SECTION I (50 marks)

1.

$$\frac{0.039-0.003}{0.09}=\frac{0.036}{0.09}\times\frac{1000}{1000}$$

$$=\frac{\cancel{36}^{4}}{\cancel{9}_{1}\times10}=\frac{4}{10}$$

$$=0.4$$

2.

$$\frac{4x^2-9}{2x^2+x-6}=\frac{(2x)^2-3^2}{2x^2+4x-3x-6}$$

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

$$=\frac{\cancel{(2x-3)}^{1}(2x-3)}{\cancel{(2x-3)}^{1}(x+2)}$$

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

3.

Given $y=-\frac{1}{3}x+2,\ \Rightarrow\ \text{Q}(0,2).$

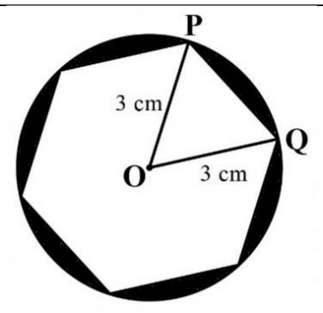
$$m_2=-\left(-\frac{1}{3}\right)^{-1}=-1\times\frac{-3}{1}=3$$

$y=3x+c$

At Q, $2=3(0)+c$ hence $c=2.$

Equation of L_2 is $\boxed{y=3x+2}$.

4.



$$\angle POQ=\frac{360°}{6}=60°$$

Area of hexagon

$$6\times\frac{1}{2}\times3^2\times\sin60°=23.3827\text{cm}^2$$

Area of circle $=\frac{22}{7}\times3^2=28.2857\text{cm}^2$

Shaded area $=28.2857-23.3827$

$=4.903\text{ cm}^2$

5.

$25=5^2,\quad 125=5^3$

$$\therefore 5^{2x}=5^{\left(\cancel{3}_1\times\frac{2}{\cancel{3}_1}\right)-(-1)}$$

$5^{2x}=5^3\Rightarrow 2x=3$

$$x=\frac{3}{2}=1\tfrac{1}{2}\text{ or }1.5$$

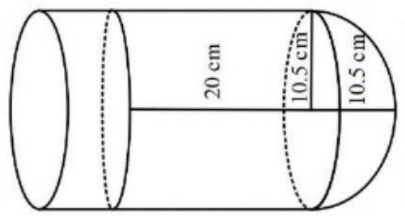
6.

$15=3^1\times5^1,\quad 24=2^3\times3^1$

Minimum length = LCM of 15 and 24

LCM $=2^3\times3^1\times5^1=120$ cm

7.

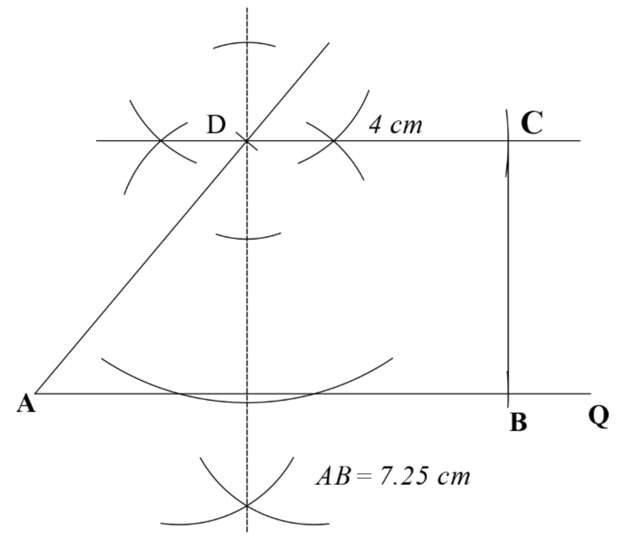


$$\text{SA}=\left(2\times\frac{22}{7}\times10.5^2\right)+\left(2\times\frac{22}{7}\times10.5\times20\right)$$

$=693+1320$

$=2013\text{ cm}^2$

8.



9.

$$\boxed{2\times\frac{22}{7}\times r\times\frac{\theta^c}{2\pi^c}=l}$$

$$2\times\frac{22}{7}\times r\times\frac{1.25}{2\pi}=10$$

$$\frac{44}{7}\times r\times1.25\times\frac{7}{44}=10$$

$1.25r=10$

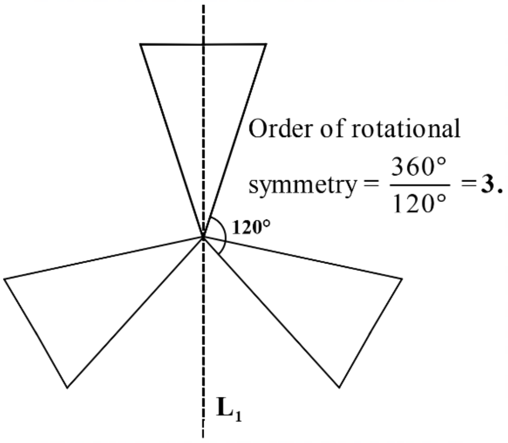
$$\therefore r=\frac{10}{1.25}=8\text{ cm}$$

$$\boxed{\frac{22}{7}\times r^2\times\frac{\theta^c}{2\pi^c}=Area}$$

$$\text{Area}=\frac{22}{7}\times8^2\times1.25\times\frac{7}{44}$$

$=40\text{ cm}^2$

10.



11.

The bank buys 1 S.A. rand at Ksh. 7.08

$\therefore 7.08 \times 15\ 000 = \text{Ksh.}106\ 200$

$\text{Remainder} = \text{Ksh.}(106\ 200 - 53\ 075)$

$= \text{Ksh. } 53\ 125$

The bank sells Tsh. 100 for Ksh. 21.25

$\therefore \frac{53\ 125}{21.25} \times 100 = \text{Tsh. } 250\ 000$

12.

$$\mathbf{AB} = \mathbf{OB} - \mathbf{OA} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$\mathbf{OM} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} + \frac{5}{2}\begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 5 \\ 7.5 \end{pmatrix} = \begin{pmatrix} 7 \\ 8.5 \end{pmatrix}$$

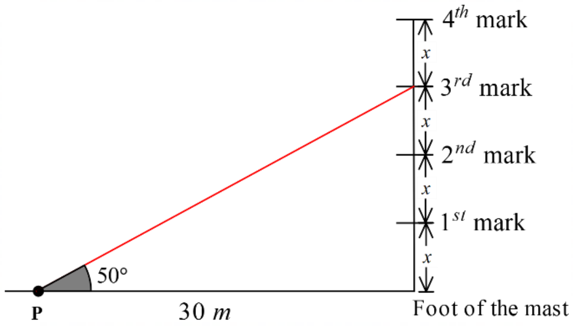
$\therefore$ M (7,8.5)

$\frac{x-1}{2} = 7 \Rightarrow x - 1 = 14$ hence $x = 15$

$\frac{y+7}{2} = 8.5 \Rightarrow y + 7 = 17$ hence $y = 10$

$\therefore D(15,10)$

13.



$\tan 50° = \frac{3x}{30}$

$3x = 30 \tan 50°$

$x = \frac{30 \times 1.1918}{3} = 11.918\text{m}$

$\text{Height} = 4x$

$= 11.918 \times 4$

$= 47.672\text{m}$

14.

cf	3	11	21	28	30

$\text{Median position} = \frac{30+1}{2} = 15.5$

Median class is $30 - 39$.

lcb of median class $= 29.5$

$\text{Median} = 29.5 + \left(\frac{(15.5 - 11)}{10} \times 10 \right)$

$= 34$

15.

x	0	0.5	1	1.5	2	2.5	3
y	0	0.25	1	**2.25**	4	**6.25**	9

$h = \frac{3}{3} = 1$

$Area = h(y_1 + y_2 + y_3)$

$Area = 1(0.25 + 2.25 + 6.25)$

$= 8.75$ sq. units

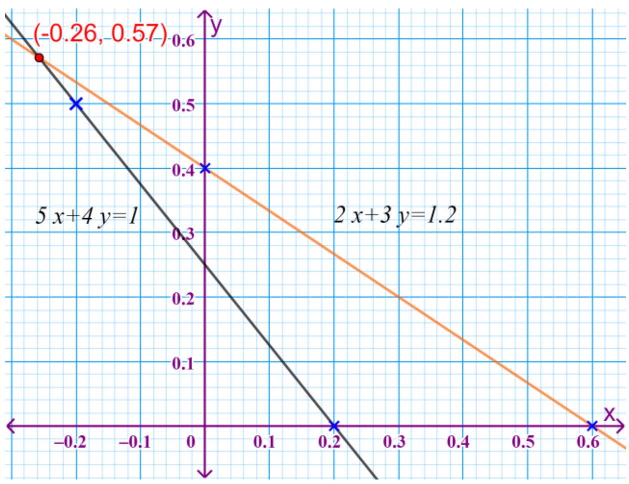
16.

$2x + 3y = 1.2$

x	0	0.6
y	0.4	0

$5x + 4y = 1$

x	–0.2	0.2
y	0.5	0



$x = -0.26$

$y = 0.57$

SECTION II (50 marks)

17.

(a)

Farmer	Abdul	Chebet
Sold	x	$2x$
Remaining	$32-x$	$56-2x$
Selling price	$1.05k$	k

$\frac{32-x}{56-2x}=\frac{3}{5}$

$160-5x=168-6x$

$x=8$

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 $1.05\times 4\ 000=$ Ksh. 4 200

Abdul's earnings : Chebet's earnings

$(4200\times 8):(4000\times 16)$

$33600:64000$

$21:40$

(c) $\frac{19}{21}\times 4200=$ Ksh. 3 800

18.

(a) (i) $\frac{4200}{x-2}$ (ii) $\frac{4500}{x+2}$

(b)

$\frac{4200}{x-2}-\frac{4500}{x+2}=50$

$4200(x+2)-4500(x-2)=50(x^2-4)$

$4200x+8400-4500x+9000=50x^2-200$

$50x^2+300x-17600=0$

$x^2+6x-352=0$

$x^2+22x-16x-352=0$

$x(x+22)-16(x+22)=0$

$(x-16)(x+22)=0$

$x-16=0$ or $x+22=0$

$x=16$ or $x=-22$

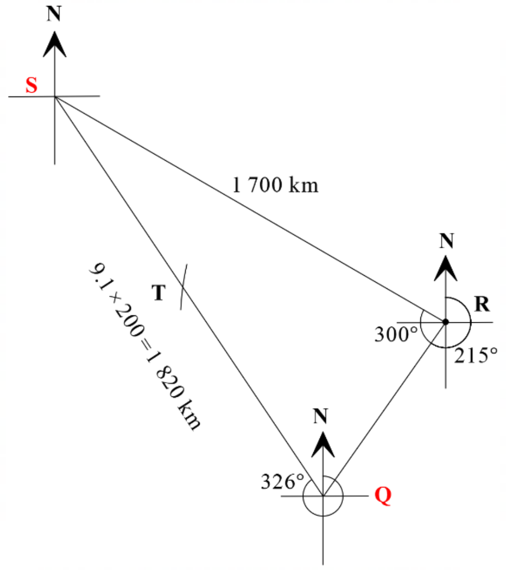
Taling the positive value, $x=16$ watches

In Feb, $\frac{4200}{16-2}=300$ pens sold.

(c) % change $=\frac{50}{300}\times 100=16\frac{2}{3}\%$

19.

(a)



(b) Mark T; 5 cm (on paper) from R along SQ.

ST = $3.6\times 200=720$ km

Time taken to reach T $=\frac{720}{400}=1\frac{4}{5}h$

$\equiv$ 1hr 48 min

The aircraft will be at T at:

0800 + 1hr 48 min = 0948h//9.48 am.

20

(a) $s=\frac{39+41+50}{2}=65$

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.

$\frac{1}{2}\times 50\times h=780$

$25h=780\Rightarrow h=31.2$m or $31\frac{1}{5}m$

(b) (i) $\sin 30°=\frac{31.2}{BC}$

$\Rightarrow \text{BC}=\frac{31.2}{\sin 30°}=\frac{31.2}{0.5}=62.4$m

(ii) $x^2=50^2+62.4^2-(2\times 50\times 62.4\times \cos 30°)$

$x^2=2500+3893.76-5403.84$

$x^2=989.92$

Hence $x=\sqrt{989.92}=31.463m$

(c) $\frac{31.463}{\sin 30°}=\frac{62.4}{\sin y}$

$\sin y=\frac{62.4\sin 30°}{31.463}=\frac{31.2}{31.463}=0.9916$

$y=\sin^{-1}0.9916=82.57°$

Obtuse $\angle$BMC $=180°-82.57°$

$=97.43°$

21

(a)

(i) $\mathbf{PQ} = \begin{pmatrix} 3 & 7 \\ h & 4 \end{pmatrix}\begin{pmatrix} 5 & -4 \\ 3 & -2 \end{pmatrix} = \begin{pmatrix} (3\times5)+(7\times3) & (3\times-4)+(7\times-2) \\ (h\times5)+(4\times3) & (h\times-4)+(4\times-2) \end{pmatrix} = \begin{pmatrix} 36 & -26 \\ 5h+12 & -4h-8 \end{pmatrix}$

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

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

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

$$-14h+24=3$$

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

(ii) $\mathbf{P} = \begin{pmatrix} 3 & 7 \\ 1.5 & 4 \end{pmatrix}$; $\quad \det \mathbf{P} = \begin{vmatrix} 3 & 7 \\ 1.5 & 4 \end{vmatrix} = (3\times4)-(7\times1.5)=1.5$

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

(b)

(i) $12m+28n=24600$ | $15m+40n=34500$

$3m+7n=6150...(i)$ | $1.5m+4n=3450...(ii)$

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

$$\begin{bmatrix} (\frac{8}{3}\times3)+(-\frac{14}{3}\times1.5) & (\frac{8}{3}\times7)+(-\frac{14}{3}\times4) \\ (-1\times3)+(2\times1.5) & (-1\times7)+(2\times4) \end{bmatrix}\begin{pmatrix} m \\ n \end{pmatrix} = \begin{bmatrix} (\frac{8}{3}\times6150)+(-\frac{14}{3}\times3450) \\ (-1\times6500)+(2\times3450) \end{bmatrix}$$

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

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

22

(a) (i)

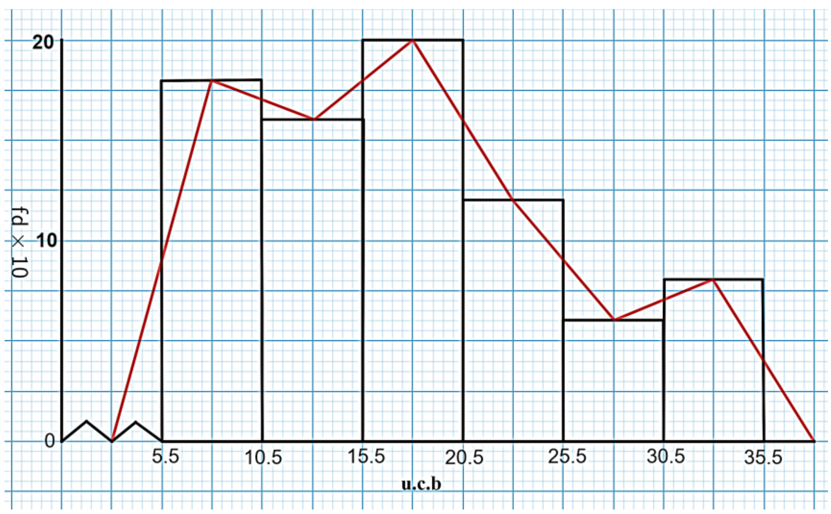
Trees (class)	*Number (f)*	*Midpoint, (x)*	*fx*
6 – 10	9	8	72
11 – 15	8	13	104
16 – 20	10	18	180
21 – 25	6	23	138
26 – 30	3	28	84
31 – 35	4	33	132
	$\sum f = \mathbf{40}$		$\sum fx = \mathbf{710}$

(ii) 16 – 20

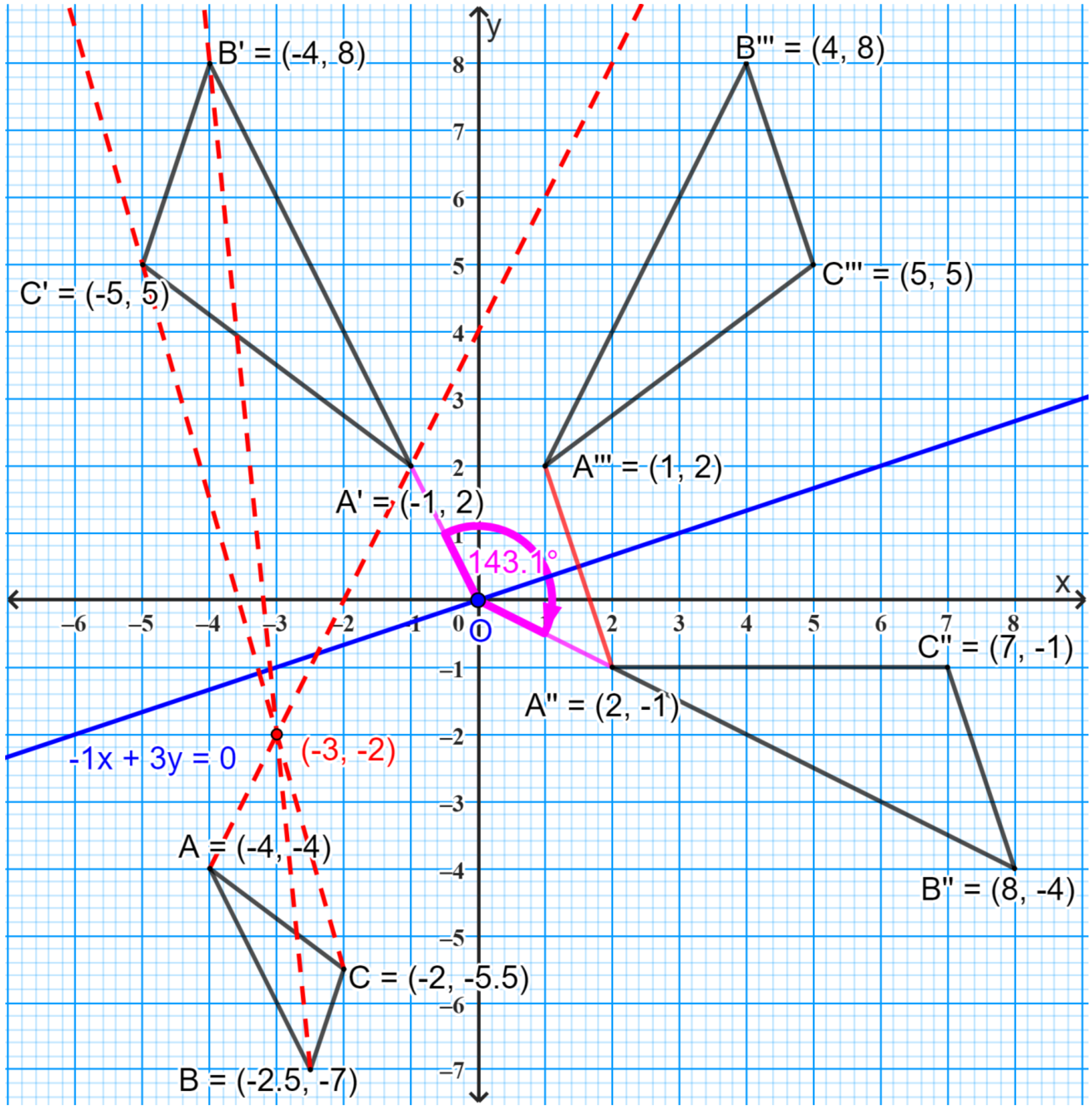
(iii) $\bar{x} = \dfrac{\sum fx}{\sum f}$

$$= \frac{710}{40} = 17.75$$

(b)



23



(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, $c=0$

$\therefore$ using $y=mx+c,\ y=mx$ 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 truning point, $3x^2+10x-8=0$ $3x^2+12-2x-8=0$ $3x(x+4)-2(x+4)=0$ $x+4=0$ or $3x-2=0$ $x=-4$ 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 $\left(\frac{2}{3},-20\frac{22}{27}\right)$