Question			Answer	Marks	Guidance	
1	**(i)**		$y' = 3x^2 - 5$	M1		
			their $y' = 0$	M1		
			(1.3, – 4.3) cao	A1	or A1 for $x = \pm\sqrt{\frac{5}{3}}$ oe soi	
			(– 1.3, 4.3) cao	A1 **[4]**	allow if not written as co-ordinates if pairing is clear	ignore any work relating to second derivative
1	**(ii)**		crosses axes at (0, 0)	B1	condone x and y intercepts not written as co-ordinates; may be on graph	See examples in Appendix
			and $(\pm\sqrt{5}, 0)$	B1	$\pm$(2.23 to 2.24) implies $\pm\sqrt{5}$	
			sketch of cubic with turning points in correct quadrants and of correct orientation and passing through origin	B1		must meet the x-axis three times B0 eg if more than 1 point of inflection
			x-intercepts $\pm\sqrt{5}$ marked	B1 **[4]**	may be in decimal form ($\pm$2.2…)	
1	**(iii)**		substitution of $x = 1$ in $f'(x) = 3x^2 - 5$	M1		sight of – 2 does not necessarily imply M1: check $f'(x) = 3x^2 - 5$ is correct in part (i)
			– 2	A1		
			$y - -4 =$ (their $f'(1)$) $\times (x - 1)$ oe	M1*	or $-4 = -2\times(1) + c$	
			$-2x - 2 = x^3 - 5x$ and completion to given result www	M1dep*		
			use of Factor theorem in $x^3 - 3x + 2$ with – 1 or ± 2	M1	or any other valid method; must be shown	eg long division or comparing coefficients to find $(x-1)(x^2+x-2)$ or $(x+2)(x^2-2x+1)$ is enough for M1 with both factors correct
			$x = -2$ obtained correctly	A1 **[6]**		NB M0A0 for $x(x^2-3) = -2$ so $x = -2$ or $x^2 - 3 = -2$ oe

2	**i**	$(x + 5)(x - 2)(x + 2)$	2	M1 for *a* $(x + 5)(x - 2)(x + 2)$	2
	ii	$[(x + 2)](x^2 + 3x - 10)$	M1	for correct expansion of one pair of their brackets	
		$x^3 + 3x^2 - 10x + 2x^2 + 6x - 20$ o.	M1	for clear expansion of correct factors – accept given answer from $(x + 5)(x^2 - 4)$ as first step	2
	iii	$y' = 3x^2 + 10x - 4$	M2	M1 if one error	
		their $3x^2 + 10x - 4 = 0$ s.o.i.	M1	or M1 for substitution of 0.4 if trying to obtain 0, and A1 for correct demonstration of sign change	
		x = 0.36… from formula o.e.	A1		
		(−3.7, 12.6)	B1+1		6
	iv	(-1.8, 12.6)	B1+1	accept (−1.9, 12.6) or f.t.(½ their max x, their max y)	2

3	(i)	$3x^2 - 6x - 9$	M1		
		use of their $y' = 0$	M1		
		$x = -1$	A1		
		$x = 3$	A1		
		valid method for determining nature of turning point	M1		
		max at $x = -1$ and min at $x = 3$	A1	c.a.o.	6
	(ii)	$x(x^2 - 3x - 9)$	M1		
		$\frac{3 \pm \sqrt{45}}{2}$ or $(x - \frac{3}{2})^2 = 9 + \frac{9}{4}$	M1		
		$0, \frac{3}{2} \pm \frac{\sqrt{45}}{2}$ o.e.	A1		3
	(iii)	sketch of cubic with two turning points correct way up	G1		
		x-intercepts – negative, 0, positive shown	DG1		2

4	**i**	$y' = 6x^2 - 18x + 12$	M1	condone one error	
		$= 12$	M1	subst of $x = 3$ in their y'	
		$y = 7$ when $x = 3$	B1		
		tgt is $y - 7 = 12(x - 3)$	M1	f.t. their y and y'	
		verifying $(-1, -41)$ on tgt	A1	or B2 for showing line joining (3, 7) and $(-1, -41)$ has gradient 12	5
	ii	$y' = 0$ soi	M1	Their y'	
		quadratic with 3 terms	M1	Any valid attempt at solution	
		$x = 1$ or 2	A1	or A1 for (1, 3) and A1 for (2,2) marking	
		$y = 3$ or 2	A1	to benefit of candidate	4
	iii	cubic curve correct orientation touching x- axis only at (0.2,0)	G1		
		max and min correct	G1	f.	
		curve crossing y axis only at -2	G1		3

5	**i**	$y' = 6 - 2x$	M1	condone one error	
		$y' = 0$ used	M1		
		$x = 3$	A1		
		$y = 16$	A1		
		(0, 7) (–1, 0) and (7,0) found or marked on graph	3	1 each	
		sketch of correct shape	1	must reach pos. y - axis	8
	ii	58.6 to 58.7	3	B1 for $7x + 3x^2 - x^3/3$	
			M1	[their value at 5] – [their value at 1] dependent on integration attempted	3
	iii	using his (ii) and 48	1		1