Question Number	Scheme	Marks
10(a)	$\alpha + \beta = -3 \quad \alpha\beta = -5$	B1
(i)	$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta, \ = 19$	M1,A1
(ii)	$\alpha^4 + \beta^4 = (\alpha^2 + \beta^2)^2 - 2\alpha^2\beta^2, \ = 19^2 - 50 = 311$	M1,A1(5)
	OR: $\alpha^4 + \beta^4 = (\alpha + \beta)^4 - 4\alpha\beta(\alpha^2 + \beta^2) - 6\alpha^2\beta^2, \ = 19^2 - 50 = 311$	
(b)	$(\alpha - \beta)^2 = \alpha^2 - 2\alpha\beta + \beta^2 = 19 + 10$ OR $(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta = 9 - (-20)$	M1
	$\alpha - \beta = \sqrt{29}$ $*$	A1 cso (2)
(c)	$\alpha^4 - \beta^4 = (\alpha^2 - \beta^2)(\alpha^2 + \beta^2) = (\alpha - \beta)(\alpha + \beta)(\alpha^2 + \beta^2)$	M1A1A1 (3)
(d)	$\alpha^4 - \beta^4 = \sqrt{29} \times (-3) \times 19 = -57\sqrt{29} \ (-\sqrt{94221})$	M1A1 (2)
(e)	$2\beta^4 = \alpha^4 + \beta^4 - (\alpha^4 - \beta^4)$	M1
	$\beta^4 = \frac{1}{2}(311 + 57\sqrt{29}), = \frac{311}{2} + \frac{57}{2}\sqrt{29}$	A1,A1 (3)
	$p = \frac{311}{2} \quad q = \frac{57}{2}$	[15]
ALT	$\beta^4 = \left(\dfrac{-3 - \sqrt{29}}{2}\right)^4$ **and** use a correct binomial expansion $\quad$ M1A1	
	Correct final answer $\qquad\qquad\qquad\qquad\qquad$ A1	

(a)B1	Correct sum **and** product of roots, seen explicitly or used (in (a)). Must be clear that sum is negative
(i)M1	Correct algebra, ready for substitution of sum and product
A1	Correct answer, condone use of $\alpha + \beta = 3$.
(ii)M1	Correct algebra, ready for substitution
A1	Correct answer, condone use of $\alpha + \beta = 3$.
(b)M1	Correct algebra and substitution of their values
A1cso	Correct answer from correct working. Must have seen sum = -3 here if not shown in (a)
(c)	
M1	Factorise to 2 quadratic brackets or 2 linear and one quadratic bracket
A1	Obtain 2 linear and 1 quadratic brackets with 2 of the 3 brackets correct
A1	Third correct bracket Accept $(\alpha^2 + \beta^2)$ or $((\alpha + \beta)^2 - 2\alpha\beta)$
(d)M1	Substitute their values for each of the 3 brackets obtained in (c)
A1	Correct answer as shown or equivalent **exact** value
(e)	
M1	Correct expression for $2\beta^4$ or β^4
A1ft	Substitute their numbers to obtain a numerical expression for β^4 The expression must be exact but need not be simplified
	NB A correct numerical expression for their values implies M1
A1	Correct answer in the required form. p and q need not be shown explicitly.