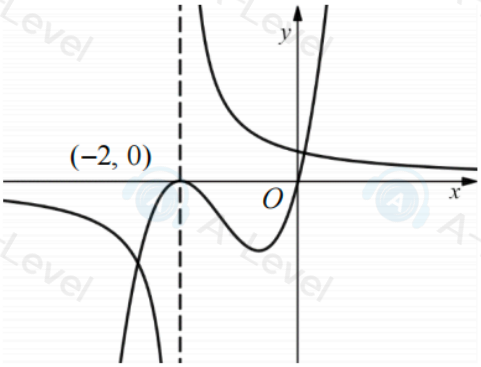
Question Number	Scheme	Marks
4a	$x=-2$	B1
		(1)
b	$x^3+4x^2+4x=x(x+2)^2$	M1A1
		(2)
c		B1B1B1
		(3)
d	2 as the graphs intersect (each other) twice (since $(x+2)(x^3+4x^2+4x)=1$ is the same as $x^3+4x^2+4x=\frac{1}{x+2}$)	B1
		(1)
		(7 marks)

Question Number	Scheme	Marks
4.(a)	Sets $kx+2=\frac{2}{x}+3x-4$ and attempts to collect terms or multiply through by x	M1
	$(k-3)x+6-\frac{2}{x}=0\Rightarrow(k-3)x^2+6x-2=0$ *	A1*
		(2)
(b)	Attempts b^2-4ac for $(k-3)x^2+6x-2=0$	M1
	Solves $b^2-4ac=0$ for $(k-3)x^2+6x-2=0\Rightarrow 36+8(k-3)=0\Rightarrow k=...$	dM1
	$k=-\frac{3}{2}$	A1
		(3)
		(5 marks)

	$-a+6a+8+a^2=32 \Rightarrow a^2+5a-24=0$	M1
	$(a+8)(a-3)=0$	dM1
	$a=3$ or $a=-8$ and chooses $a=3$ with reason *	A1* cso
		(3)
(ii)	$3x^3+26x^2-9x=0 \Rightarrow x(3x^2+26x-9)=0$	M1
	$x(3x-1)(x+9)$	
	$(x=)\ 0, \frac{1}{3}, -9$	A1
		(2)
(b)(i)	$(y=)\ 0$	B1
	$y^{\frac{1}{3}}="\frac{1}{3}"$ or $y^{\frac{1}{3}}="-9" \Rightarrow y=...$ (or $(-9)^3=...$ or $\left(\frac{1}{3}\right)^3=...$)	M1
	$(y=)\ \frac{1}{27},\ -729$	A1
		(3)
(b)(ii)	$9^z="\frac{1}{3}" \rightarrow z=...$	M1
	$(z=)\ -\frac{1}{2}$ only	A1
		(2)
		(10 marks)

Question Number	Scheme	Marks
3.(a)	Attempts perimeter of garden $= 2\times 5x+2\times(6x-2)$	M1
	Sets $2\times 5x+2\times(6x-2)>29 \Rightarrow 22x>33$	dM1
	$\Rightarrow x>\frac{33}{22} \Rightarrow x>1.5$ *	A1*
		(3)
(b)	Attempts area of garden $= 2x(2x-1)+3x(6x-2)$	M1
	Sets $A<72 \Rightarrow 22x^2-8x-72<0$	A1
	Finds critical values $11x^2-4x-36 \Rightarrow x=-\frac{18}{11}, 2$	M1
	Chooses inside region	ddM1
	$-\frac{18}{11}<x<2$	A1
		(5)
(c)	$1.5<x<2$	B1
		(1)
		(9 marks)

Question Number	Scheme	Marks
2(a)	$P(-3,7), Q(9,11)$ and $R(12,2)$	
Way 1	grad $PQ=\frac{11-7}{9--3}=\frac{1}{3}$, grad $QR=\frac{11-2}{9-12}=-3$	M1 A1
	$\frac{1}{3}\times -3=-1$ so angle $PQR=$ 90°	A1
		(3)
Way 2	$PQ^2=(9--3)^2+(11-7)^2=160$ $QR^2=(12-9)^2+(2-11)^2=90$ $PR^2=(12--3)^2+(2-7)^2=250$	M1 A1
	$PQ^2+QR^2=PR^2$ (or e.g. $90+160=250$) so angle $PQR=$ 90° or e.g. $\cos\theta=\frac{160+90-250}{2\sqrt{160}\sqrt{90}}=0 \Rightarrow \theta=90°$	A1
		(3)
Way 3	$\overrightarrow{PQ}=\begin{pmatrix}9--3\\11-7\end{pmatrix}=\begin{pmatrix}12\\4\end{pmatrix}$, $\overrightarrow{QR}=\begin{pmatrix}12-9\\2-11\end{pmatrix}=\begin{pmatrix}3\\-9\end{pmatrix}$	M1A1
	$\overrightarrow{PQ}\bullet\overrightarrow{QR}=\begin{pmatrix}12\\4\end{pmatrix}\bullet\begin{pmatrix}3\\-9\end{pmatrix}=36-36=0$ so angle $PQR=$ 90°	A1
		(3)

Part (b)

(b)	E.g. $(-3,7)+(3,-9)=...$ or $(12,2)-(12,4)=...$	M1
	$(0,-2)$	A1
		(2)
ALT 1	grad $PQ=\frac{11-7}{9--3}=\frac{1}{3}\Rightarrow$ eqn RS is $y-2=\frac{1}{3}(x-12)$ grad $QR=\frac{11-2}{9-12}=-3\Rightarrow$ eqn PS is $y-7=-3(x+3)$ $\Rightarrow x=..., y=...$	M1
	$(0,-2)$	A1
ALT 2	Midpoint PR is $\left(\frac{9}{2},\frac{9}{2}\right)\Rightarrow\frac{9+x}{2}=\frac{9}{2},\ \frac{11+y}{2}=\frac{9}{2}\Rightarrow x=..,y=...$	M1
	$(0,-2)$	A1
		(5 marks)

Question Number	Scheme	Marks
9 (a)	$x...-5$	B1 **(1)**
(b)	$f(x)=(x+5)(3x^2-4x+20)=3x^3+11x^2+100$	M1
	$f'(x)=9x^2+22x$	M1 A1cso **(3)**
(c)	Finds $f'(-4)=9\times(-4)^2+22\times-4=(56)$	M1
	Sets $f'(x)="9x^2+22x"="56"$	dM1
	$9x^2+22x-56=0\Rightarrow x=\frac{14}{9},(-4)$	ddM1 A1cso **(4)**
(d)(i)	$(-1,84)$	B1
(ii)	$(-4,336)$	B1 **(2)** **(10 marks)**

Question Number	Scheme	Marks
5a	e.g. $(\cos\theta =)\ \dfrac{5^2+(1+x)^2-x^2}{2\times5(1+x)}\ \left(=\dfrac{25+1+2x+x^2-x^2}{2\times5(1+x)}\right)$ or e.g. $x^2=5^2+(1+x)^2-2\times5(1+x)\cos\theta$ $\cos\theta=\dfrac{13+x}{5+5x}$ *	M1 A1*
		(2)
b	$\theta=$ awrt $42°$ $(42.470747\ldots.)$ --- Attempts to find AB, AD or AC: e.g. $\dfrac{AB}{\sin"42"}=\dfrac{5}{\sin30}\Rightarrow AB=\ldots$ or e.g. $\angle ABC=180-30-"42.5"="107.6"$ $\dfrac{\sin DBC}{1+2\sqrt{3}}=\dfrac{\sin"42.5"}{2\sqrt{3}}\Rightarrow\angle DBC="60.5",\ \angle ABD="107.6"-"60.5"="47.1"$ $\dfrac{AD}{\sin("47.1")}=\dfrac{2\sqrt{3}}{\sin30}\Rightarrow AD=\ldots$ or e.g. $\dfrac{AC}{\sin"108"}=\dfrac{5}{\sin30}\Rightarrow AC=\ldots$ --- $AB=6.75\ldots$ or $AD=5.07\ldots$ or $AC=9.53\ldots$ Area $=\dfrac{1}{2}\times5\times"6.75"\times\sin(180-30-"42.5")$ or $=\dfrac{1}{2}\times5\times"9.54"\times\sin("42.5")$ $=$ awrt 16.1 (m^2)	B1 M1 A1 dM1 A1
		(5)
		(7 marks)

Question Number	Scheme	Marks
1.	$\int(2x-5)(3x+2)(2x+5)\,dx$ $(2x-5)(3x+2)(2x+5)=(6x^2-11x-10)(2x+5)=\ldots$ $=12x^3+8x^2-75x-50$ $\int(2x-5)(3x+2)(2x+5)\,dx=3x^4+\dfrac{8}{3}x^3-\dfrac{75}{2}x^2-50x+c$	M1 A1 M1, A1ft, A1 **(5 marks)**

Question	Scheme	Marks
8(a)	$y=\frac{1}{4}x^3-8x^{-\frac{1}{2}} \Rightarrow \left(\frac{dy}{dx}=\right)\frac{1}{4}\times 3x^2-8\times-\frac{1}{2}x^{-\frac{3}{2}}$	M1 A1
	$\left.\frac{dy}{dx}\right\|_{x=4}=\ldots\left(\frac{25}{2}\right)$	M1
	$y-12="\frac{25}{2}"\left(x-4\right)$	dM1
	$25x-2y-76=0$ oe e.g. $-25x+2y+76=0$	A1
		(5)