

**Mark Scheme 4751**  
**January 2006**

## Section A

1	$n(n+1)$ seen = odd $\times$ even and/or even $\times$ 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 $\binom{2}{0}$  (ii) $y = f(x-2)$	1  1  2	or '2 to the right' or ' $x \rightarrow x+2$ ' 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 $\times 4$ 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 = $-\frac{1}{4}$ soi  $y-3 = -\frac{1}{4}(x-2)$ o.e. cao 14 or ft from their BC	2  1 2	M1 for $m_1m_2 = -1$ 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 $\frac{1+2\sqrt{3}}{11}$	
<b>9</b>	(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 subst in eqn of circle to eliminate variable $9 - 6y + y^2 + y^2 = 45$ $2y^2 - 6y - 36 = 0$ or $y^2 - 3y - 18 = 0$ $(y - 6)(y + 3) = 0$ $y = 6$ or $-3$ $x = -3$ or $6$ $\sqrt{(6 - (-3))^2 + (3 - (-6))^2}$	M1 M1 M1 M1 M1 A1 A1 M1	for correct expn of $(3 - y)^2$ seen oe condone one error if quadratic or quad. formula attempted [complete sq attempt earns last 2 Ms] or A1 for $(6, -3)$ and A1 for $(-3, 6)$ no ft from wrong points (A.G.)	8
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 $6 - (\text{their } a)^2$	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	$(0, 6)$ $(1, 0)$ $(6, 0)$ curve of correct shape fully correct intns and min in 4th quadrant	3 G1 G1	1 each [stated or numbers shown on graph]	5
	iv	$x^2 - 7x + 6 = x^2 - 3x + 4$ $2 = 4x$ $x = \frac{1}{2}$ or $0.5$ or $2/4$ cao	M1 M1 A1	or $4x - 2 = 0$ (simple linear form; condone one error) condone no comment re only one intn	3
12	i	sketch of cubic the correct way up curve passing through $(0, 0)$ curve touching $x$ axis at $(3, 0)$	G1 G1 G1		3
	ii	$x(x^2 - 6x + 9) = 2$ $x^3 - 6x^2 + 9x = 2$	M1 M1	or $(x^2 - 3x)(x - 3) = 2$ [for one step in expanding brackets]	2
	iii	subst $x = 2$ in LHS of their eqn or in $x(x - 3)^2 = 2$ o.e. working to show consistent division of their eqn by $(x - 2)$ attempted $x^2 - 4x + 1$	1 1 M1 A1	for 2nd step, dep on first M1 or 2 for division of their eqn by $(x - 2)$ and showing no remainder or inspection attempted with $(x^2 + kx + c)$ seen	

	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
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