Question number	Scheme	Marks
5(a)	$\text{f}(-2) = 0, \quad \text{f}(-3) = 21$ $a(-2)^3 + 5b(-2)^2 + 8a(-2) - 4b = 0$ $a(-3)^3 + 5b(-3)^2 + 8a(-3) - 4b = 21$ $2b = 3a$ $41b = 51a + 21$ $a = 2^*, b = 3$	M1 A1 M1 A1cso A1 [5]
(b)	$x+2\overline{\big)2x^3+15x^2+16x-12}$ with quotient $2x^2+11x-6$ **ALT** $2x^3+15x^2+16x-12=(x+2)(Ax^2+Bx+C)\Rightarrow(x+2)(2x^2+11x-6)$ $2x^2+11x-6=(2x-1)(x+6)$ $(2x-1)(x+6)=0 \Rightarrow 2x-1=0, x+6=0$ $x=-6, \ -2, \ \frac{1}{2}$	M1 M1 M1 A1 [4]
	Total 9 marks	

Question	Marks	Scheme
(a)	**M1**	For attempting either $\text{f}(-2)=0$ or $\text{f}(-3)=21$ Allow $\text{f}(\pm2)=0$ or $\text{f}(\pm3)=21$ for this mark. Allow for $\text{f}(\pm3) = 21$ with $a = 2$ assumed.
	A1	For both correct equations in terms of a and b $a(-2)^3 + 5b(-2)^2 + 8a(-2) - 4b = 0$ $a(-3)^3 + 5b(-3)^2 + 8a(-3) - 4b = 21$ Evaluation not required for this mark, just the correct substitution.
	M1	Attempts to solve their two linear simultaneous equation in a and b $2b = 3a$ $41b = 51a + 21$ Condone one slip provided consistent addition or subtraction if using elimination.
	A1 cso	For $a = 2^*$
	A1	For $b = 3$
(b)	**M1**	For attempting division of $\text{f}(x)=2x^3+15x^2+16x-12$ by $(x+2)$ getting as far as $2x^2 + \cdots$ $x+2\overline{\big)2x^3+15x^2+16x-12}$ with quotient $2x^2+11x-6$ **ALT**

		Equates coefficients to find the 3TQ factor $2x^3+15x^2+16x-12=(x+2)(Ax^2+Bx+C)\Rightarrow(x+2)(2x^2+11x-6)$ Must get as far as $(x+2)(2x^2+\cdots)$ for the mark.
	M1	For attempting to factorise **their** 3TQ, but it must be a 3TQ $2x^2+11x-6=(2x-1)(x+6)$ Refer to general guidance for what constitutes an attempt to factorise.
	M1	An attempt to solve f (x) = 0
	A1	For $x=-6,\ -2,\ \frac{1}{2}$ **Note:** Correct answers with no working scores M0M0M0A0

Question number	Scheme	Marks
6(a)(i)	$\frac{\sin 30^{\circ}}{x}=\frac{\sin ACB}{x+3}$	M1
	$\sin\theta^{\circ}=\frac{x+3}{2x}$ *	A1 cso
(ii)	$\cos^2\theta^{\circ}=1-\left(\frac{x+3}{2x}\right)^2$	M1
	$\cos^2\theta^{\circ}=\frac{(2x)^2-(x+3)^2}{(2x)^2}$	M1
	$\cos\theta^{\circ}=\frac{\sqrt{3x^2-6x-9}}{2x}$ *	A1
		[5]
Alt – use of right-angled triangle with Pythagoras' theorem		
	Adjacent $=\sqrt{(2x)^2-(x+3)^2}$	[M1
	$\cos\theta=\frac{\sqrt{(2x)^2-(x+3)^2}}{2x}$	M1
	$\cos\theta^{\circ}=\frac{\sqrt{3x^2-6x-9}}{2x}$ *	A1]
(b)	$\frac{\angle BAC}{30^{\circ}}=\frac{7}{2}\Rightarrow\angle BAC=105^{\circ}$	B1
	$\theta=180-30-105=45$	B1
	$\cos 45^{o}=\frac{\sqrt{2}}{2}=\frac{\sqrt{3x^2-6x-9}}{2x}\Rightarrow 2x^2=3x^2-6x-9\Rightarrow x^2-6x-9=0$	M1
	$x^2-6x-9=0\Rightarrow(x-3)^2-18=0\Rightarrow x=\ldots$	M1
	$x=3+3\sqrt{2}$	A1
		[5]
Alt – last three marks		
	$\sin\theta^{\circ}=\frac{x+3}{2x}=\frac{\sqrt{2}}{2}\Rightarrow x+3=\sqrt{2}x$	[M1
	$x+3=\sqrt{2}x\Rightarrow x\left(\sqrt{2}-1\right)=3\Rightarrow x=\frac{3}{\sqrt{2}-1}$	M1
	$x=3+3\sqrt{2}$	A1]
		Total 10 marks

Part	Marks	Scheme
(a) (i)	M1	For using a correct sine rule to give, $\frac{\sin 30^\circ}{x} = \frac{\sin ACB}{x+3}$
	A1 cso	For correctly obtaining the expression for $\sin\theta$ $\quad \sin\theta^\circ = \frac{x+3}{2x}$ *
(ii)	M1	For using the Pythagorean identity $\quad \cos^2\theta^\circ = 1 - \left(\frac{x+3}{2x}\right)^2$
	M1	For simplifying to form a single fraction $\quad \cos^2\theta^\circ = \frac{(2x)^2 - (x+3)^2}{(2x)^2}$
	A1 cso	For simplifying to achieve the given expression, $\cos\theta^\circ = \frac{\sqrt{3x^2 - 6x - 9}}{2x}$ * Note this is a show question
Alt – use of right-angled triangle with Pythagoras' theorem		
	M1	For use of a right-angled triangle with Pythagoras' theorem to determine the adjacent Adjacent $= \sqrt{(2x)^2 - (x+3)^2}$
	M1	For use of cosine ratio $\cos\theta = \frac{\sqrt{(2x)^2-(x+3)^2}}{2x}$
	A1 cso	For simplifying to achieve the given expression, $\cos\theta^\circ = \frac{\sqrt{3x^2 - 6x - 9}}{2x}$ * Note this is a show question
(b)	B1	For finding the size of $\angle BAC$ $\quad \frac{\angle BAC}{30^\circ} = \frac{7}{2} \Rightarrow \angle BAC = 105^\circ$
	B1	For finding the value of $\theta = 180 - 30 - 105 = 45$
	M1	For substituting the value of $\angle ABC$ into the given expression for $\cos\theta$ and forming a 3TQ, condone arithmetic errors in rearrangement. $\cos 45^o = \frac{\sqrt{2}}{2} = \frac{\sqrt{3x^2-6x-9}}{2x} \Rightarrow 2x^2 = 3x^2 - 6x - 9 \Rightarrow x^2 - 6x - 9 = 0$ Allow for use of their 45˚ but this must come from an attempt at working with the ratio. Do not allow if their 45˚ is 30˚.
	M1	For an attempt to solve their 3TQ by any valid method (see general guidance) $x^2 - 6x - 9 = 0 \Rightarrow (x-3)^2 - 18 = 0 \Rightarrow x = \ldots$
	A1 cao	For the correct value of x in the correct form $\quad x = 3 + 3\sqrt{2}$ Allow $a = 3, b = 2$
Alternative method		
	M1	For substituting the value of $\angle ABC$ into the given expression for $\sin\theta$ and forming a linear equation $\sin\theta^\circ = \frac{x+3}{2x} = \frac{\sqrt{2}}{2} \Rightarrow x + 3 = \sqrt{2}x$

	M1	For an attempt to solve their linear equation $x+3=\sqrt{2}x \Rightarrow x\left(\sqrt{2}-1\right)=3 \Rightarrow x=\dfrac{3}{\sqrt{2}-1}$
	A1 **cao**	For the correct value of x in the correct form $x=3+3\sqrt{2}$ Allow $a=3$, $b=2$