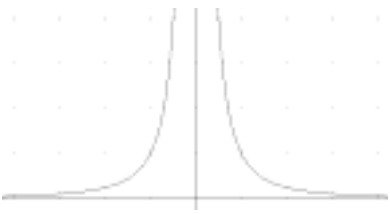
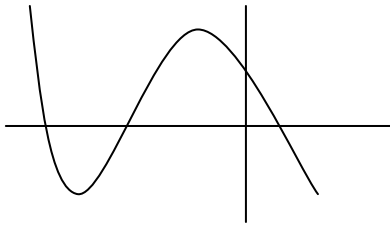


4721 Core Mathematics 1

1	$3\sqrt{5} + \frac{20\sqrt{5}}{5}$ $= 7\sqrt{5}$	B1 M1 A1 $\frac{3}{3}$	$3\sqrt{5}$ soi Attempt to rationalise $\frac{20}{\sqrt{5}}$ cao
2 (i) (ii)	x^2 $\frac{3y^4 \times 1000y^3}{2y^5}$ $= 1500y^2$	B1 1 B1 B1 $\frac{3}{4}$	cao $1000y^3$ soi 1500 y^2
3	<i>Let</i> $y = x^{\frac{1}{3}}$ $3y^2 + y - 2 = 0$ $(3y - 2)(y + 1) = 0$ $y = \frac{2}{3}, y = -1$ $x = \left(\frac{2}{3}\right)^3, x = (-1)^3$ $x = \frac{8}{27}, x = -1$	*M1 DM1 A1 DM1 A1 ft 5 $\frac{5}{5}$	Attempt a substitution to obtain a quadratic or factorise with $\sqrt[3]{x}$ in each bracket Correct method to find roots Both values correct Attempt cube of at least one value Both answers correctly followed through SR If M1* not awarded, B1 $x = -1$ from T & I
4 (i) (ii) (iii)	 $y = \frac{1}{(x+3)^2}$ $(1, 4)$	B1 B1 2 M1 A1 2 B1 B1 $\frac{2}{6}$	Excellent curve in one quadrant or roughly correct curves in correct 2 quadrants Completely correct $\frac{1}{(x+3)^2}$ $y = \frac{1}{(x+3)^2}$ Correct x coordinate Correct y coordinate

<p>5 (i)</p> $\frac{dy}{dx} = -50x^{-6}$ <p>(ii)</p> $y = x^{\frac{1}{4}}$ $\frac{dy}{dx} = \frac{1}{4}x^{-\frac{3}{4}}$ <p>(iii)</p> $y = (x^2 + 3x)(1 - 5x)$ $= 3x - 14x^2 - 5x^3$ $\frac{dy}{dx} = 3 - 28x - 15x^2$	<p>M1</p> <p>A1 2</p> <p>B1</p> <p>B1</p> <p>B1 3</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 4</p> <p style="text-align: center;">9</p>	<p>kx^{-6}</p> <p>Fully correct answer</p> <p>$\sqrt[4]{x} = x^{\frac{1}{4}}$ soi</p> <p>$\frac{1}{4}x^c$</p> <p>$kx^{-\frac{3}{4}}$</p> <p>Attempt to multiply out fully</p> <p>Correct expression (may have 4 terms)</p> <p>Two terms correctly differentiated from their expanded expression</p> <p>Completely correct (3 terms)</p>
<p>6(i)</p> $5(x^2 + 4x) - 8$ $= 5[(x + 2)^2 - 4] - 8$ $= 5(x + 2)^2 - 20 - 8$ $= 5(x + 2)^2 - 28$ <p>(ii)</p> $x = -2$ <p>(iii)</p> $20^2 - 4 \times 5 \times -8$ $= 560$ <p>(iv)</p> <p>2 real roots</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1 4</p> <p>B1 ft 1</p> <p>M1</p> <p>A1 2</p> <p>B1 1</p> <p style="text-align: center;">8</p>	<p>$p = 5$</p> <p>$(x + 2)^2$ seen or $q = 2$</p> <p>$-8 - 5q^2$ or $-\frac{8}{5} - q^2$</p> <p>$r = -28$</p> <p>Uses $b^2 - 4ac$</p> <p>560</p> <p>2 real roots</p>
<p>7(i)</p> $30 + 4k - 10 = 0$ $\therefore k = -5$ <p>(ii)</p> $\sqrt{(10 - 2)^2 + (-5 - 1)^2}$ $= \sqrt{64 + 36}$ $= 10$ <p>(iii)</p> <p>Centre (6, -2)</p> <p>Radius 5</p> <p>(iv)</p> <p>Midpoint of AB = (6, -2)</p> <p>Length of AB = 2 x radius</p> <p>Both A and B lie on circumference</p> <p>Centre lies on line $3x + 4y - 10 = 0$</p>	<p>M1</p> <p>A1 2</p> <p>M1</p> <p>A1 2</p> <p>B1</p> <p>B1 2</p> <p>B1</p> <p>B1 2</p> <p style="text-align: center;">8</p>	<p>Attempt to substitute $x = 10$ into equation of line</p> <p>Correct method to find line length using Pythagoras' theorem</p> <p>cao, dependent on correct value of k in (i)</p> <p>One correct statement of verification</p> <p>Complete verification</p>

<p>8 (i)</p>	$x = \frac{8 \pm \sqrt{(-8)^2 - (4 \times -1 \times 5)}}{-2}$ $= \frac{8 \pm \sqrt{84}}{-2}$ $= -4 - \sqrt{21} \text{ or } = -4 + \sqrt{21}$	<p>M1</p> <p>A1</p> <p>A1 3</p>	<p>Correct method to solve quadratic</p> $x = \frac{8 \pm \sqrt{84}}{-2}$ <p>Both roots correct and simplified</p>
<p>(ii)</p>	$x \leq -4 - \sqrt{21}, x \geq -4 + \sqrt{21}$	<p>M1</p> <p>A1 2</p>	<p>Identifying $x \leq$ their lower root, $x \geq$ their higher root</p> $x \leq -4 - \sqrt{21}, x \geq -4 + \sqrt{21}$ <p>(not wrapped, no 'and')</p>
<p>(iii)</p>		<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1 5</p>	<p>Roughly correct negative cubic with max and min</p> <p>(-4, 0)</p> <p>(0, 20)</p> <p>Cubic with 3 distinct real roots</p> <p>Completely correct graph</p>
10			
<p>9</p>	$\frac{dy}{dx} = 3x^2 + 2px$ <p>When $x = 4$, $\frac{dy}{dx} = 0$</p> $\therefore 3 \times 4^2 + 8p = 0$ $8p = -48$ $p = -6$ $\frac{d^2y}{dx^2} = 6x - 12$ <p>When $x = 4$, $6x - 12 > 0$</p> <p>Minimum point</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 7</p>	<p>Attempt to differentiate</p> <p>Correct expression cao</p> <p>Setting their $\frac{dy}{dx} = 0$</p> <p>Substitution of $x = 4$ into their $\frac{dy}{dx} = 0$ to evaluate p</p> <p>Looks at sign of $\frac{d^2y}{dx^2}$, derived correctly from their $\frac{dy}{dx}$, or other correct method</p> <p>Minimum point CWO</p>
7			

10(i)	$\frac{dy}{dx} = 2x + 1$ $= 5$	M1 A1 2	Attempt to differentiate y cao
(ii)	Gradient of normal = $-\frac{1}{5}$ When $x = 2, y = 6$ $y - 6 = -\frac{1}{5}(x - 2)$ $x + 5y - 32 = 0$	B1 ft B1 M1 A1 4	ft from a non-zero numerical value in (i) May be embedded in equation of line Equation of line, any non-zero gradient, their y coordinate Correct equation in correct form
(iii)	$x^2 + x = kx - 4$ $x^2 + (1 - k)x + 4 = 0$ One solution $\Rightarrow b^2 - 4ac = 0$ $(1 - k)^2 - 4 \times 1 \times 4 = 0$ $(1 - k)^2 = 16$ $1 - k = \pm 4$ $k = -3$ or 5	*M1 DM1 DM1 A1 DM1 A1 6 12	Equating $y_1 = y_2$ Statement that discriminant = 0 Attempt (involving k) to use a, b, c from their equation Correct equation (may be unsimplified) Correct method to find k , dep on 1 st 3Ms Both values correct