Question number	Scheme	Marks
4 (a)	$\alpha+\beta=-2 \qquad \alpha\beta=\frac{3}{2}$	B1
	$(\alpha+\beta)^2-2\alpha\beta=\alpha^2+\beta^2$	M1
	$(-2)^2-2\left(\frac{3}{2}\right)=4-3=1$ *	M1 A1cso (4)
ALT		
	$2\alpha^2+4\alpha+3=0$ and $2\beta^2+4\beta+3=0$	{B1}
	$2\ \alpha^2+\beta^2\ +4\ \alpha+\beta\ +6=0$	{M1}
	$\alpha^2+\beta^2\ =-2\ -2\ -3=1$*	{M1} {A1cso} (4)
(b)	$\alpha^4+\beta^4=\left(\alpha^2+\beta^2\right)\left(\alpha^2+\beta^2\right)-2\alpha^2\beta^2$	M1
	$1\times1-2\left(\frac{3}{2}\right)^2=-\frac{7}{2}$	M1 A1 (3)
ALT		
	$\alpha^2+\beta^2\ ^2=1=\alpha^4+2\alpha^2\beta^2+\beta^4=\alpha^4+\beta^4+2\times\frac{9}{4}$	{M1}
	$\alpha^4+\beta^4=1-\frac{9}{2}=-\frac{7}{2}$	{M1} {A1} (3)
(c)	Product of the roots: $\alpha^4\beta^4=\left(\frac{3}{2}\right)^4=\frac{81}{16}$	M1
	(Sum of the roots: $\alpha^4+\beta^4=-\frac{7}{2}$)	
	$16x^2+56x+81=0$	M1 A1ft (3)
		Total 10 marks

Part	Mark	Notes
(a)	**B1**	For $\alpha+\beta=-2$ and $\alpha\beta=\frac{3}{2}$
	M1	For $(\alpha+\beta)^2-2\alpha\beta=\alpha^2+\beta^2$ This must be correct
	M1	For substituting their sum and product into their expansion for $\alpha^2+\beta^2$ $(-2)^2-2\left(\frac{3}{2}\right)$
	A1cso	For obtaining the given expression $\alpha^2+\beta^2=1$
	ALT	
	B1	For $2\alpha^2+4\alpha+3=0$ and $2\beta^2+4\beta+3=0$
	M1	For $2\ \alpha^2+\beta^2\ +4\ \alpha+\beta\ +6=0$
	M1	For $-2\ -2\ -3$
	A1cso	For obtaining the given expression $\alpha^2+\beta^2=1$
(b)	**M1**	For $\alpha^4+\beta^4=(\alpha^2+\beta^2)(\alpha^2+\beta^2)-2\alpha^2\beta^2$ This must be correct
	M1	For substituting $\alpha^2+\beta^2=1$ and their product from (a) into their expansion for $\alpha^4+\beta^4$ $\alpha^4+\beta^4=1\times1-2\left(\frac{3}{2}\right)^2$
	A1	For the correct value $\alpha^4+\beta^4=-\frac{7}{2}$
	ALT	
	M1	For $1=\alpha^4+2\alpha^2\beta^2+\beta^4$
	M1	For $1=\alpha^4+\beta^4+2\times\frac{9}{4}$
	A1	For $\alpha^4+\beta^4=-\frac{7}{2}$
(d)	**M1**	For product of the roots: $\alpha^4\beta^4\left(=\left(\frac{3}{2}\right)^4=\frac{81}{16}\right)$
	M1	For use of x^2- (their sum) $x+$(their product) $=[0]$
	A1	For $16x^2+56x+81=0$ Must include = 0