

# Mathematics

Advanced GCE A2 7890 - 2

Advanced Subsidiary GCE AS 3890 - 2

## Mark Schemes for the Units

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**January 2008**

**3890-2/7890-2/MS/R/08J**

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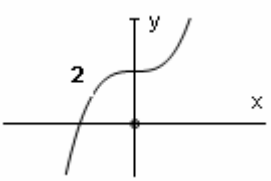
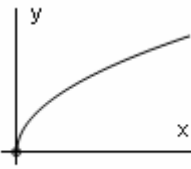
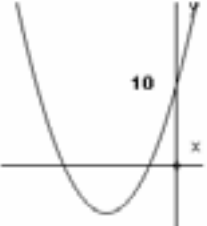
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## 4721 Core Mathematics 1

1	$\frac{4(3+\sqrt{7})}{(3-\sqrt{7})(3+\sqrt{7})}$ $= \frac{12+4\sqrt{7}}{9-7}$ $= 6 + 2\sqrt{7}$	M1 B1 A1 $\frac{3}{3}$	Multiply top and bottom by conjugate 9 ± 7 soi in denominator $6 + 2\sqrt{7}$
2(i)  (ii)	$x^2 + y^2 = 49$ $x^2 + y^2 - 6x - 10y - 30 = 0$ $(x-3)^2 - 9 + (y-5)^2 - 25 - 30 = 0$ $(x-3)^2 + (y-5)^2 = 64$ $r^2 = 64$ $r = 8$	B1 1 M1 A1 $\frac{2}{3}$	$x^2 + y^2 = 49$ $3^2 5^2 30$ with consistent signs soi 8 cao
3	$a(x+3)^2 + c = 3x^2 + bx + 10$ $3(x^2 + 6x + 9) + c = 3x^2 + bx + 10$ $3x^2 + 18x + 27 + c = 3x^2 + bx + 10$ $c = -17$	B1 B1 M1 A1 $\frac{4}{4}$	$a = 3$ soi $b = 18$ soi $c = 10 - 9a$ or $c = 10 - \frac{b^2}{12}$ $c = -17$
4(i)  (ii)          (iii)	$p = -1$ $\sqrt{25k^2} = 15$ $25k^2 = 225$ $k^2 = 9$ $k = \pm 3$ $\sqrt[3]{t} = 2$ $t = 8$	B1 1 M1 A1 A1 3 M1 A1 $\frac{2}{6}$	$p = -1$ Attempt to square 15 or attempt to square root $25k^2$ $k = 3$ $k = -3$ $\frac{1}{t^3} = \frac{1}{2}$ or $t^{\frac{1}{3}} = 2$ soi $t = 8$

5(i)		B1 B1 2	+ve cubic +ve or -ve cubic with point of inflection at (0, 2) and no max/min points
(ii)		B1 B1 2	curve with correct curvature in +ve quadrant only completely correct curve
(iii)	Stretch scale factor 1.5 parallel to y-axis	B1 B1 B1 3 <u>7</u>	stretch factor 1.5 parallel to y-axis or in y-direction
6(i)	<p>EITHER</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-8 \pm \sqrt{64 - 40}}{2}$ $x = \frac{-8 \pm \sqrt{24}}{2}$ $x = \frac{-8 \pm 2\sqrt{6}}{2}$ $x = -4 \pm \sqrt{6}$ <p>OR</p> $(x+4)^2 - 16 + 10 = 0$ $(x+4)^2 = 6$ $x+4 = \pm\sqrt{6} \quad \text{M1 A1}$ $x = \pm\sqrt{6} - 4 \quad \text{A1}$	M1  A1  A1 3	Correct method to solve quadratic  $x = \frac{-8 \pm \sqrt{24}}{2}$  $x = -4 \pm \sqrt{6}$
(ii)		B1 B1 B1 3	+ve parabola parabola cutting y-axis at (0, 10) where (0, 10) is not min/max point parabola with 2 negative roots
(iii)	$x \leq -\sqrt{6} - 4, x \geq \sqrt{6} - 4$	M1 A1 ft 2 <u>8</u>	$x \leq$ lower root $x \geq$ higher root (allow $<, >$ ) Fully correct answer, ft from roots found in (i)

7(i)	Gradient = $-\frac{1}{2}$	B1 1	$-\frac{1}{2}$
(ii)	$y - 5 = -\frac{1}{2}(x - 6)$ $2y - 10 = -x + 6$ $x + 2y - 16 = 0$	M1 B1 ft A1 3	Equation of straight line through (6, 5) with any non-zero numerical gradient Uses gradient found in (i) in their equation of line Correct answer in correct form (integer coefficients)
(iii)	EITHER $\frac{4-x}{2} = x^2 + x + 1$ $4 - x = 2x^2 + 2x + 2$ $2x^2 + 3x - 2 = 0$ $(2x - 1)(x + 2) = 0$ $x = \frac{1}{2}, x = -2$ $y = \frac{7}{4}, y = 3$	*M1  DM1 A1 A1 4	Substitute to find an equation in $x$ (or $y$ )  Correct method to solve quadratic $x = \frac{1}{2}, x = -2$ $y = \frac{7}{4}, y = 3$
	OR $y = (4 - 2y)^2 + (4 - 2y) + 1$ $y = 16 - 16y + 4y^2 + 4 - 2y + 1$ $0 = 21 - 19y + 4y^2$ $0 = (4y - 7)(y - 3)$ $y = \frac{7}{4}, y = 3$ $x = \frac{1}{2}, x = -2$	*M1  DM1 A1 A1	<b>SR</b> one correct (x,y) pair <b>www B1</b>
			<b>8</b>

8(i)	$\frac{dy}{dx} = 3x^2 + 2x - 1$ <p>At stationary points,  <math>3x^2 + 2x - 1 = 0</math>  <math>(3x - 1)(x + 1) = 0</math>  <math>x = \frac{1}{3}, x = -1</math>  <math>y = \frac{76}{27}, y = 4</math></p>	*M1 A1  M1  DM1  A1  A1 6	<p>Attempt to differentiate (at least one correct term)            3 correct terms</p> <p>Use of <math>\frac{dy}{dx} = 0</math></p> <p>Correct method to solve 3 term quadratic</p> <p><math>x = \frac{1}{3}, x = -1</math></p> <p><math>y = \frac{76}{27}, 4</math></p> <p><b>SR</b> one correct (x,y) pair <b>www B1</b></p>
(ii)	$\frac{d^2y}{dx^2} = 6x + 2$ <p><math>x = \frac{1}{3}, \frac{d^2y}{dx^2} &gt; 0</math>  <math>x = -1, \frac{d^2y}{dx^2} &lt; 0</math></p>	M1  A1  A1 3	<p>Looks at sign of <math>\frac{d^2y}{dx^2}</math> for at least one of their  <i>x</i>-values or other correct method</p> <p><math>x = \frac{1}{3}</math>, minimum point CWO</p> <p><math>x = -1</math>, maximum point CWO</p>
(iii)	$-1 < x < \frac{1}{3}$	M1  A1 2	<p>Any inequality (or inequalities) involving both            their <i>x</i> values from part (i)</p> <p>Correct inequality (allow <math>&lt;</math> or <math>\leq</math>)</p>
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9(i)	Gradient of AB = $\frac{-2-1}{-5-3}$ $= \frac{3}{8}$  $y-1 = \frac{3}{8}(x-3)$ $8y-8 = 3x-9$ $3x-8y-1 = 0$	B1  M1  A1 3	$\frac{3}{8}$ oe  Equation of line through either A or B, any non-zero numerical gradient  Correct equation in correct form
(ii)	$\left(\frac{-5+3}{2}, \frac{-2+1}{2}\right)$ $= (-1, -\frac{1}{2})$	M1  A1 2	Uses $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$  $(-1, -\frac{1}{2})$
(iii)	$AC = \sqrt{(-5+3)^2 + (-2-4)^2}$ $= \sqrt{2^2 + 6^2}$ $= \sqrt{40}$ $= 2\sqrt{10}$	M1  A1  A1 3	Uses $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$  $\sqrt{40}$  Correctly simplified surd
(iv)	Gradient of AC = $\frac{-2-4}{-5+3} = 3$  Gradient of BC = $\frac{4-1}{-3-3} = -\frac{1}{2}$  $3 \times -\frac{1}{2} \neq -1$ so lines are not perpendicular	B1  B1  M1  A1 4	3 oe  $-\frac{1}{2}$ oe  Attempts to check $m_1 \times m_2$ Correct conclusion <b>www</b>
<b>12</b>			



10(i)	$24x^2 - 3x^{-4}$  $48x + 12x^{-5}$	B1 B1 B1  M1 A1 5	$24x^2$ $kx^{-4}$ $-3x^{-4}$  Attempt to differentiate their (i) Fully correct
(ii)	$8x^3 + \frac{1}{x^3} = -9$ $8x^6 + 1 = -9x^3$ $8x^6 + 9x^3 + 1 = 0$  Let $y = x^3$ $8y^2 + 9y + 1 = 0$ $(8y + 1)(y + 1) = 0$ $y = -\frac{1}{8}, y = -1$ $x = -\frac{1}{2}, x = -1$	*M1  DM1 A1 M1 A1 5  <b>10</b>	Use a substitution to obtain a 3-term quadratic  Correct method to solve quadratic $-\frac{1}{8}, -1$ Attempt to cube root at least one of their $y$ -values $-\frac{1}{2}, -1$  <b>SR</b> one correct $x$ value <b>www</b> <b>B1</b>  <b>SR for trial and improvement:</b> $x = -1$ B1 $x = -\frac{1}{2}$ B2 Justification that there are no further solutions B2