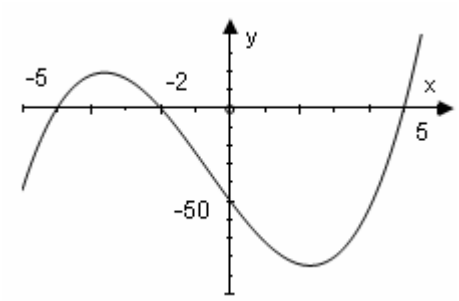
4721 Core Mathematics 1

1	**(i)**	$n = -2$	**B1**	
			1	
	(ii)	$n = 3$	**B1**	
			1	
	(iii)		**M1**	$\sqrt{4^3}$ or $64^{\frac{1}{2}}$ or $\left(4^{\frac{1}{2}}\right)^3$ or $\left(4^3\right)^{\frac{1}{2}}$ or $4\times\sqrt{4}$ with brackets correct if used
		$n = \frac{3}{2}$	**A1**	
			2	
2	**(i)**		**M1**	$y = (x \pm 2)^2$
		$y = (x-2)^2$	**A1**	
			2	
	(ii)	$y = -(x^3 - 4)$	**B1**	oe
			1	
3	**(i)**	$\sqrt{2\times100} = 10\sqrt{2}$	**B1**	
			1	
	(ii)	$\frac{12}{\sqrt{2}} = \frac{12\sqrt{2}}{2} = 6\sqrt{2}$	**B1**	
			1	
	(iii)		**M1**	Attempt to express $5\sqrt{8}$ in terms of $\sqrt{2}$
		$10\sqrt{2} - 3\sqrt{2} = 7\sqrt{2}$	**A1**	
			2	
4		$y = x^{\frac{1}{2}}$		
		$2y^2 - 7y + 3 = 0$	**M1***	Use a substitution to obtain a quadratic or factorise into 2 brackets each containing $x^{\frac{1}{2}}$
		$(2y-1)(y-3) = 0$	**M1dep**	Correct method to solve a quadratic
		$y = \frac{1}{2}, y = 3$	**A1**	
			M1	Attempt to square to obtain x
		$x = \frac{1}{4}, x = 9$	**A1**	
			SR	**If first M1 not gained and 3 and ½ given as final answers, award B1**
			5	

5		**M1**	Attempt to differentiate
		A1	$kx^{-\frac{1}{2}}$
	$\frac{dy}{dx} = 4x^{-\frac{1}{2}} + 1$	**A1**	
	$= 4\left(\frac{1}{\sqrt{9}}\right) + 1$	**M1**	Correct substitution of $x = 9$ into their
$\frac{dy}{dx}$	$= \frac{7}{3}$	**A1**	$\frac{7}{3}$ only
		5	
6 **(i)**	$(x-5)(x+2)(x+5)$	**B1**	$x^2 - 3x - 10$ or $x^2 + 7x + 10$ or $x^2 - 25$ seen
	$= (x^2 - 3x - 10)(x+5)$	**M1**	Attempt to multiply a quadratic by a linear factor
	$= x^3 + 2x^2 - 25x - 50$	**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)**	$8 < 3x - 2 < 11$	**M1**	2 equations or inequalities both dealing with all 3 terms resulting in $a < kx < b$
	$10 < 3x < 13$	**A1**	10 and 13 seen
	$\frac{10}{3} < x < \frac{13}{3}$	**A1**	
		3	
(ii)	$x(x+2) \geq 0$	**M1**	Correct method to solve a quadratic
		A1	0, –2
		M1	Correct method to solve inequality
	$x \geq 0,\ x \leq -2$	**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 $x = 1$, $\frac{d^2y}{dx^2} > 0$ ∴ 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	

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

10 (i)	$2(x^2-3x)+11$	**B1**	$p = 2$
	$=2\left[\left(x-\frac{3}{2}\right)^2-\frac{9}{4}\right]+11$	**B1**	$q = -\frac{3}{2}$
	$=2\left(x-\frac{3}{2}\right)^2+\frac{13}{2}$	**M1**	$r=11-2q^2$ or $\frac{11}{2}-q^2$
		A1	$r=\frac{13}{2}$
		4	
(ii)	$\left(\frac{3}{2},\frac{13}{2}\right)$	**B1√**	
		B1√	
		2	
(iii)	$36-4\times2\times11$	**M1**	uses b^2-4ac
	$= -52$	**A1**	
		2	
(iv)	0 real roots	**B1**	cao
		1	
(v)	$2x^2-6x+11=14-7x$	**M1***	substitute for x/y or attempt to get an equation in 1 variable only
	$2x^2+x-3=0$	**A1**	obtain correct 3 term quadratic
	$(2x+3)(x-1)=0$	**M1dep**	correct method to solve 3 term quadratic
	$x=-\frac{3}{2}, x=1$	**A1**	
	$y=\frac{49}{2}, y=7$	**A1**	
			SR If A0 A0, one correct pair of values, spotted or from correct factorisation **www B1**
		5	