Mark Scheme 4751
January 2006

Section A

1	$n(n+1)$ seen = odd × even and/or even × odd = even	M1 A1	or B1 for n odd $\Rightarrow n^2$ odd, and comment eg odd + odd = even B1 for n even$\Rightarrow n^2$ even, and comment eg even + even = even allow A1 for 'any number multiplied by the consecutive number is even'	2
2	(i) translation of $\begin{pmatrix}2\\0\end{pmatrix}$ (ii) $y = f(x-2)$	1 1 2	 or '2 to the right' or '$x \to x+2$' or 'all x values are increased by 2' 1 for $y = f(x+2)$	4
3	$16 + 32x + 24x^2 + 8x^3 + x^4$ isw	4	3 for 4 terms correct, 2 for 3 terms correct, or M1 for 1 4 6 4 1 s.o.i. and M1 for expansion with correct powers of 2	4
4	$x > -4.5$ o.e. isw www [M1 for × 4 M1 expand brackets or divide by 3 M1 subtract constant from LHS M1 divide to find x]	4	accept −27/6 or better; 3 for $x = -4.5$ etc or Ms for each of the four steps carried out correctly with inequality [−1 if working with equation] (ft from earlier errors if of comparable difficulty)	4
5	$[C =]\frac{4P}{1-P}$ or $\frac{-4P}{P-1}$ o.e.	4	M1 for $PC + 4P = C$ M1 for $4P = C - PC$ or ft M1 for $4P = C(1-P)$ or ft B3 for $[C =]\frac{4}{\frac{1}{P}-1}$ o.e. unsimplified	4
6	f(1) used $1^3 + 3 \times 1 + k = 6$ $k = 2$	M1 A1 A1	or division by $x - 1$ as far as $x^2 + x$ or remainder = $4 + k$ B3 for $k = 2$ www	3
7	grad BC = – ¼ soi $y - 3 = -\frac{1}{4}(x-2)$ o.e. cao 14 or ft from their BC	2 1 2	M1 for $m_1 m_2 = -1$ soi or for grad AB = 4 or grad BC = 1/4 e.g. $y = -0.25x + 3.5$ M1 for subst $y = 0$ in their BC	5
8	(i) $30\sqrt{2}$ (ii) $\frac{1}{11}+\frac{2}{11}\sqrt{3}$ or $\frac{3}{33}+\frac{6}{33}\sqrt{3}$ or mixture of these	2 3	M1 for $\sqrt{8}=2\sqrt{2}$ or $\sqrt{50} = 5\sqrt{2}$ soi B1 for $6\sqrt{50}$ or other correct $a\sqrt{b}$ M1 for mult num and denom by $6+\sqrt{3}$ and M1 for denom = 11 or 33	5

			B2 for $\frac{3+6\sqrt{3}}{33}$ or $\frac{1+2\sqrt{3}}{11}$	
9	(i) $k \leq 25/4$ (ii) -2.5	3 2	M2 for $5^2 - 4k \geq 0$ or B2 for 25/4 obtained isw or M1 for $b^2 - 4ac$ soi or completing square accept $-20/8$ or better, isw; M1 for attempt to express quadratic as $(2x + a)^2$ or for attempt at quadratic formula	5

Section B

10	**i**	(0, 0), $\sqrt{45}$ isw or $3\sqrt{5}$	1+1		2
	ii	$x = 3 - y$ or $y = 3 - x$ seen or used	M1		
		subst in eqn of circle to eliminate variable	M1		
		$9 - 6y + y^2 + y^2 = 45$	M1	for correct expn of $(3 - y)^2$ seen oe	
		$2y^2 - 6y - 36 = 0$ or $y^2 - 3y - 18 = 0$	M1	condone one error if quadratic or quad. formula attempted	
		$(y - 6)(y + 3) = 0$	A1		
		$y = 6$ or -3	A1	[complete sq attempt earns last 2 Ms]	
		$x = -3$ or 6	M1		
		$\sqrt{(6--3)^2 + (3--6)^2}$		or A1 for (6, –3) and A1 for (–3, 6)	8
				no ft from wrong points (A.G.)	
11	**i**	$(x - 3.5)^2 - 6.25$	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
12	**i**	sketch of cubic the correct way up	G1		
		curve passing through (0, 0)	G1		
		curve touching x axis at (3, 0)	G1		3
	ii	$x(x^2 - 6x + 9) = 2$	M1	or $(x^2 - 3x)(x - 3) = 2$ [for one step in expanding brackets]	
		$x^3 - 6x^2 + 9x = 2$	M1	for 2nd step, dep on first M1	2
	iii	subst $x = 2$ in LHS of their eqn or in $x(x - 3)^2 = 2$ o.e.	1	or 2 for division of their eqn by $(x - 2)$ and showing no remainder	
		working to show consistent	1		
		division of their eqn by $(x - 2)$ attempted	M1	or inspection attempted with $(x^2 + kx + c)$ seen	
		$x^2 - 4x + 1$	A1		

		soln of their quadratic by formula or completing square attempted $x = 2 \pm \sqrt{3}$ or $(4 \pm \sqrt{12})/2$ isw locating the roots on intersection of their curve and $y = 2$	M1 A2 G1	condone ignoring remainder if they have gone wrong A1 for one correct must be 3 intns; condone $x = 2$ not marked; mark this when marking sketch graph in (i)	7 G1