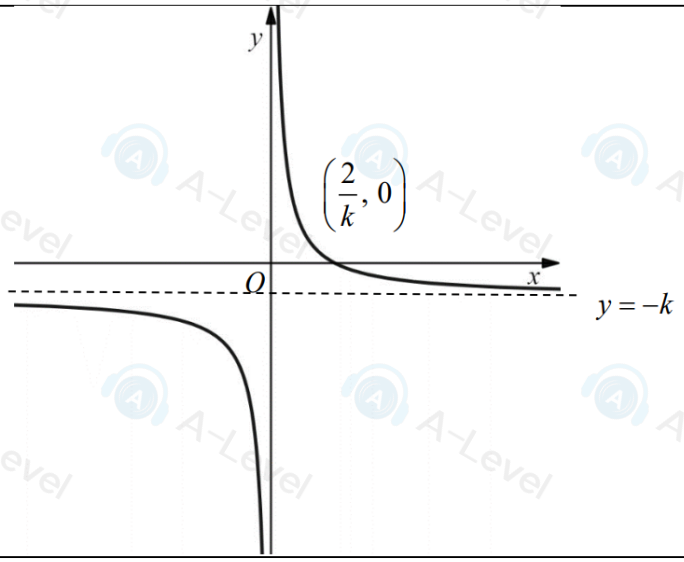
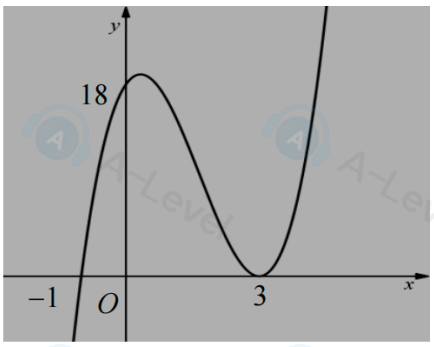
Question Number	Scheme	Marks
6 (a)	Angle $AFB = \dfrac{\pi - 2.275}{2} = 0.433$ *	B1*
		(1)
(b)	Attempts $r\theta = 6.2 \times 2.275 = (14.105)$	M1
	Attempts $\left(x^2\right) = 6.4^2 + 6.2^2 - 2 \times 6.4 \times 6.2 \cos(0.433) = (7.36)$ or $(x = 2.71)$	M1
	Correct attempt = $2x + r\theta + 12.8 = 2 \times 2.714 + 14.105 + 12.8 = 32.3\,(\text{m})$	dM1, A1
		(4)
(c)	Attempts $\dfrac{1}{2} r^2 \theta = \dfrac{1}{2} \times 6.2^2 \times 2.275 = (43.7255)$	M1
	Attempts $\dfrac{1}{2} ab \sin C = \dfrac{1}{2} \times 6.2 \times 6.4 \times \sin 0.433 = (8.325)$	M1
	Correct attempt = $2 \times 8.325 + 43.7255 = 60.4\,(\text{m}^2)$	dM1, A1
		(4)
		(9 marks)

Question Number	Scheme	Marks
7(a)		B1B1B1
		(3)
(b)	$-kx - 6 = \dfrac{2}{x} - k \Rightarrow -kx^2 - 6x = 2 - kx \Rightarrow kx^2 + (6-k)x + 2 = 0$	M1
	$(6-k)^2 - 4 \times k \times 2 \Rightarrow k^2 - 20k + 36$	dM1A1
	$\Rightarrow$ CVs $= 2, 18 \Rightarrow k <$ "2" or $k >$ "18"	M1
	$(0 <) k < 2$ or $k > 18$	A1
		(5)
		(8 marks)

Question Number	Scheme	Marks
	$f'(x)=4\sqrt{x^3}+\frac{k}{x^2}=4x^{\frac{3}{2}}+kx^{-2}$	
10 (a)	$f''(x)=6x^{\frac{1}{2}}-2kx^{-3}$	M1, A1
	$f''(2)=6\sqrt{2}-2k\times\frac{1}{8}=0\Rightarrow k=24\sqrt{2}$	dM1, A1
		(4)
(b)	$f'(x)=4x^{\frac{3}{2}}+kx^{-2}\Rightarrow\ f(x)=4\times\frac{2}{5}x^{\frac{5}{2}}-kx^{-1}(+c)$	M1, A1 ft
	Uses $P\left(2,8\sqrt{2}\right)\Rightarrow 8\sqrt{2}=4\times\frac{2}{5}\times 2^{\frac{5}{2}}-\frac{k}{2}+c\Rightarrow c=p\sqrt{2}$	dM1
	$f(x)=\frac{8}{5}x^{\frac{5}{2}}-\frac{24\sqrt{2}}{x}+\frac{68}{5}\sqrt{2}$	A1
		(4)
		(8 marks)

Question Number	Scheme	Marks
10(a)	$m=\frac{4}{5}$	B1
	$y+3=\frac{4}{5}(x-4)$ or $-3=\frac{4}{5}\times 4+c\Rightarrow c=...$	M1
	$y=\frac{4}{5}x-\frac{31}{5}$	A1
		(3)
(b)	$f'(4)=\frac{4}{5}\Rightarrow\frac{k\sqrt{4}(4-3)}{5}=\frac{4}{5}\Rightarrow k=...$	M1
	$k=2$	A1
		(2)
(c)	$(f'(x)=)\frac{2\sqrt{x}(x-3)}{5}=\frac{2x^{\frac{3}{2}}}{5}-\frac{6x^{\frac{1}{2}}}{5}$	M1
	$(f(x)=)\frac{4x^{\frac{5}{2}}}{25}-\frac{4x^{\frac{3}{2}}}{5}(+c)$	M1 A1ft
	$x=4,y=-3\Rightarrow -3=\frac{4(4)^{\frac{5}{2}}}{25}-\frac{4(4)^{\frac{3}{2}}}{5}+c\Rightarrow c=\left(-\frac{43}{25}\right)$	ddM1
	$(f(x)=)\frac{4x^{\frac{5}{2}}}{25}-\frac{4x^{\frac{3}{2}}}{5}-\frac{43}{25}$	A1
		(5)
		(10 marks)

Question Number	Scheme		Marks
6.(a)		Positive cubic shape anywhere with 1 maximum and 1 minimum	M1
		Positive cubic shape that at least reaches the x-axis at $x=-1$ and with a minimum on the x-axis at $x=3$	A1
		y intercept at 18. Must correspond with their sketch	B1
	For the intercepts allow as numbers as above or allow as coordinates e.g. (18, 0), (0, −1), (0, 3) as long as they are marked in the correct place.		
			(3)
(b)	E.g. $(2x+2)(x^2-6x+9)=\ldots$		M1
	$=2x^3-10x^2+6x+18$		A1 A1
			(3)
(c)	$(f'(x)=)6x^2-20x+6$		B1ft
	$f'\left(\frac{1}{3}\right)=6\left(\frac{1}{3}\right)^2-20\left(\frac{1}{3}\right)+6$		M1
	$f'\left(\frac{1}{3}\right)=0$		A1
	$y=\frac{512}{27}$		A1
			(4)
			(10 marks)

Question	Scheme	Marks
1	$4x^2-3x+7\geqslant 4x+9$ $\Rightarrow 4x^2-7x-2\ldots 0\Rightarrow (4x+1)(x-2)\ldots 0\Rightarrow x=\ldots$ or $\Rightarrow 4x^2-7x-2\ldots 0\Rightarrow x=\frac{-(-7)\pm\sqrt{(-7)^2-4(4)(-2)}}{2\times 4}\Rightarrow x=\ldots$ or $\Rightarrow 4x^2-7x-2\ldots 0\Rightarrow 4\left(x^2-\frac{7}{4}x-\frac{1}{2}\right)\ldots 0\Rightarrow 4\left(\left(x-\frac{7}{8}\right)^2-\left(\frac{7}{8}\right)^2-\frac{1}{2}\right)\ldots 0\Rightarrow x=\ldots$	**M1**
	$x=-\frac{1}{4},2$	**A1**
	$x\leqslant "-\frac{1}{4}"$, $x\geqslant "2"$	**M1**
	$x\leqslant -\frac{1}{4}$ or $x\geqslant 2$ oe	**A1**
		(4)
		(4 marks)

Question	Scheme	Marks
10(a)	$f'(4)=6(4)-\frac{7\times14}{4}=-\frac{1}{2}$	B1
	$m_T=-\frac{1}{2}\Rightarrow m_N=\frac{-1}{-\frac{1}{2}}$	M1
	$y-12=2(x-4)$ or $y=mx+c\Rightarrow y=2x+c\Rightarrow 12=2(4)+c\Rightarrow c=...$	M1 (A1 on ePen)
	$y=2x+4$	A1
		(4)
(b)	$...\frac{(2x-1)(3x+2)}{2\sqrt{x}}=...\frac{6x^2+x-2}{2\sqrt{x}}=...3x^{\frac{3}{2}}+\frac{1}{2}x^{\frac{1}{2}}-x^{-\frac{1}{2}}$	M1
	$f(x)=\frac{6x^2}{2}-\frac{6}{5}x^{\frac{5}{2}}-\frac{1}{3}x^{\frac{3}{2}}+2x^{\frac{1}{2}}(+c)$ or e.g. $f(x)=\frac{6x^2}{2}-\frac{3}{\frac{5}{2}}x^{\frac{5}{2}}-\frac{\frac{1}{2}}{\frac{3}{2}}x^{\frac{3}{2}}+\frac{x^{\frac{1}{2}}}{\frac{1}{2}}(+c)$ or e.g. $f(x)=\frac{6x^2}{2}-\left(\frac{3}{\frac{5}{2}}x^{\frac{5}{2}}+\frac{\frac{1}{2}}{\frac{3}{2}}x^{\frac{3}{2}}-\frac{x^{\frac{1}{2}}}{\frac{1}{2}}\right)(+c)$	M1A1A1
	$12=\frac{6(4)^2}{2}-\frac{6}{5}(4)^{\frac{5}{2}}-\frac{1}{3}(4)^{\frac{3}{2}}+2(4)^{\frac{1}{2}}+c\Rightarrow c=...$	M1
	$(f(x)=)3x^2-\frac{6}{5}x^{\frac{5}{2}}-\frac{1}{3}x^{\frac{3}{2}}+2x^{\frac{1}{2}}+\frac{16}{15}$	A1
		(6)
		Total 10

Question Number	Scheme	Marks
9(a)	$\frac{1}{2}x^2-10x+22=\frac{1}{2}(x\pm...)^2\pm...$ or states $a=\frac{1}{2}$	B1
	$\frac{1}{2}x^2-10x+22=\frac{1}{2}(x\pm10)^2\pm...$ or states $a=\frac{1}{2}$ and $b=\pm10$	M1
	$\frac{1}{2}x^2-10x+22=\frac{1}{2}(x-10)^2-28$	A1
		(3)
(b)	$("10","-28")$	B1ftB1ft
		(2)
(c)(i)	Gradient of tangent $=8$	B1
	$\frac{dy}{dx}=x-10=8\Rightarrow x=...$	M1
	$x=18,\ y=4$	A1A1
(c)(ii)	$k-\frac{1}{8}\times"18"="4"\Rightarrow k=\frac{25}{4}$	dM1A1
		(6)
(d)	One of x ... "10" or y „ $"\frac{25}{4}"-\frac{1}{8}x$ or y ... $\frac{1}{2}x^2-10x+22$	B1ft
	Two of x ... "10" or y „ $"\frac{25}{4}"-\frac{1}{8}x$ or y ... $\frac{1}{2}x^2-10x+22$	B1ft
	All three of x ... 10, y „ $\frac{25}{4}-\frac{1}{8}x$ and y ... $\frac{1}{2}x^2-10x+22$	B1
		(3)
		(14 marks)

Question Number	Scheme	Marks
4(a)	$x+y=6,\ y=6x-2x^2+1$ $\Rightarrow 6-x=6x-2x^2+1$ $\Rightarrow 2x^2-7x+5=0$ oe	M1
	$2x^2-7x+5=0\Rightarrow(2x-5)(x-1)=0$ $\Rightarrow x=\frac{5}{2},\ 1$	M1
	$x="\frac{5}{2}"\Rightarrow y=\frac{7}{2}$ or $x="1"\Rightarrow y=5$	dM1
	$(1,\ 5)$ and $(2.5,\ 3.5)$	A1
		(4)
(b)	$y\geqslant 6x-2x^2+1$ oe	M1
	$x+y\leqslant 6$ oe $x\geqslant a$ where $1\leqslant a\leqslant 2.5$	A1
	$(\text{or } a\leqslant x\leqslant b \text{ where } 1\leqslant a\leqslant 2.5,\ b\geqslant 6)$ $y\geqslant 0$ (or $0\leqslant y\leqslant c$ where $c\geqslant 3.5$)	A1
	Allow strict or non-strict inequalities	
		(3)
		Total 7