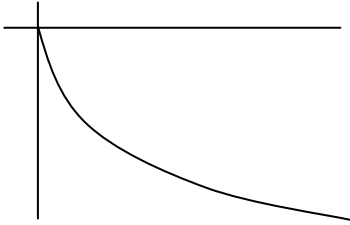
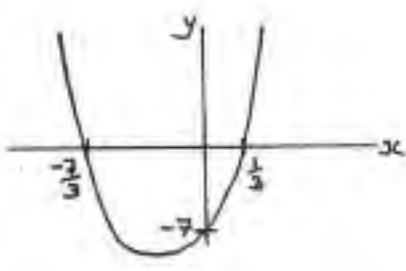


4721 Core Mathematics 1

<p>1 (i)</p> $\frac{dy}{dx} = 5x^4 - 2x^{-3}$ <p>(ii)</p> $\frac{d^2y}{dx^2} = 20x^3 + 6x^{-4}$	<p>B1</p> <p>M1</p> <p>A1 3</p> <p>M1</p> <p>A1 2 5</p>	<p>$5x^4$</p> <p>x^{-2} before differentiation or kx^{-3} in $\frac{dy}{dx}$ soi</p> <p>$-2x^{-3}$</p> <p>Attempt to differentiate their (i) – at least one term correct cao</p>
<p>2</p> $\frac{(8 + \sqrt{7})(2 - \sqrt{7})}{(2 + \sqrt{7})(2 - \sqrt{7})}$ $= \frac{9 - 6\sqrt{7}}{4 - 7}$ $= -3 + 2\sqrt{7}$	<p>M1</p> <p>A1</p> <p>A1</p> <p>A1 4 4</p>	<p>Multiply numerator and denominator by conjugate</p> <p>Numerator correct and simplified Denominator correct and simplified cao</p>
<p>3 (i)</p> 3^{-2} <p>(ii)</p> $3^{\frac{1}{3}}$ <p>(iii)</p> $3^{10} \times 3^{30}$ $= 3^{40}$	<p>B1 1</p> <p>B1 1</p> <p>M1</p> <p>A1 2 4</p>	<p>3^{30} or 9^{20} soi</p>
<p>4</p> $y = 2x - 4$ $4x^2 + (2x - 4)^2 = 10$ $8x^2 - 16x + 16 = 10$ $8x^2 - 16x + 6 = 0$ $4x^2 - 8x + 3 = 0$ $(2x - 1)(2x - 3) = 0$ $x = \frac{1}{2}, x = \frac{3}{2}$ $y = -3, y = -1$	<p>M1*</p> <p>A1</p> <p>M1dep*</p> <p>A1</p> <p>A1</p> <p>A1 6</p> <p>6</p>	<p>Attempt to get an equation in 1 variable only</p> <p>Obtain correct 3 term quadratic (aef)</p> <p>Correct method to solve quadratic of form $ax^2 + bx + c = 0$ ($b \neq 0$) Correct factorisation oe</p> <p>Both x values correct</p> <p>Both y values correct</p> <p>or one correct pair of values B1 second correct pair of values B1</p>

<p>5 (i)</p>	$(2x^2 - 5x - 3)(x + 4)$ $= 2x^3 + 8x^2 - 5x^2 - 20x - 3x - 12$ $= 2x^3 + 3x^2 - 23x - 12$	<p>M1</p> <p>A1</p> <p>A1 3</p>	<p>Attempt to multiply a 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 no more than one incorrect term</p>
<p>(ii)</p>	$2x^4 + 7x^4$ $= 9x^4$ <p>9</p>	<p>B1</p> <p>B1 2</p> <p>5</p>	<p>$2x^4$ or $7x^4$ soi www</p> <p>$9x^4$ or 9</p>
<p>6 (i)</p>		<p>B1</p> <p>B1 2</p> <p>B1</p> <p>B1 2</p> <p>M1</p> <p>A1 2</p> <p>6</p>	<p>One to one graph <u>only</u> in bottom right hand quadrant</p> <p>Correct graph, passing through origin</p> <p>$\sqrt{2x}$ or $\sqrt{\frac{x}{2}}$ seen</p> <p>cao</p>
<p>7 (i)</p>	$\left(x - \frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2 + \frac{1}{4}$ $= \left(x - \frac{5}{2}\right)^2 - 6$	<p>B1</p> <p>M1</p> <p>A1 3</p>	<p>$a = \frac{5}{2}$</p> <p>$\frac{1}{4} - a^2$</p> <p>cao</p>
<p>(ii)</p>	$\left(x - \frac{5}{2}\right)^2 - 6 + y^2 = 0$ <p>Centre $\left(\frac{5}{2}, 0\right)$</p> <p>Radius = $\sqrt{6}$</p>	<p>B1</p> <p>B1</p> <p>B1 3</p> <p>6</p>	<p>Correct x coordinate</p> <p>Correct y coordinate</p>

<p>8 (i)</p> <p>$-42 < 6x < -6$</p> <p>$-7 < x < -1$</p> <p>(ii)</p> <p>$x^2 > 16$</p> <p>$x > 4$</p> <p>or $x < -4$</p>	<p>M1</p> <p>A1</p> <p>A1 3</p> <p>B1</p> <p>B1</p> <p>B1 3</p> <p>6</p>	<p>2 equations or inequalities both dealing with all 3 terms</p> <p>-7 and -1 seen oe</p> <p>$-7 < x < -1$ (or $x > -7$ <u>and</u> $x < -1$)</p> <p>± 4 oe seen</p> <p>$x > 4$</p> <p>$x < -4$ not wrapped, not 'and'</p>
<p>9 (i)</p> <p>$\sqrt{(-1-4)^2 + (9-3)^2}$</p> <p>=13</p> <p>(ii)</p> <p>$\left(\frac{4+1}{2}, \frac{-3+9}{2}\right)$</p> <p>$\left(\frac{3}{2}, 3\right)$</p> <p>(iii)</p> <p>Gradient of $AB = -\frac{12}{5}$</p> <p>$y - 3 = -\frac{12}{5}(x - 1)$</p> <p>$12x + 5y - 27 = 0$</p>	<p>M1</p> <p>A1 2</p> <p>M1</p> <p>A1 2</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1 4</p> <p>8</p>	<p>Correct method to find line length using Pythagoras' theorem</p> <p>cao</p> <p>Correct method to find midpoint</p> <p>Correct equation for line, any gradient, through (1, 3)</p> <p>Correct equation in any form with gradient simplified</p> <p>$12x + 5y - 27 = 0$</p>
<p>10 (i)</p> <p>$(3x + 7)(3x - 1) = 0$</p> <p>$x = -\frac{7}{3}, x = \frac{1}{3}$</p> <p>(ii)</p> <p>$\frac{dy}{dx} = 18x + 18$</p> <p>$18x + 18 = 0$</p> <p>$x = -1$</p> <p>$y = -16$</p> <p>(iii)</p>  <p>(iv)</p> <p>$x > -1$</p>	<p>M1</p> <p>A1</p> <p>A1 3</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>A1 ft 4</p> <p>B1</p> <p>B1</p> <p>B1 3</p> <p>B1 1</p> <p>11</p>	<p>Correct method to find roots</p> <p>Correct factorisation oe</p> <p>Correct roots</p> <p>Attempt to differentiate y</p> <p>Uses $\frac{dy}{dx} = 0$</p> <p>Positive quadratic curve</p> <p>y intercept (0, -7)</p> <p>Good graph, with correct roots indicated and minimum point in correct quadrant</p>

<p>11 (i)</p> <p>Gradient of normal = $-\frac{2}{3}$</p> <p>$\frac{dy}{dx} = \frac{1}{2}kx^{-\frac{1}{2}}$</p> <p>When $x = 4$, $\frac{dy}{dx} = \frac{k}{4}$</p> <p>$\therefore \frac{k}{4} = \frac{3}{2}$</p> <p>$k = 6$</p> <p>(ii)</p> <p>P is point (4, 12)</p> <p>Q is point (22, 0)</p> <p>Area of triangle = $\frac{1}{2} \times 12 \times 22$</p> <p style="text-align: right;">= 132 sq. units</p>	<p>B1</p> <p>M1*</p> <p>A1</p> <p>M1dep*</p> <p>M1dep*</p> <p>A1 6</p> <p>B1 ft</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 5</p> <p style="text-align: right;">11</p>	<p>Attempt to differentiate equation of curve</p> <p>$\frac{1}{2}kx^{-\frac{1}{2}}$</p> <p>Attempt to substitute $x = 4$ into their $\frac{dy}{dx}$ so</p> <p>Equate their gradient expression to negative reciprocal of their gradient of normal</p> <p>cao</p> <p>Correct method to find coordinates of Q</p> <p>Correct x coordinate</p> <p>Must use y coordinate of P and x coordinate of Q</p>
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