Chebet sold a goat at Ksh. 4 000 Abdul sold a goat at $1.05 \times 4\,000 = \text{Ksh. } 4\,200$ <u>Abdul's earnings</u> : <u>Chebet's earnings</u> $(4200 \times 8) : (4000 \times 16)$ $33600 : 64000$ $21 : 40$		
(c)	$\frac{19}{21} \times 4200 = \text{Ksh. } 3\,800$		

18.			
(a)	(i) $\frac{4200}{x - 2}$	(ii) $\frac{4500}{x + 2}$	
(b)	$\frac{4200}{x - 2} - \frac{4500}{x + 2} = 50$ $4200(x + 2) - 4500(x - 2) = 50(x^2 - 4)$ $4200x + 8400 - 4500x + 9000 = 50x^2 - 200$ $50x^2 + 300x - 17600 = 0$ $x^2 + 6x - 352 = 0$ $x^2 + 22x - 16x - 352 = 0$ $x(x + 22) - 16(x + 22) = 0$ $(x - 16)(x + 22) = 0$ $x - 16 = 0 \text{ or } x + 22 = 0$ $x = 16 \text{ or } x = -22$ Taling the positive value, $x = 16$ watches In Feb, $\frac{4200}{16 - 2} = 300$ pens sold.		
(c)	$\% \text{ change} = \frac{50}{300} \times 100 = 16\frac{2}{3} \%$		

19.	
(a)	
(b)	Mark T; 5 cm (on paper) from R along SQ. $ST = 3.6 \times 200 = 720 \text{ km}$ Time taken to reach T = $\frac{720}{400} = 1\frac{4}{5} \text{ h}$ $\equiv 1\text{hr } 48 \text{ min}$ The aircraft will be at T at: $0800 + 1\text{hr } 48 \text{ min} = 0948\text{h}/9.48 \text{ am.}$

20	(a)	$s = \frac{39 + 41 + 50}{2} = 65$ $\text{Area} = \sqrt{65(65 - 50)(65 - 41)(65 - 39)}$ $= \sqrt{65 \times 15 \times 24 \times 26} = 780\text{m}^2$ Let the perpendicular height be h. $\frac{1}{2} \times 50 \times h = 780$ $25h = 780 \Rightarrow h = 31.2\text{m or } 31\frac{1}{5}\text{m}$
	(b) (i)	$\sin 30^\circ = \frac{31.2}{BC}$ $\Rightarrow BC = \frac{31.2}{\sin 30^\circ} = \frac{31.2}{0.5} = 62.4\text{m}$
	(ii)	$x^2 = 50^2 + 62.4^2 - (2 \times 50 \times 62.4 \times \cos 30^\circ)$ $x^2 = 2500 + 3893.76 - 5403.84$ $x^2 = 989.92$ Hence $x = \sqrt{989.92} = 31.463\text{m}$
	(c)	$\frac{31.463}{\sin 30^\circ} = \frac{62.4}{\sin y}$ $\sin y = \frac{62.4 \sin 30^\circ}{31.463} = \frac{31.2}{31.463} = 0.9916$ $y = \sin^{-1} 0.9916 = 82.57^\circ$ Obtuse $\angle BMC = 180^\circ - 82.57^\circ$ $= 97.43^\circ$

(a)

$$(i) \mathbf{PQ} = \begin{pmatrix} 3 & 7 \\ h & 4 \end{pmatrix} \begin{pmatrix} 5 & -4 \\ 3 & -2 \end{pmatrix} = \begin{pmatrix} (3 \times 5) + (7 \times 3) & (3 \times -4) + (7 \times -2) \\ (h \times 5) + (4 \times 3) & (h \times -4) + (4 \times -2) \end{pmatrix} = \begin{pmatrix} 36 & -26 \\ 5h+12 & -4h-8 \end{pmatrix}$$

$$\det \mathbf{PQ} = 36(-4h-8) - [-26((5h+12))] = 3$$

$$\therefore -144h - 288 - [-130h - 312] = 3$$

$$-144h - 288 + 130h + 312 = 3$$

$$-14h + 24 = 3$$

$$-14h = -21 \Rightarrow h = 1.5 \text{ or } 1\frac{1}{2}.$$

$$(ii) \mathbf{P} = \begin{pmatrix} 3 & 7 \\ 1.5 & 4 \end{pmatrix}; \quad \det \mathbf{P} = \begin{vmatrix} 3 & 7 \\ 1.5 & 4 \end{vmatrix} = (3 \times 4) - (7 \times 1.5) = 1.5$$

$$\mathbf{P}^{-1} = \frac{1}{1.5} \begin{pmatrix} 4 & -7 \\ -1.5 & 3 \end{pmatrix} = \begin{pmatrix} \frac{8}{3} & -\frac{14}{3} \\ -1 & 2 \end{pmatrix}$$

(b)

$$(i) \begin{array}{l|l} 12m + 28n = 24600 & 15m + 40n = 34500 \\ 3m + 7n = 6150 \dots (i) & 1.5m + 4n = 3450 \dots (ii) \end{array}$$

$$(ii) \begin{pmatrix} \frac{8}{3} & -\frac{14}{3} \\ -1 & 2 \end{pmatrix} \begin{pmatrix} 3 & 7 \\ 1.5 & 4 \end{pmatrix} \begin{pmatrix} m \\ n \end{pmatrix} = \begin{pmatrix} \frac{8}{3} & -\frac{14}{3} \\ -1 & 2 \end{pmatrix} \begin{pmatrix} 6150 \\ 3450 \end{pmatrix}$$

$$\begin{bmatrix} (\frac{8}{3} \times 3) + (-\frac{14}{3} \times 1.5) & (\frac{8}{3} \times 7) + (-\frac{14}{3} \times 4) \\ (-1 \times 3) + (2 \times 1.5) & (-1 \times 7) + (2 \times 4) \end{bmatrix} \begin{pmatrix} m \\ n \end{pmatrix} = \begin{bmatrix} (\frac{8}{3} \times 6150) + (-\frac{14}{3} \times 3450) \\ (-1 \times 6150) + (2 \times 3450) \end{bmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} m \\ n \end{pmatrix} = \begin{pmatrix} 300 \\ 750 \end{pmatrix}$$

$$\begin{pmatrix} m \\ n \end{pmatrix} = \begin{pmatrix} 300 \\ 750 \end{pmatrix} \Rightarrow m = 300 \text{ and } n = 750 \quad \therefore \text{watch's price} = \text{Ksh. } 300, \text{ phone's price} = \text{Ksh. } 750$$

(a) (i)

Trees (class)	Number (f)	Midpoint, (x)	fx
6 – 10	9	8	72
11 – 15	8	13	104
16 – 20	10	18	180
21 – 25	6	23	138
26 – 30	3	28	84
31 – 35	4	33	132
$\sum f = 40$			$\sum fx = 710$

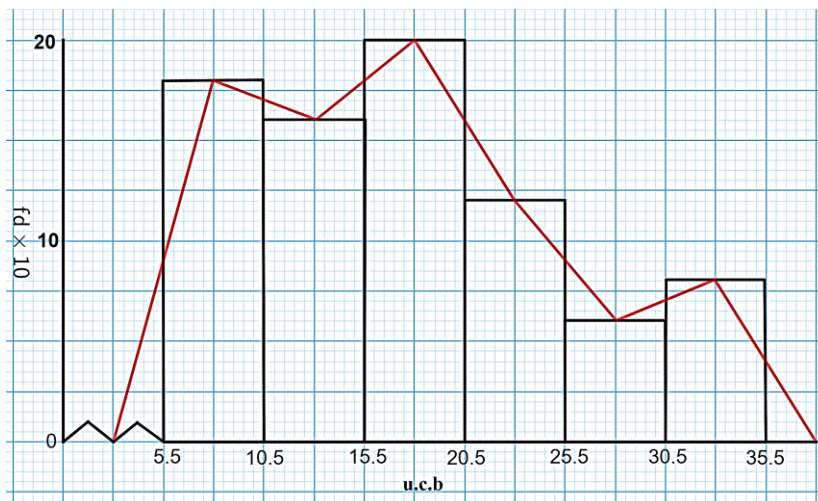
(ii)

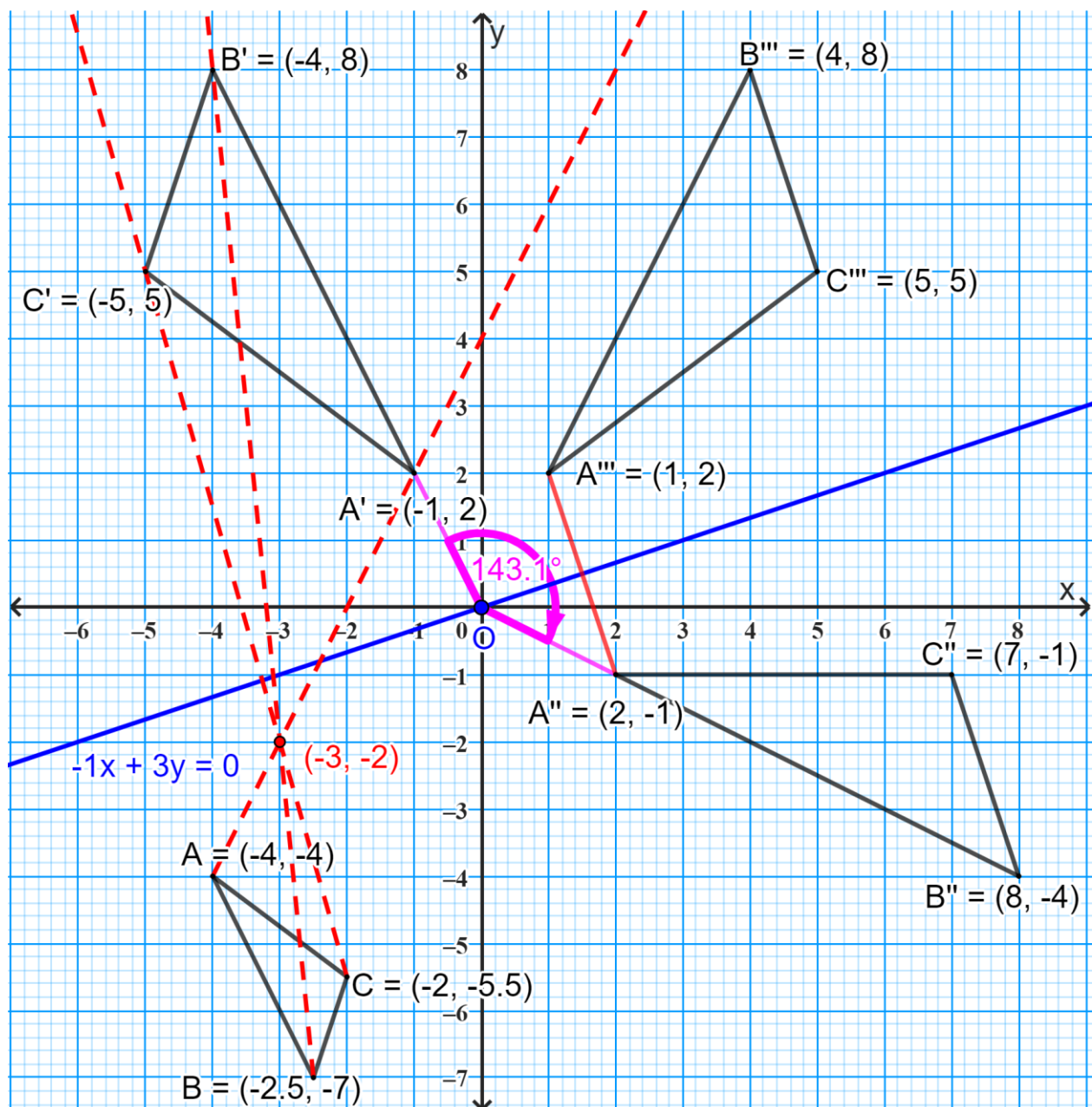
$$16 - 20$$

(iii)

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{710}{40} = 17.75$$

(b)





(a) $A'B'C'$ the image of ABC under an enlargement centre $(-3, -2)$ and $(S.F.) = -2$.

(b) $A''B''C''$ the image of $A'B'C'$ under rotation centre $O(0,0)$.

(i) Angle of rotation. **143.1°**

(ii) Completing triangle $A''B''C''$.

(c) $A'''B'''C'''$ the image of triangle $A''B''C''$ under a reflection.

(i) Mirror line **drawn in blue**.

(ii) Equation of the mirror line

Using $(6, 2)$ and $(-6, -2)$;

$$\text{Gradient, } m = \frac{2 - (-2)}{6 - (-6)} = \frac{4}{12} = \frac{1}{3}$$

y -intercept, $c = 0$

$$\therefore \text{ using } y = mx + c, y = mx \text{ hence the eqn } \boxed{y = \frac{1}{3}x}$$

(d) $A'B'C'$ is mapped onto $A''B''C''$ by reflection in the y -axis (the line $x = 0$.)

24	(a)	(i) $\frac{dy}{dx} = 3x^2 + 10x + P$ At $x = -1$, $\frac{dy}{dx} = 3(-1)^2 + 10(-1) + P = -15$ $3 - 10 + P = -15$ $P = -15 + 10 - 3 = -8$
	(ii)	Gradient of normal $= \frac{-1}{-15} = \frac{1}{15}$ At $x = -1$, $y = (-1)^3 + 5(-1)^2 + (-8)(-1) - 18 = -6$ $\frac{y+6}{x+1} = \frac{1}{15}$ $x+1 = 15y+90 \Rightarrow x-15y-89=0$
	(b)	$y = x^3 + 5x^2 - 8x - 18$ $\frac{dy}{dx} = 3x^2 + 10x - 8$ At a turning point, $3x^2 + 10x - 8 = 0$ $3x^2 + 12 - 2x - 8 = 0$ $3x(x+4) - 2(x+4) = 0$ $x+4=0 \text{ or } 3x-2=0$ $x=-4 \text{ or } x=\frac{2}{3}$ When $x = -4$, $y = (-4)^3 + 5(-4)^2 - 8(-4) - 18 = 30$ When $x = \frac{2}{3}$, $y = \left(\frac{2}{3}\right)^3 + 5\left(\frac{2}{3}\right)^2 - 8\left(\frac{2}{3}\right) - 18 = -20\frac{22}{27}$ $\therefore$ the turning points occur at $(-4, 30)$ and $\left(\frac{2}{3}, -20\frac{22}{27}\right)$