

Mathematics

Advanced Subsidiary GCE 4721

Core Mathematics 1

Mark Scheme for June 2010

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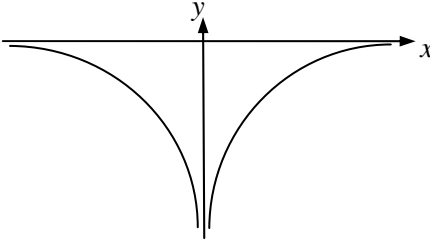
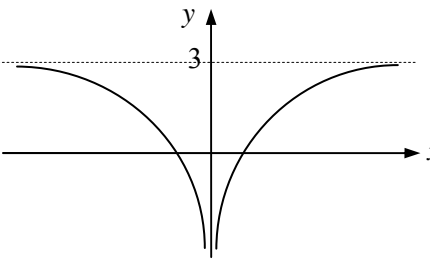
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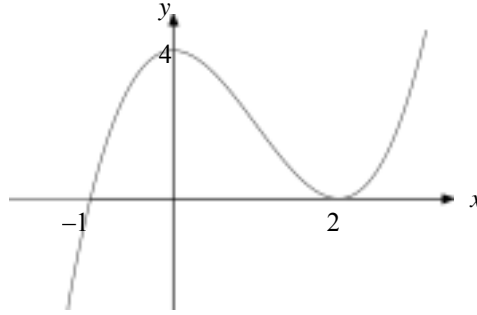
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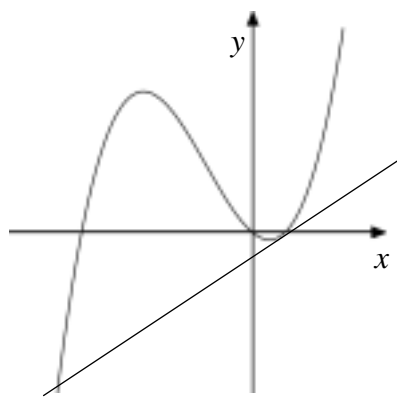
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1 (i)	1	B1	1
(ii)	$\frac{1}{3}$	M1	$\frac{1}{9^2}$ or $\frac{1}{\sqrt{9}}$ soi
		A1	$\frac{2}{3}$ cao
2 (i)		B1*	Reasonably correct curve for $y = -\frac{1}{x^2}$ in 3 rd and 4 th quadrants only
		B1 dep*	2 Very good curves in curve for $y = -\frac{1}{x^2}$ in 3 rd and 4 th quadrants
		SC	If 0, very good single curve in either 3 rd or 4 th quadrant and nothing in other three quadrants. B1
(ii)		M1	Translation of their $y = -\frac{1}{x^2}$ vertically
		A1	2 Reasonably correct curve, horizontal asymptote soi at $y = 3$
(iii)	$y = -\frac{2}{x^2}$	B1	1 $\frac{5}{5}$
3 (i)	$\frac{12(3-\sqrt{5})}{(3+\sqrt{5})(3-\sqrt{5})}$	M1	Multiply numerator and denom by $3-\sqrt{5}$
	$= \frac{12(3-\sqrt{5})}{9-5}$	A1	$(3+\sqrt{5})(3-\sqrt{5}) = 9-5$
	$= 9-3\sqrt{5}$	A1	3
(ii)	$3\sqrt{2}-\sqrt{2}$	M1	Attempt to express $\sqrt{18}$ as $k\sqrt{2}$
	$= 2\sqrt{2}$	A1	$\frac{2}{5}$

<p>4 (i) $(x^2 - 4x + 4)(x + 1)$</p> <p>$= x^3 - 3x^2 + 4$</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>Attempt to multiply a 3 term quadratic by a linear factor or to expand all 3 brackets with an appropriate number of terms (including an x^3 term)</p> <p>Expansion with at most 1 incorrect term</p> <p>3 Correct, simplified answer</p>
<p>(ii)</p> 	<p>B1</p> <p>B1</p> <p>B1</p>	<p>+ve cubic with 2 or 3 roots</p> <p>Intercept of curve labelled (0, 4) or indicated on y-axis</p> <p>3 (-1, 0) and turning point at (2, 0) labelled or indicated on x-axis and no other x intercepts</p> <p>6</p>
<p>5</p> <p>$k = x^2$</p> <p>$4k^2 + 3k - 1 = 0$</p> <p>$(4k - 1)(k + 1) = 0$</p> <p>$k = \frac{1}{4}$ (or $k = -1$)</p> <p>$x = \pm \frac{1}{2}$</p>	<p>M1*</p> <p>M1</p> <p>dep</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Use a substitution to obtain a quadratic or factorise into 2 brackets each containing x^2</p> <p>Correct method to solve a quadratic</p> <p>Attempt to square root to obtain $x = \pm \frac{1}{2}$ and no other values</p> <p>5</p> <p>5</p>
<p>6</p> <p>$y = 2x + 6x^{-\frac{1}{2}}$</p> <p>$\frac{dy}{dx} = 2 - 3x^{-\frac{3}{2}}$</p> <p>When $x = 4$, gradient = $2 - \frac{3}{\sqrt{4^3}}$</p> <p>$= \frac{13}{8}$</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Attempt to differentiate</p> <p>$kx^{-\frac{3}{2}}$</p> <p>Completely correct expression (no +c)</p> <p>Correct evaluation of either $4^{-\frac{3}{2}}$ or $4^{-\frac{1}{2}}$</p> <p>5</p> <p>5</p>
<p>7</p> <p>$2(6 - 2y)^2 + y^2 = 57$</p> <p>$2(36 - 24y + 4y^2) + y^2 = 57$</p> <p>$9y^2 - 48y + 15 = 0$</p> <p>$3y^2 - 16y + 5 = 0$</p> <p>$(3y - 1)(y - 5) = 0$</p> <p>$y = \frac{1}{3}$ or $y = 5$</p> <p>$x = \frac{16}{3}$ or $x = -4$</p>	<p>M1*</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>dep</p> <p>A1</p> <p>A1</p>	<p>substitute for x/y or attempt to get an equation in 1 variable only</p> <p>correct unsimplified expression</p> <p>obtain correct 3 term quadratic</p> <p>correct method to solve 3 term quadratic</p> <p>6 SC If A0 A0, one correct pair of values, spotted or from correct factorisation www</p> <p>B1</p> <p>6</p> <p>6</p>

8 (i) $2\left(x^2 + \frac{5}{2}x\right)$ $= 2\left[\left(x + \frac{5}{4}\right)^2 - \frac{25}{16}\right]$ $= 2\left(x + \frac{5}{4}\right)^2 - \frac{25}{8}$	B1 M1 A1	$\left(x + \frac{5}{4}\right)^2$ $q = -2p^2$ $q = -\frac{25}{8}$ c.w.o.
(ii) $\left(-\frac{5}{4}, -\frac{25}{8}\right)$	B1√ B1√	2
(iii) $x = -\frac{5}{4}$	B1	1
(iv) $x(2x + 5) > 0$ $x < -\frac{5}{2}, x > 0$	M1 A1 M1 A1	Correct method to find roots $0, -\frac{5}{2}$ seen Correct method to solve quadratic inequality. (not wrapped, strict inequalities, no 'and')
9 (i) $\frac{4+p}{2} = -1, \frac{5+q}{2} = 3$ $p = -6$ $q = 1$	M1 A1 A1	Correct method (may be implied by one correct coordinate) 3
(ii) $r^2 = (4 - 1)^2 + (5 - 3)^2$ $r = \sqrt{29}$	M1 A1	Use of $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ for either radius or diameter 2
(iii) $(x+1)^2 + (y-3)^2 = 29$ $x^2 + y^2 + 2x - 6y - 19 = 0$	M1 M1 A1	$(x+1)^2$ and $(y-3)^2$ seen $(x \pm 1)^2 + (y \pm 3)^2 = \text{their } r^2$ Correct equation in correct form
(iv) gradient of radius = $\frac{3-5}{-1-4}$ $= \frac{2}{5}$ gradient of tangent = $-\frac{5}{2}$ $y - 5 = -\frac{5}{2}(x - 4)$ $y = -\frac{5}{2}x + 15$	M1 A1 B1√ M1 A1	uses $\frac{y_2 - y_1}{x_2 - x_1}$ oe oe correct equation of straight line through (4, 5), any non-zero gradient oe 3 term equation e.g. $5x + 2y = 30$

<p>10(i) $\frac{dy}{dx} = 6x^2 + 10x - 4$ $6x^2 + 10x - 4 = 0$ $2(3x^2 + 5x - 2) = 0$ $(3x - 1)(x + 2) = 0$ $x = \frac{1}{3}$ or $x = -2$ $y = -\frac{19}{27}$ or $y = 12$</p>	<p>B1 B1 M1* M1 dep* A1 A1</p>	<p>1 term correct Completely correct (no +c) Sets their $\frac{dy}{dx} = 0$ Correct method to solve quadratic SC If A0 A0, one correct pair of values, spotted or from correct factorisation www B1</p>
<p>(ii) $-2 < x < \frac{1}{3}$</p>	<p>M1 A1</p>	<p>Any inequality (or inequalities) involving both their x values from part (i) Allow \leq and \geq</p>
<p>(iii) When $x = \frac{1}{2}$, $6x^2 + 10x - 4 = \frac{5}{2}$ and $2x^3 + 5x^2 - 4x = -\frac{1}{2}$ $y + \frac{1}{2} = \frac{5}{2}\left(x - \frac{1}{2}\right)$ $10x - 4y - 7 = 0$</p>	<p>M1 B1 M1 A1</p>	<p>Substitute $x = \frac{1}{2}$ into their $\frac{dy}{dx}$ Correct y coordinate Correct equation of straight line using their values. Must use their $\frac{dy}{dx}$ value not e.g. the negative reciprocal Shows rearrangement to given equation CWO throughout for A1</p>
<p>(iv)</p> 	<p>B1 B1</p>	<p>Sketch of a cubic with a tangent which meets it at 2 points only +ve cubic with max/min points and line with +ve gradient as tangent to the curve to the right of the min 14 SC1 B1 Convincing algebra to show that the cubic $8x^3 + 20x^2 - 26x + 7 = 0$ factorises into $(2x - 1)(2x - 1)(x + 7)$ B1 Correct argument to say there are 2 distinct roots SC2 B1 Recognising $y = 2.5x - 7/4$ is tangent from part (iii) B1 As second B1 on main scheme</p>

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