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Section A

1	$x > -0.6$ o.e. eg $-3/5 < x$ isw	3	M2 for $-3 < 5x$ or $x > \frac{3}{-5}$ or M1 for $-5x < 3$ or $k < 5x$ or $-3 < kx$ [condone \leq for Ms]; if 0, allow SC1 for -0.6 found	3
2	$t = [\pm] \sqrt{\frac{2s}{a}}$ o.e.	3	B2 for t omitted or $t = \sqrt{\frac{s}{\frac{1}{2}a}}$ o.e. M1 for correct constructive first step in rearrangement and M1 (indep) for finding sq rt of their t^2	3
3	'If $2n$ is an even integer, then n is an odd integer' showing wrong eg 'if n is an even integer, $2n$ is an even integer'	1 1	or: $2n$ an even integer $\Rightarrow n$ an odd integer or counterexample eg $n = 2$ and $2n = 4$ seen [in either order]	2
4	$c = 6$ $k = -7$	1 2	M1 for $f(2) = 0$ used or for long division as far as $x^3 - 2x^2$ in working	3
5	(i) $4x^4y$ (ii) 32	2 2	M1 for two elements correct; condone y^1 M1 for $\left(\frac{2}{1}\right)^5$ or 2^5 soi or $\left(\frac{1}{32}\right)^{-1}$ or $\frac{1}{32}$	4
6	$-720 [x^3]$	4	B3 for 720; M1 for each of 3^2 and $\pm 2^3$ or $(-2x)^3$ or $(2x)^3$, and M1 for 10 or $(5 \times 4 \times 3) / (3 \times 2 \times 1)$ or for 1 5 10 10 5 1 seen but not for 5C_3	4
7	$\frac{-5}{10}$ o.e. isw	3	M1 for $4x + 5 = 2x \times -3$ and M1 for $10x = -5$ o.e. or M1 for $2 + \frac{5}{2x} = -3$ and M1 for $\frac{5}{2x} = -5$ o.e.	3
8	(i) $2\sqrt{2}$ or $\sqrt{8}$ (ii) $30 - 12\sqrt{5}$	2 3	M1 for $7\sqrt{2}$ or $5\sqrt{2}$ seen M1 for attempt to multiply num. and denom. by $2 - \sqrt{5}$ and M1 (dep) for denom -1 or $4 - 5$ soi or for numerator $12\sqrt{5} - 30$	5
9	(i) ± 5 (ii) $y = (x - 2)^2 - 4$ or $y = x^2 - 4x$ o.e. isw	2 2	B1 for one soln M1 if y omitted or for $y = (x + 2)^2 - 4$ or $y = x^2 + 4x$ o.e.	4
10	(i) $\frac{1}{2} \times (x + 1)(2x - 3) = 9$ o.e. $2x^2 - x - 3 = 18$ or $x^2 - \frac{1}{2}x - 3/2 = 9$ (ii) $(2x - 7)(x + 3)$ -3 and $7/2$ o.e. or ft their factors base 4, height 4.5 o.e. cao	M1 A1 B1 B1 B1	for clear algebraic use of $\frac{1}{2}bh$; condone $(x + 1)(2x - 3) = 18$ allow x terms uncollected. NB ans $2x^2 - x - 21 = 0$ given NB B0 for formula or comp. sq. if factors seen, allow omission of -3 B0 if also give $b = -9, h = -2$	5

Section B

11	i	grad AC = $\frac{7-3}{3-1}$ or 4/2 o.e. [= 2]	M1	not from using $-\frac{1}{2}$	4
		so grad AT = $-\frac{1}{2}$	M1	or ft their grad AC [for use of $m_1m_2 = -1$]	
		eqn of AT is $y - 7 = -\frac{1}{2}(x - 3)$	M1	or subst (3, 7) in $y = -\frac{1}{2}x + c$ or in $2y + x = 17$; allow ft from their grad of AT, except 2 (may be AC not AT)	
		one correct constructive step towards $x + 2y = 17$ [ans given]	M1	or working back from given line to $y = -\frac{1}{2}x + 8.5$ o.e.	
	ii	$x + 2(2x - 9) = 17$	M1	attempt at subst for x or y or elimination	3
		$5x - 18 = 17$ or $5x = 35$ o.e. $x = 7$ and $y = 5$ [so (7, 5)]	A1 B1	allow $2.5x = 17.5$ etc graphically: allow M2 for both lines correct or showing (7, 5) fits both lines	
	iii	$(x - 1)^2 + (2x - 12)^2 = 20$ $5x^2 - 50x + 125 [= 0]$ $(x - 5)^2 = 0$ equal roots so tangent	M1 M1 A1 B1	subst $2x - 9$ for y [oe for x] rearranging to 0; condone one error showing 5 is root and only root explicit statement of condition needed (may be obtained earlier in part) or showing line is perp. to radius at point of contact	5
		(5, 1)	B1	condone $x = 5, y = 1$	
		<u>or</u>			
		$y - 3 = -\frac{1}{2}(x - 1)$ o.e. seen	M1	or if $y = 2x - 9$ is tgt then line through C with gradient $-\frac{1}{2}$ is radius	
subst or elim. with $y = 2x - 9$ $x = 5$ (5, 1)		M1 A1 B1 B1			
showing (5, 1) on circle			or showing distance between (1, 3) and (5, 1) = $\sqrt{20}$		

12	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	$(2x-3)(2x-9)$ $x = 1.5$ or 4.5 o.e.	M1 A2	attempt at factorising or formula or use of their (i) to sq rt stage A1 for 1 correct; accept fractional equivs eg $36/8$ and $12/8$	3
	iv	sketch of quadratic the right way up crosses x axis at 1.5 and 4.5 or ft crosses y axis at 27	M1 A1 B1	allow unsimplified shown on graph or in table etc; condone not extending to negative x	3
13	i	$2x^3 + 5x^2 + 4x - 6x^2 - 15x - 12$	1	for correct interim step; allow correct long division of $f(x)$ by $(x-3)$ to obtain $2x^2 + 5x + 4$ with no remainder	4
		3 is root use of $b^2 - 4ac$ $5^2 - 4 \times 2 \times 4$ or -7 and [negative] implies no real root	B1 M1 A1	allow $f(3) = 0$ shown or equivalents for M1 and A1 using formula or completing square	
	ii	divn of $f(x) + 22$ by $x - 2$ as far as $2x^3 - 4x^2$ used $2x^2 + 3x - 5$ obtained $(2x+5)(x-1)$ 1 and -2.5 o.e. <u>or</u> $2 \times 2^3 - 2^2 - 11 \times 2 - 12$ $16 - 4 - 22 - 12$ $x = 1$ is a root obtained by factor thm $x = -2.5$ obtained as root	M1 A1 M1 A1 +A1 M1 A1 B1 B2	or inspection eg $(x-2)(2x^2 \dots -5)$ attempt at factorising/quad. formula/ compl. sq. <u>or</u> equivs using $f(x) + 22$ not just stated	5
iii	cubic right way up crossing x axis only once (3, 0) and (0, -12) shown	G1 G1 G1	must have turning points must have max and min below x axis at intns with axes or in working (indep of cubic shape); ignore other intns	3	