1	**i**	$3x^2 - 20x + 12$	2	B1 if one error "+c" is an error	2
	ii	$y - 64 = -16(x - 2)$ o.e. eg $y = -16x + 96$	4	M1 for subst $x = 2$ in their y' A1 for $y' = -16$ and B1 for $y = 64$	4
	iii	Factorising $f(x) \equiv (x+2)(x-6)^2$ OR Expanding $(x+2)(x-6)^2$	B3 M2 E1	or B1 for $f(-2) = -8-40-24+72 = 0$ and B1 for $f'(6) = 0$ and B1dep for $f(6)=0$	3
	iv	$\frac{x^4}{4} - \frac{10x^3}{3} + 6x^2 + 72x$ value at ($x = 6$) ~ value at ($x = -2$) 341(.3..) cao	B2 M1 A1	-1 for each error Must have integrated $f(x)$	4

Question			Answer	Marks	Guidance	
2	**(i)**		at A $y = 3$	B1		
			$\frac{dy}{dx} = 2x - 4$	B1		
			their $\frac{dy}{dx} = 2 \times 4 - 4$	M1*	must follow from attempt at differentiation	
			grad of normal = $^{-1}/_{\text{their } 4}$	M1dep*		
			$y - 3 = (^{-1}/_4) \times (x - 4)$ oe isw	A1		
			substitution of $y = 0$ and completion to given result with at least 1 correct interim step www	A1 **[6]**	or substitution of $x = 16$ to obtain $y = 0$	correct interim step may occur before substitution
2	**(ii)**		at B, $x = 3$	B1	may be embedded	
			$\text{F}[x] = \frac{x^3}{3} - \frac{4x^2}{2} + 3x$	M1*	condone one error, must be three terms, ignore + c	
			F[4] – F[their 3]	M1* dep	dependent on integration attempted	
			area of triangle = 18 soi	B1		may be embedded in final answer
			area of region = $19\frac{1}{3}$ oe isw	A1 **[5]**	19.3 or better	

Question			Answer	Marks	Guidance	
3	**(i)**		sketch of parabola the right way up cutting y-axis at 3 and *either* x-axis at 1 and 3 only *or* minimum value at (2, -1)	B1 B1 **[2]**	 intersections must be marked on graph or shown worked out next to sketch	
3	**(ii)**		$y' = 2x - 4$ at A $y' = 6$ at A $y = 8$ soi y – their 8 = 6(x – 5) or substitution of (5, their 8) into $y = 6x + c$ and evaluation of c	M1* A1 B1 M1dep* **[4]**	 must be obtained by calculus implied by $y = 6x - 22$; M0 if value of y' not y used	
3	**(iii)**		$m = \frac{-1}{their 6}$ $y - 8 = -1/6\ (x - 5)$ oe and interim step completing to given answer $\frac{53 - x}{6} = x^2 - 4x + 3$ oe $x^2 - \frac{23}{6}x - \frac{35}{6}[=0]$ oe $(x - 5)(6x + 7)$ $x = -\frac{7}{6}$ oe isw (accept –1.17 or better)	M1 A1 M1* A1 M1dep* A1 **[6]**	 NB answer $x + 6y = 53$ given must be three terms or correct substitution in quadratic formula or correct completion of square previous M1 implied by correct answer	M0 if clearly obtained from $x + 6y = 53$ if quadratic in y, then B2 for $y = \frac{325}{36}$ = 9.0277… B2 for $x = -\frac{7}{6}$ oe obtained from correct value for y

4	(i) eqn of AB is $y = 3x + 1$ o.e. their "$3x + 1$" $= 4x^2$ $(4x + 1)(x – 1) = 0$ o.e. so $x = −1/4$ at C, $x = −1/4$, $y = 4 × (−1/4)^2$ or $3 × (− 1/4) + 1$[=1/4 as required]	**M1** **M1** **M1** **A1**	 or equiv in y: $y = 4\left(\frac{y-1}{3}\right)^2$ or rearranging and deriving roots $y = 4$ or ¼ condone verification by showing lhs = rhs o.e. or $y = ¼$ implies $x = ± ¼$ so at C $x = − ¼$	**SC3** for verifying that A, B and C are collinear and that C also lies on the curve **SC2** for verifying that A, B and C are collinear by showing that gradient of AB = AC (for example) or showing C lies on AB solely verifying that C lies on the curve scores 0
4	(ii) $y' = 8x$ at A $y' = 8$ eqn of tgt at A $y − 4$ = their"8"$(x − 1)$ $y = 8x - 4$ at C $y' = 8 × −1/4$ [=−2] $y − ¼ = −2(x − (− ¼))$ or other unsimplified equivalent to obtain given result. allow correct verification that (-¼,¼) lies on given line	**M1** **A1** **M1** **A1** **M1** **A1**	 ft their gradient NB if m = -2 obtained from given answer or only showing that (− ¼, ¼) lies on given line $y = −2x − ¼$ then 0 marks.	 gradient must follow from evaluation of $\frac{dy}{dx}$ condone unsimplified versions of $y = 8x - 4$ dependent on award of first **M1** **SC2** if equation of tangent and curve solved simultaneously to correctly show repeated root
4	(iii) their "$8x – 4$" $= −2x − ¼$ $y = −1$ www	**M1** **A1**	or $\frac{y+4}{8} = \frac{y+\frac{1}{4}}{-2}$	o.e. [$x = 3/8$]

5		$y' = 3x^{-\frac{1}{2}}$ ¾ when $x = 16$ $y = 24$ when $x = 16$ $y -$ their 24 = their ¾ $(x - 16)$ $y - 24 = $ ¾ $(x - 16)$ o.e.	M1 A1 B1 M1 A1	condone if unsimplified dependent on $\frac{dy}{dx}$ used for m	5