Question	Scheme	Marks
6(a)	$\alpha+\beta=-\frac{5}{2}\quad \alpha\beta=-\frac{p}{2}$	B1
	$\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$	M1
	$\alpha^3+\beta^3=\left(-\frac{5}{2}\right)^3-3\left(-\frac{p}{2}\right)\left(-\frac{5}{2}\right)=-\frac{125}{8}-\frac{15p}{4}=-\frac{215}{8}$	M1M1
	$\Rightarrow p=3$	A1
	ALT	[5]
	$\alpha^3+\beta^3=(\alpha+\beta)(\alpha^2-\alpha\beta+\beta^2)=(\alpha+\beta)\left((\alpha+\beta)^2-3\alpha\beta\right)$	[M1]
(b)	Sum:	
	$\frac{\alpha+\beta}{\alpha^2}+\frac{\alpha+\beta}{\beta^2}=\frac{\alpha\beta^2+\beta^3+\alpha^3+\alpha^2\beta}{\alpha^2\beta^2}=\frac{\alpha^3+\beta^3+\alpha\beta(\alpha+\beta)}{\alpha^2\beta^2}$	M1
	ALT	
	$\frac{\alpha+\beta}{\alpha^2}+\frac{\alpha+\beta}{\beta^2}=\frac{\alpha^2(\alpha+\beta)+\beta^2(\alpha+\beta)}{\alpha^2\beta^2}=\frac{(\alpha^2+\beta^2)(\alpha+\beta)}{\alpha^2\beta^2}$	M1
	$=\frac{\left((\alpha+\beta)^2-2\alpha\beta\right)(\alpha+\beta)}{\alpha^2\beta^2}$	
	$\frac{-\frac{215}{8}+\left(-\frac{3}{2}\right)\left(-\frac{5}{2}\right)}{\left(-\frac{3}{2}\right)^2}=-\frac{185}{18}$ allow $\frac{185}{18}$ if they start with a negative.	B1
	Product:	
	$\left(\frac{\alpha+\beta}{\alpha^2}\right)\times\left(\frac{\alpha+\beta}{\beta^2}\right)=\frac{(\alpha+\beta)^2}{\alpha^2\beta^2}=\frac{\left(-\frac{5}{2}\right)^2}{\left(-\frac{3}{2}\right)^2}=\frac{25}{9}$	M1A1
	Equation:	[5]
	$x^2+\frac{185}{18}x+\frac{25}{9}=0\Rightarrow 18x^2+185x+50=0$ oe	
		Total 10 marks

Part	Mark	Notes
(a)	B1	For the correct expression/values for **BOTH** the sum and product. This must be identified, or implied from their working.
	M1	For the correct algebra to find $\alpha^3+\beta^3$ in terms of $\alpha+\beta$ and $\alpha\beta$ • $\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$ • $\alpha^3+\beta^3=(\alpha+\beta)\left((\alpha+\beta)^2-3\alpha\beta\right)$ • Or any other algebra, but do not award this mark until the values of $\alpha+\beta$ and $\alpha\beta$ can be substituted in directly.
	M1	For substituting their values of the sum and product into their expression for $\alpha^3+\beta^3$
	M1	For solving the **linear** equation in p Allow one slip in their working.
	A1	For the correct value of p with no errors.
(b)	M1	For the correct algebra for the sum of roots. This must be such that the given value of $\alpha^3+\beta^3$, with their values of $\alpha\beta$ and $(\alpha+\beta)$ can be substituted in. If they use the **ALT** they will not need $\alpha^3+\beta^3$ Some candidates will reverse the sign at this stage in anticipation of the reversal required in the equation.
	M1	For substituting in the given value for $\alpha^3+\beta^3$, and their values for $\alpha+\beta$ and $\alpha\beta$ into their expansion for the sum. If they use the **ALT** they will not need $\alpha^3+\beta^3$
	B1ft	For the correct value of the product of roots. You must follow through their p. You do not need to check the calculation once you see the correct algebra with a correct substitution.
	M1	For forming an equation with their sum and product. Ft the sign of their sum. Some candidates reverse the sign when finding the sum. Watch out for that! Accept this without = 0
	A1	For a correct equation including = 0 There is no follow through on this mark. **NB** accept a correct equivalent equation provided it has integer coefficients. e.g. $36x^2+370x+100=0$
	SC – they solve the equation and find values for α and β Award marks for correct work seen above in part (b) • If they do not obtain an expansion for the sum into which $\alpha^3+\beta^3$, $\alpha\beta$ and $(\alpha+\beta)$ cannot be directly substituted – first M0 • If they do not substitute $\alpha^3+\beta^3$, $\alpha\beta$ and $(\alpha+\beta)$ but other values based on α and β - second M0 • If they cannot substitute $\alpha\beta$ and $(\alpha+\beta)$ into the product – B0 Then allow marks for forming the equation as above.	