

January 2005
6663 Core Mathematics C1
Mark Scheme

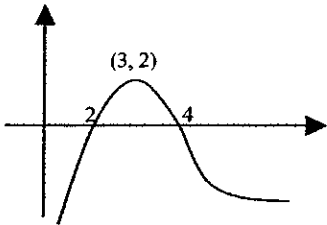
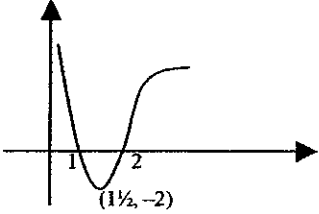
Question number	Scheme	Marks
1.	<p>(a) 4</p> <p>(b) $16^{-\frac{3}{2}} = \frac{1}{16^{\frac{3}{2}}}$ and attempt to find $16^{\frac{3}{2}}$</p> <p>$\frac{1}{64}$ (or exact equivalent, e.g. 0.015625)</p>	B1 M1 A1 (3) 3
	<p>(b) <u>Any</u> attempt to evaluate $16^{\frac{3}{2}}$.</p> <p>Answer only scores both marks.</p>	

Question number	Scheme	Marks
2.	(i) (a) $15x^2 + 7$ (i) (b) $30x$ (ii) $x + 2x^{\frac{3}{2}} + x^{-1} + C$	M1 A1 A1 (3) B1ft (1) A1: $x + C$, A1: $2x^{\frac{3}{2}}$, A1: x^{-1} M1 A1 A1 A1(4) 8
	(i) (a) A1: 2 terms correctly differentiated. A1: Fully correct. (ii) Allow any equivalent version of each term.	

Question number	Scheme	Marks
3.	Attempt to use discriminant $b^2 - 4ac$ (Need not be equated to zero) $144 - 4 \times k \times k = 0$ Attempt to solve for k $k = 6$	M1 A1 M1 A1 (4) 4
	<p><u>Alternative for first 2 marks</u></p> <p>Attempt to complete square $(x \pm p)^2 \pm q \pm c$, $p \neq 0$, $q \neq 0$ M1</p> <p>$1 - \frac{36}{k^2} = 0$ or equiv. A1</p> <p><u>Other alternatives</u></p> <p>(i) $x^2 + \frac{12}{k}x + 1$ must be equivalent to $(x + 1)^2$ M1 A1</p> <p>Compare coefficients and attempt to solve for k: $\frac{12}{k} = 2$ $k = 6$ M1 A1</p> <p>(ii) Finding the root first, e.g. $(\sqrt{k}x + \sqrt{k})^2 = 0$, so $x = -1$ M1 A1</p> <p>Substitute the root to find k, $k = 6$ M1 A1</p> <p><u>Answer only</u></p> <p>Scores 2 marks: M0 A0 M1 A1</p> <p>The first two marks would only be scored if solution then justifies that $k = 6$ gives equal roots.</p>	

Question number	Scheme	Marks
4.	$x^2 + 2(2 - x) = 12$ or $(2 - y)^2 + 2y = 12$ (Eqn. in x or y only) $x^2 - 2x - 8 = 0$ or $y^2 - 2y - 8 = 0$ (Correct 3 term version) $(x - 4)(x + 2) = 0$ $x = \dots$ or $(y - 4)(y + 2) = 0$ $y = \dots$ $x = 4, x = -2$ or $y = 4, y = -2$ $y = -2, y = 4$ or $x = -2, x = 4$ (M: attempt one, A: both)	M1 A1 M1 A1 M1 A1ft (6) 6
	<p>A1ft requires 3 s.f. accuracy if not exact.</p> <p><u>“Non-algebraic” solutions:</u></p> <p>No working, and only one correct solution pair found (e.g. $x = 4, y = -2$): M0 A0 M0 A0 M1 A1</p> <p>No working, and both correct solution pairs found, but not demonstrated: M0 A0 M1 A1 M1 A1</p> <p>Both correct solution pairs found, and demonstrated, perhaps in a table of values: Full marks</p>	

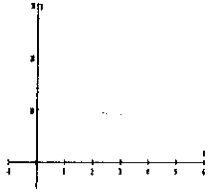
Question number	Scheme	Marks
5.	(a) -3, -1, 1 (b) 2 (c) $\text{Sum} = \frac{1}{2}n\{2(-3) + (n-1)(2)\}$ or $\frac{1}{2}n\{(-3) + (2n-5)\}$ $= \frac{1}{2}n\{2n-8\} = n(n-4)$	B1: One correct (ft only if terms in (a) are in arithmetic progression) M1 A1ft (*) A1 (2) (1) (3) 6

Question number	Scheme	Marks
6.	<p>(a) </p> <p>(b) </p>	<p>Reflection in x-axis 2 and 4 labelled (or (2, 0) and (4, 0) seen) Image of P (3, 2)</p> <p>Stretch parallel to x-axis 1 and 2 labelled (or (1, 0) and (2, 0) seen) Image of P ($1\frac{1}{2}$, -2)</p> <p>B1 B1 B1 (3)</p> <p>M1 A1 A1 (3) 6</p>

Question number	Scheme	Marks
7.	<p>(a) $\frac{5-x}{x} = \frac{5}{x} - 1 \quad (= 5x^{-1} - 1)$</p> <p>$\frac{dy}{dx} = 8x - 5x^{-2}$</p> <p>When $x = 1$, $\frac{dy}{dx} = 3$ (*)</p> <p>(b) At P, $y = 8$</p> <p>Equation of tangent: $y - 8 = 3(x - 1) \quad (y = 3x + 5) \quad (\text{or equiv.})$</p> <p>(c) Where $y = 0$, $x = -\frac{5}{3} \quad (= k) \quad (\text{or exact equiv.})$</p>	<p>M1</p> <p>M1 A1 A1</p> <p>A1 (5)</p> <p>B1</p> <p>M1 A1ft (3)</p> <p>M1 A1 (2)</p> <p>10</p>
	<p>(a) First M1 can also be scored by an attempt to use the quotient or product rule to differentiate $\frac{5-x}{x}$.</p> <p>(b) The B mark may be earned in part (a).</p>	

Question number	Scheme	Marks
8.	<p>(a) $p = 15, q = -3$</p> <p>(b) Grad. of line ADC: $m = -\frac{5}{7}$, Grad. of perp. line $= -\frac{1}{m} \left(= \frac{7}{5} \right)$</p> <p>Equation of l: $y - 2 = \frac{7}{5}(x - 8)$</p> <p>$7x - 5y - 46 = 0$ (Allow rearrangements, e.g. $5y = 7x - 46$)</p> <p>(c) Substitute $y = 7$ into equation of l and find $x = \dots$</p> <p>$\frac{81}{7}$ or $11\frac{4}{7}$ (or exact equiv.)</p>	<p>B1 B1 (2)</p> <p>B1, M1</p> <p>M1 A1ft</p> <p>A1 (5)</p> <p>M1</p> <p>A1 (2)</p> <p>9</p>
	<p>(a) <u>Special case:</u></p> <p>If B0 B0 from main scheme, allow M1 for a correct method, e.g. $8 = \frac{1+p}{2}$.</p> <p>(b) Finding eqn. of ADC instead of l scores M1 A0 A0.</p>	

Question number	Scheme	Marks
9.	<p>(a) Gradient of tangent at P: $m = 4$, Grad. of normal $= -\frac{1}{m} \left(= -\frac{1}{4} \right)$</p> <p>Equation of normal: $y - 4 = -\frac{1}{4}(x - 1)$ $(4y = -x + 17)$</p> <p>(b) $(3x - 1)^2 = 9x^2 - 6x + 1$</p> <p>Integrate: $\frac{9x^3}{3} - \frac{6x^2}{2} + x (+C)$</p> <p>Substitute $(1, 4)$ to find $c = \dots$, $c = 3$ $(y = 3x^3 - 3x^2 + x + 3)$</p> <p>(c) Gradient of (tangent to) C is ≥ 0</p> <p>Gradient of given line is < 0 (-2)</p>	<p>B1, M1</p> <p>M1 A1 (4)</p> <p>B1</p> <p>M1 A1ft</p> <p>M1, A1 (5)</p> <p>B1</p> <p>B1 (2)</p> <p>11</p>
	<p>(a) Using gradient of tangent is M0.</p> <p>(b) <u>Alternative:</u></p> <p>$y = \frac{(3x - 1)^3}{9} (+C)$ M1 A1 (numerator) A1 (denominator)</p> <p>Substitute $(1, 4)$ to find $c = \dots$, $c = \frac{28}{9}$ $\left(y = \frac{(3x - 1)^3}{9} + \frac{28}{9} \right)$ M1, A1</p>	

Question number	Scheme	Marks
10.	<p>(a) $x^2 - 6x + 18 = (x - 3)^2 + 9$</p> <p>(b)  "U"-shaped parabola Vertex in correct quadrant P: (0, 18) (or 18 on y-axis) Q: (3, 9)</p> <p>(c) $x^2 - 6x + 18 = 41$ or $(x - 3)^2 + 9 = 41$ Attempt to solve 3 term quadratic $x = \dots$ $x = \frac{6 \pm \sqrt{36 - (4 \times -23)}}{2}$ (or equiv.) $\sqrt{128} = \sqrt{64} \times \sqrt{2}$ (or equiv. surd manipulation) $3 + 4\sqrt{2}$ (Ignore other value)</p>	<p>B1, M1 A1 (3)</p> <p>M1</p> <p>A1ft</p> <p>B1</p> <p>B1ft (4)</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 (5)</p> <p>12</p>
	<p>(a) M1 requires $(x \pm a)^2 \pm b \pm 18$, $a \neq 0$, $b \neq 0$ Answer only: full marks.</p>	