

4721 Core Mathematics 1

1 (i)	$n = -2$	B1 1
(ii)	$n = 3$	B1 1
(iii)	$n = \frac{3}{2}$	M1 $\sqrt{4^3}$ or $64^{\frac{1}{2}}$ or $\left(4^{\frac{1}{2}}\right)^3$ or $(4^3)^{\frac{1}{2}}$ or $4 \times \sqrt{4}$ with brackets correct if used A1 2
2 (i)	$y = (x-2)^2$	M1 $y = (x \pm 2)^2$ A1 2
(ii)	$y = -(x^3 - 4)$	B1 oe 1
3 (i)	$\sqrt{2 \times 100} = 10\sqrt{2}$	B1 1
(ii)	$\frac{12}{\sqrt{2}} = \frac{12\sqrt{2}}{2} = 6\sqrt{2}$	B1 1
(iii)	$10\sqrt{2} - 3\sqrt{2} = 7\sqrt{2}$	M1 Attempt to express $5\sqrt{8}$ in terms of $\sqrt{2}$ A1 2
4	$y = x^{\frac{1}{2}}$ $2y^2 - 7y + 3 = 0$ $(2y-1)(y-3) = 0$ $y = \frac{1}{2}, y = 3$ $x = \frac{1}{4}, x = 9$	M1* Use a substitution to obtain a quadratic or factorise into 2 brackets each containing $x^{\frac{1}{2}}$ M1dep Correct method to solve a quadratic A1 M1 Attempt to square to obtain x A1 SR If first M1 not gained and 3 and $\frac{1}{2}$ given as final answers, award B1 5

5

$$\frac{dy}{dx} = 4x^{-\frac{1}{2}} + 1$$

$$= 4\left(\frac{1}{\sqrt{9}}\right) + 1$$

$$\frac{dy}{dx} = \frac{7}{3}$$

M1 Attempt to differentiate

A1 $kx^{-\frac{1}{2}}$

A1

M1 Correct substitution of $x = 9$ into their

A1 $\frac{7}{3}$ only

5

6 (i) $(x-5)(x+2)(x+5)$

$$= (x^2 - 3x - 10)(x+5)$$

$$= x^3 + 2x^2 - 25x - 50$$

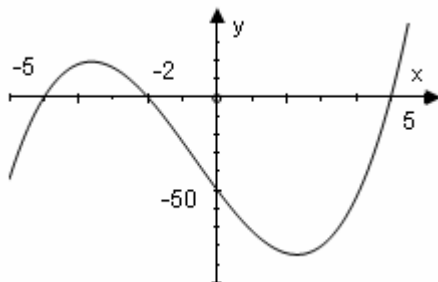
B1 $x^2 - 3x - 10$ or $x^2 + 7x + 10$ or $x^2 - 25$ seen

M1 Attempt to multiply a quadratic by a linear factor

A1

3

(ii)



B1 +ve cubic with 3 roots (not 3 line segments)

B1✓ (0, -50) labelled or indicated on y-axis

B1 (-5, 0), (-2, 0), (5, 0) labelled or indicated on x-axis and no other x- intercepts

3

7 (i) $8 < 3x - 2 < 11$

$$10 < 3x < 13$$

$$\frac{10}{3} < x < \frac{13}{3}$$

M1 2 equations or inequalities both dealing with all 3 terms resulting in $a < kx < b$

A1 10 and 13 seen

A1

3

(ii) $x(x+2) \geq 0$

$$x \geq 0, x \leq -2$$

M1 Correct method to solve a quadratic

A1 0, -2

M1 Correct method to solve inequality

A1

4

8 (i) $\frac{dy}{dx} = 3x^2 - 2kx + 1$

B1 One term correct

B1 Fully correct

2

(ii) $3x^2 - 2kx + 1 = 0$ when $x = 1$

M1 their $\frac{dy}{dx} = 0$ soi

$$3 - 2k + 1 = 0$$

M1 $x = 1$ substituted into their $\frac{dy}{dx} = 0$

$$k = 2$$

A1✓

3

(iii) $\frac{d^2y}{dx^2} = 6x - 4$

M1 Substitutes $x = 1$ into their $\frac{d^2y}{dx^2}$ and looks at sign

When $x = 1$, $\frac{d^2y}{dx^2} > 0 \therefore$ min pt

A1 States minimum **CWO**

2

(iv) $3x^2 - 4x + 1 = 0$

M1 their $\frac{dy}{dx} = 0$

$$(3x - 1)(x - 1) = 0$$

M1 correct method to solve 3-term quadratic

$$x = \frac{1}{3}, x = 1$$

$$x = \frac{1}{3}$$

A1 **WWW** at any stage

3

<p>9 (i)</p> $(x-2)^2 + (y-1)^2 = 100$ $x^2 + y^2 - 4x - 2y - 95 = 0$	<p>B1 $(x-2)^2$ and $(y-1)^2$ seen</p> <p>B1 $(x \pm 2)^2 + (y \pm 1)^2 = 100$</p> <p>B1 correct form</p> <p style="text-align: center;">3</p>
<p>(ii)</p> $(5-2)^2 + (k-1)^2 = 100$ $(k-1)^2 = 91 \quad \text{or} \quad k^2 - 2k - 90 = 0$ $k = 1 + \sqrt{91}$	<p>M1 $x = 5$ substituted into their equation</p> <p>A1 correct, simplified quadratic in k (or y) obtained</p> <p>A1 cao</p> <p style="text-align: center;">3</p>
<p>(iii) distance from $(-3, 9)$ to $(2, 1)$</p> $= \sqrt{(2 - (-3))^2 + (1 - 9)^2}$ $= \sqrt{25 + 64}$ $= \sqrt{89}$ $\sqrt{89} < 10 \quad \text{so point is inside}$	<p>M1 Uses $(x_2 - x_1)^2 + (y_2 - y_1)^2$</p> <p>A1</p> <p>B1 compares their distance with 10 and makes consistent conclusion</p> <p style="text-align: center;">3</p>
<p>(iv) gradient of radius $= \frac{9-1}{8-2}$</p> $= \frac{4}{3}$ <p>gradient of tangent $= -\frac{3}{4}$</p> $y-9 = -\frac{3}{4}(x-8)$ $y-9 = -\frac{3}{4}x + 6$ $y = -\frac{3}{4}x + 15$	<p>M1 uses $\frac{y_2 - y_1}{x_2 - x_1}$</p> <p>A1 oe</p> <p>B1✓ oe</p> <p>M1 correct equation of straight line through $(8, 9)$, any non-zero gradient</p> <p>A1 oe 3 term equation</p> <p style="text-align: center;">5</p>

<p>10 (i) $2(x^2 - 3x) + 11$</p> $= 2 \left[\left(x - \frac{3}{2} \right)^2 - \frac{9}{4} \right] + 11$ $= 2 \left(x - \frac{3}{2} \right)^2 + \frac{13}{2}$	<p>B1 $p = 2$</p> <p>B1 $q = -\frac{3}{2}$</p> <p>M1 $r = 11 - 2q^2$ or $\frac{11}{2} - q^2$</p> <p>A1 $r = \frac{13}{2}$</p> <p style="text-align: center;">4</p>
<p>(ii) $\left(\frac{3}{2}, \frac{13}{2} \right)$</p>	<p>B1√</p> <p>B1√</p> <p style="text-align: center;">2</p>
<p>(iii) $36 - 4 \times 2 \times 11$</p> $= -52$	<p>M1 uses $b^2 - 4ac$</p> <p>A1</p> <p style="text-align: center;">2</p>
<p>(iv) 0 real roots</p>	<p>B1 cao</p> <p style="text-align: center;">1</p>
<p>(v) $2x^2 - 6x + 11 = 14 - 7x$</p> $2x^2 + x - 3 = 0$ $(2x + 3)(x - 1) = 0$ $x = -\frac{3}{2}, x = 1$ $y = \frac{49}{2}, y = 7$	<p>M1* substitute for x/y or attempt to get an equation in 1 variable only</p> <p>A1 obtain correct 3 term quadratic</p> <p>M1dep correct method to solve 3 term quadratic</p> <p>A1</p> <p>A1</p> <p>SR If A0 A0, one correct pair of values, spotted or from correct factorisation www B1</p> <p style="text-align: center;">5</p>