

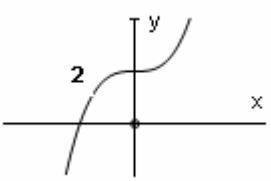
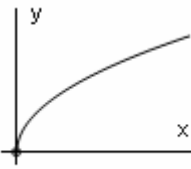
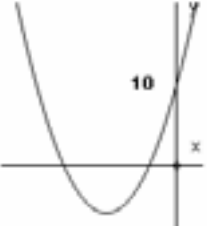
# 4721 Core Mathematics 1

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√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 <sup>2</sup> 5 <sup>2</sup> 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 <sup>2</sup>  $k = 3$ $k = -3$  $\frac{1}{t^{\frac{1}{3}}} = \frac{1}{2}$ or $t^{\frac{1}{3}} = 2$ soi $t = 8$

4721

Mark Scheme

January 2008

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

4721

Mark Scheme

January 2008

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 $\frac{4-x}{2} = x^2 + x + 1$ $4 - x = 2x^2 + 2x + 2$ $2x^2 + 3x - 2 = 0$ $(2x - 1)(x + 2) = 0$ $x = \frac{1}{2}, x = -2$ $y = \frac{7}{4}, y = 3$  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 4  *M1 DM1 A1 A1	Substitute to find an equation in $x$ (or $y$ )  Correct method to solve quadratic $x = \frac{1}{2}, x = -2$ $y = \frac{7}{4}, y = 3$ SR one correct (x,y) pair    www    B1
		8	

4721

Mark Scheme

January 2008

<p>8(i)</p>	$\frac{dy}{dx} = 3x^2 + 2x - 1$ <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>	<p>*M1 A1  M1 DM1 A1 A1 6</p>	<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>  <math>y = \frac{76}{27}, 4</math></p> <p><b>SR</b> one correct (x,y) pair <b>www B1</b></p>
<p>(ii)</p>	$\frac{d^2y}{dx^2} = 6x + 2$ <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>	<p>M1 A1 A1 3</p>	<p>Looks at sign of <math>\frac{d^2y}{dx^2}</math> for at least one of their x-values or other correct method</p> <p><math>x = \frac{1}{3}</math>, minimum point CWO  <math>x = -1</math>, maximum point CWO</p>
<p>(iii)</p>	$-1 < x < \frac{1}{3}$	<p>M1 A1 2</p>	<p>Any inequality (or inequalities) involving both their x values from part (i) Correct inequality (allow <math>&lt;</math> or <math>\leq</math>)</p>
<p><b>11</b></p>			

4721

Mark Scheme

January 2008

<p>9(i)</p>	<p>Gradient of AB = <math>\frac{-2-1}{-5-3}</math>  <math>= \frac{3}{8}</math></p> <p><math>y-1 = \frac{3}{8}(x-3)</math>  <math>8y-8 = 3x-9</math>  <math>3x-8y-1 = 0</math></p>	<p>B1</p> <p>M1</p> <p>A1 3</p>	<p><math>\frac{3}{8}</math> oe</p> <p>Equation of line through either A or B, any non-zero numerical gradient</p> <p>Correct equation in correct form</p>
<p>(ii)</p>	<p><math>\left(\frac{-5+3}{2}, \frac{-2+1}{2}\right)</math>  <math>= (-1, -\frac{1}{2})</math></p>	<p>M1</p> <p>A1 2</p>	<p>Uses <math>\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)</math></p> <p><math>(-1, -\frac{1}{2})</math></p>
<p>(iii)</p>	<p><math>AC = \sqrt{(-5+3)^2 + (-2-4)^2}</math>  <math>= \sqrt{2^2 + 6^2}</math>  <math>= \sqrt{40}</math>  <math>= 2\sqrt{10}</math></p>	<p>M1</p> <p>A1</p> <p>A1 3</p>	<p>Uses <math>\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}</math></p> <p><math>\sqrt{40}</math></p> <p>Correctly simplified surd</p>
<p>(iv)</p>	<p>Gradient of AC = <math>\frac{-2-4}{-5+3} = 3</math></p> <p>Gradient of BC = <math>\frac{4-1}{-3-3} = -\frac{1}{2}</math></p> <p><math>3 \times -\frac{1}{2} \neq -1</math> so lines are not perpendicular</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1 4</p>	<p>3 oe</p> <p><math>-\frac{1}{2}</math> oe</p> <p>Attempts to check <math>m_1 \times m_2</math></p> <p>Correct conclusion <b>www</b></p>
<p><b>12</b></p>			

4721

Mark Scheme

January 2008

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