1		$3x^2 + 6x + 10 = 2 - 4x$	M1	for subst for x or y or subtraction attempted	
		$3x^2 + 10x + 8$ [= 0]	M1	or $3y^2 - 52y + 220$ [=0]; for rearranging to zero (condone one error)	
		$(3x + 4)(x + 2)$ [=0]	M1	or $(3y - 22)(y - 10)$; for sensible attempt at factorising or formula or completing square	
		$x = -2$ or $-4/3$ o.e. $y = 10$ or $22/3$ o.e.	A1 A1	or A1 for each of $(-2, 10)$ and $(-4/3, 22/3)$ o.e.	5
	ii	$3(x + 1)^2 + 7$	4	1 for $a = 3$, 1 for $b = 1$, 2 for $c = 7$ or M1 for $10 - 3 \times$ their b^2 soi or for 7/3 or for 10/3 − their b^2 soi	4
	iii	min at $y = 7$ or ft from (ii) for positive c (ft for (ii) only if in correct form)	B2	may be obtained from (ii) or from good symmetrical graph or identified from table of values showing symmetry condone error in x value in stated min ft from (iii) [getting confused with 3 factor] B1 if say turning pt at $y = 7$ or ft without identifying min or M1 for min at $x = -1$ [e.g. may start again and use calculus to obtain $x = -1$] or min when $(x + 1)^{[2]} = 0$; and A1 for showing y positive at min or M1 for showing discriminant neg. so no real roots and A1 for showing above axis not below eg positive x^2 term or goes though (0, 10) or M1 for stating bracket squared must be positive [or zero] and A1 for saying other term is positive	2

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2		any correct y value calculated from quadratic seen or implied by plots	B1	for $x \neq 0$ or 1; may be for neg x or eg min.at (2.5, −1.25)	
		(0, 5)(1, 1)(2, −1)(3, −1)(4,1) and (5,5) plotted	P2	tol 1 mm; P1 for 4 correct [including (2.5, −1.25) if plotted]; plots may be implied by curve within 1 mm of correct position	
		good quality smooth parabola within 1mm of their points	C1	allow for correct points only [accept graph on graph paper, not insert]	4
	ii	$x^2 - 5x + 5 = \frac{1}{x}$	M1		
		$x^3 - 5x^2 + 5x = 1$ and completion to given answer	M1		2
	iii	divn of $x^3 - 5x^2 + 5x - 1$ by $x - 1$ as far as $x^3 - x^2$ used in working	M1	or inspection eg $(x - 1)(x^2 \ldots\ldots + 1)$ or equating coeffts with two correct coeffts found	
		$x^2 - 4x + 1$ obtained	A1		
		use of $b^2 - 4ac$ or formula with quadratic factor	M1	or $(x - 2)^2 = 3$; may be implied by correct roots or $\sqrt{12}$ obtained	
		$\sqrt{12}$ obtained and comment re shows other roots (real and) irrational <u>or</u> for $2 \pm \sqrt{3}$ or $\frac{4 \pm \sqrt{12}}{2}$ obtained isw	A2	[A1 for $\sqrt{12}$ and A1 for comment] NB A2 is available only for correct quadratic factor used; if wrong factor used, allow A1 ft for obtaining two irrational roots or for their discriminant and comment re irrational [no ft if their discriminant is negative]	5

3	$\frac{3x-4}{x+1}$ or $3-\frac{7}{x+1}$ www as final answer	3	M1 for $(3x - 4)(x - 1)$ and M1 for $(x + 1)(x - 1)$	3

4	(i) $n = 2m$	M1	or any attempt at generalising; M0 for just trying numbers	
	$3n^2 + 6n = 12m^2 + 12m$ or $= 12m(m + 1)$	M2	or M1 for $3n^2 + 6n = 3n\,(n + 2) = 3 \times$ even $\times$ even and M1 for explaining that 4 is a factor of even $\times$ even or M1 for 12 is a factor of $6n$ when n is even and M1 for 4 is a factor of n^2 so 12 is a factor of $3n^2$	
	(ii) showing false w n is odd e.g. $3n^2 + 6n$ = odd + even = odd	B2	or $3n\,(n + 2)$ =3 $\times$ odd $\times$ odd = odd or counterexample showing not always true; M1 for false with partial explanation or incorrect calculation	5

5		$(x - 2.5)^2$ o.e. $-2.5^2 + 8$ $(x - 2.5)^2 + 7/4$ o.e.	M1 M1 A1	 for clear attempt at -2.5^2 allow M2A0 for $(x - 2.5) + 7/4$ o.e. with no $(x - 2.5)^2$ seen		
		min $y = 7/4$ o.e. [so above x axis] or commenting $(x - 2.5)^2 \geq 0$	B1	ft, dep on $(x - a)^2 + b$ with b positive; condone starting again, showing $b^2 - 4ac < 0$ or using calculus	4	
	ii	correct symmetrical quadratic shape 8 marked as intercept on y axis tp (5/2, 7/4) o.e. or ft from (i)	G1 G1 G1	 or (0, 8) seen in table	3	
	iii	$x^2 - 5x - 6$ seen or used −1 and 6 obtained $x < -1$ and $x > 6$ isw or ft their solns	M1 M1 M1	or $(x - 2.5)^2$ [> or =] 12.25 or ft $14 - b$ also implies first M1 if M0, allow B1 for one of $x < -1$ and $x > 6$	3	
	iv	min = (2.5, − 8.25) or ft from (i) so yes, crosses	M1 A1	or M1 for other clear comment re translated 10 down and A1 for referring to min in (i) or graph in (ii); or M1 for correct method for solving $x^2 - 5x - 2 = 0$ or using $b^2 - 4ac$ with this and A1 for showing real solns eg $b^2 - 4ac = 33$; allow M1A0 for valid comment but error in −8.25 ft; allow M1 for showing y can be neg eg (0, −2) found and A1 for correct conclusion	2	12

6	**i**	$4(x-3)^2-9$	4	1 for $a = 4$, 1 for $b = 3$, 2 for $c = -9$ or M1 for $27 - 4 \times 3^2$ or $\frac{27}{4} - 3^2 [= -\frac{9}{4}]$	4
	ii	min at (3, –9) or ft from (i)	B2	1 for each coord [e.g. may start again and use calculus to obtain $x = 3$]	2
	iii	$(2x-3)(2x-9)$	M1	attempt at factorising or formula or use of their (i) to sq rt stage	
		$x = 1.5$ or 4.5 o.e.	A2	A1 for 1 correct; accept fractional equivs eg 36/8 and 12/8	3
	iv	sketch of quadratic the right way up	M1		
		crosses x axis at 1.5 and 4.5 or ft	A1	allow unsimplified	
		crosses y axis at 27	B1	shown on graph or in table etc; condone not extending to negative x	3