1	showing $a + b + c = 6$ o.e $bc = \frac{9^2 - 17}{16}$ =64/16 o.e. correctly obtained completion showing $abc = 6$ o.e.	1 M1 A1 A1	simple equiv fraction eg 192/32 or 24/4 correct expansion of numerator; may be unsimplified 4 term expansion; M0 if get no further than $\left(\sqrt{17}\right)^2$; M0 if no evidence before 64/16 o.e. may be implicit in use of factors in completion	4

2	(i) a^5b^3 as final answer (ii) $\frac{(x+2)(x-2)}{(x-2)(x-3)}$ $\frac{x+2}{x-3}$ as final answer	2 M2 A1	1 for 2 'terms' correct in final answer M1 for each of numerator or denom. correct or M1, M1 for correct factors seen separately	5
3	correct expansion of both brackets seen (may be unsimplified), or difference of squares used $4m^2$ correctly obtained [p =] [±]2m cao	M2 A1 A1	M1 for one bracket expanded correctly; for M2, condone done together and lack of brackets round second expression if correct when we insert the pair of brackets	4

4		$y = 2x + 3$ drawn on graph	M1		
		$x = 0.2$ to 0.4 and -1.7 to -1.9	A2	1 each; condone coords; must have line drawn	3
	ii	$1 = 2x^2 + 3x$	M1	for multiplying by x correctly	
		$2x^2 + 3x - 1$ [= 0]	M1	for correctly rearranging to zero (may be earned first) or suitable step re completing square if they go on	
		attempt at formula or completing square	M1	ft, but no ft for factorising	
		$x = \frac{-3 \pm \sqrt{17}}{4}$	A2	A1 for one soln	5
	iii	branch through (1,3),	1	and approaching $y = 2$ from above	
		branch through (−1,1),approaching $y = 2$ from below	1	and extending below x axis	2
	iv	-1 and ½ or ft intersection of their curve and line [tolerance 1 mm]	2	1 each; may be found algebraically; ignore y coords.	2

5		$(x - 3.5)^2 - 6.25$	**3**	B1 for $a = 7/2$ o.e, B2 for $b = -25/4$ o.e. or M1 for $6 - (7/2)^2$ or $6 -$ (their a)^2	3
	ii	(3.5, –6.25) o.e. or ft from their (i)	1+1	allow $x = 3.5$ and $y = -6.25$ or ft; allow shown on graph	2
	iii	(0, 6) (1, 0) (6, 0)	3	1 each [stated or numbers shown on graph]	
		curve of correct shape	G1		
		fully correct intns and min in 4th quadrant	G1		5
	iv	$x^2 - 7x + 6 = x^2 - 3x + 4$	M1		
		$2 = 4x$	M1	or $4x - 2 = 0$ (simple linear form; condone one error)	
		$x = ½$ or 0.5 or 2/4 cao	A1	condone no comment re only one intn	3

Question			Answer	Marks	Guidance	
6	(i)		$x = 4$ (4, –3)	B1 B1 **[2]**	 or $x = 4$, $y = –3$	 condone 4, –3
6	(ii)		(0, 13) isw [when $y = 0$,] $(x – 4)^2 = 3$ $[x =]4 \pm \sqrt{3}$ or $\frac{8 \pm \sqrt{12}}{2}$ isw	1 M1 A2 **[4]**	or [when $x = 0$], $y = 13$ isw 0 for just (13, 0) or (k, 13) where $k \neq 0$ or $x^2 – 8x + 13$ [= 0] need not go on to give coordinate form A1 for one root correct	annotate this question if partially correct may be implied by correct value(s) for x found allow M1 for $y = x^2 – 8x + 13$ only if they go on to find values for x as if y were 0
6	(iii)		replacement of x in their eqn by $(x – 2)$ completion to given answer $y = x^2 – 12x + 33$, showing at least one correct interim step	M1 A1 **[2]**	may be simplified; eg $[y =] (x – 6)^2 – 3$ or allow M1 for $(x – 6 – \sqrt{3})(x – 6 + \sqrt{3})$ [=0 or y] cao; condone using f($x – 2$) in place of y	condone omission of '$y =$' for M1, but must be present in final line for A1

Question			Answer	Marks	Guidance	
6	(iv)		$x^2 - 12x + 33 = 8 - 2x$ or $(x - 6)^2 - 3 = 8 - 2x$	M1	for equating curve and line; correct eqns only; or for attempt to subst $(8 - y)/2$ for x in $y = x^2 - 12x + 33$	annotate this question if partially correct
			$x^2 - 10x + 25 = 0$	M1	for rearrangement to zero, condoning one error such as omission of '= 0'	
			$(x - 5)^2$ [= 0]	A1	or showing $b^2 = 4ac$	allow $\frac{10 \pm \sqrt{0}}{2}$ oe if $b^2 - 4ac = 0$ is not used explicitly A0 for $(x - 5)^2 = y$
			$x = 5$ www [so just one point of contact]	A1	may be part of coordinates $(5, k)$	allow recovery from $(x - 5)^2 = y$
			point of contact at $(5, -2)$	A1	dependent on previous A1 earned; allow for $y = -2$ found	
			<u>alt. method</u>	**or**		examiners: use one mark scheme or the other, to the benefit of the candidate if both methods attempted, but do not use a mixture of the schemes
			for curve, $y' = 2x - 12$	M1		
			$2x - 12 = -2$	M1	for equating their y' to -2	
			$x = 5$, and y shown to be -2 using eqn to curve	A1		
			tgt is $y + 2 = -2(x - 5)$	A1		
			deriving $y = 8 - 2x$	A1		condone no further interim step if all working in this part is correct so far
				[5]		

7 (i)	translation by $\begin{pmatrix} -4 \\ 0 \end{pmatrix}$ or 4 [units] to left	**B1** **B1**	**0** for shift/move or 4 units in negative *x* direction o.e.
7 (ii)	sketch of parabola right way up and with minimum on negative *y*-axis min at (0, −4) and graph through −2 and 2 on *x*-axis	**B1** **B1**	mark intent for both marks must be labelled or shown nearby