FP1 Roots & Coefficients of Equations Answers

		D1	1	1
(b)(i)		B1	1	
(ii)	Sum of roots is $2\sqrt{5}$	B1		
	Product is 6	M1A1	3	
(iii)	$p = -2\sqrt{5}, q = 6$	B1 B1√	2	ft wrong answers in (ii)
		DIV	2	It wrong answers in (ii)
1(a)	$\alpha + \beta = 2, \ \alpha \beta = \frac{2}{3}$	B1B1	2	SC 1/2 for answers 6 and 2
(b)(i)	$(\alpha + \beta)^3 = \alpha^3 + 3\alpha^2\beta + 3\alpha\beta^2 + \beta^3$	B1	1	Accept unsimplified
(ii)	$\alpha^{3} + \beta^{3} = (\alpha + \beta)^{3} - 3\alpha\beta(\alpha + \beta)$	M1		
	Substitution of numerical values	m1		
	$\alpha^3 + \beta^3 = 4$	A1	3	convincingly shown AG
(c)	$\alpha^3 \beta^3 = \frac{8}{27}$	B1		
	Equation of form $px^2 \pm 4px + r = 0$	M1		
	Answer $27x^2 - 108x + 8 = 0$	A1√	3	ft wrong value for $\alpha^3 \beta^3$
	Total		9	
i			1	I
3(a)	$\alpha + \beta = -2, \ \alpha\beta = \frac{3}{2}$	B1B1	2	
3(a)	$\alpha + \beta = 2, \alpha \beta = 2$	DIDI	2	
3(a)	$\alpha + \beta = -2, \ \alpha\beta = \frac{3}{2}$	DIDI	2	
		M1	2	
	Use of expansion of $(\alpha + \beta)^2$	M1		convincingly shown (AC):
			3	convincingly shown (AG); m1A0 if $\alpha + \beta = 2$ used
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$	M1		convincingly shown (AG); m1A0 if $\alpha + \beta = 2$ used
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$	M1 m1A1		m1A0 if $\alpha + \beta = 2$ used
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$	M1		
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$	M1 m1A1 M1A1	3	m1A0 if $\alpha + \beta = 2$ used M1A0 if num error made
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$ $\alpha^4 + \beta^4 = -\frac{7}{2}$	M1 m1A1	3 3	m1A0 if $\alpha + \beta = 2$ used
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$	M1 m1A1 M1A1	3	m1A0 if $\alpha + \beta = 2$ used M1A0 if num error made
(b)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$ $\alpha^4 + \beta^4 = -\frac{7}{2}$	M1 m1A1 M1A1	3 3	m1A0 if $\alpha + \beta = 2$ used M1A0 if num error made
(b) (c)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$ $\alpha^4 + \beta^4 = -\frac{7}{2}$ Total	M1 m1A1 M1A1 A1	3 3 8	m1A0 if $\alpha + \beta = 2$ used M1A0 if num error made
(b) (c)	Use of expansion of $(\alpha + \beta)^2$ $\alpha^2 + \beta^2 = (-2)^2 - 2\left(\frac{3}{2}\right) = 1$ $\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$ $\alpha^4 + \beta^4 = -\frac{7}{2}$	M1 m1A1 M1A1	3 3	m1A0 if $\alpha + \beta = 2$ used M1A0 if num error made

	Total		7	
	Equation is $x^2 - x + 8 = 0$	B1F	3	ft wrong sum/product; "= 0" needed
	Product of roots = $\frac{16}{\alpha\beta} = 8$	B1F		ft wrong value of $lphaeta$
(c)	Sum of roots = 1	B1F		PI by term $\pm x$; ft error(s) in (a)
	$\dots = \frac{\frac{1}{2}}{\frac{2}{2}} = \frac{1}{4}$	A1	2	Convincingly shown (AG)
(b)	$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha \beta}$	M1		
- (a)	$a + p = \frac{1}{2}, a p = 2$	DIDI	2	