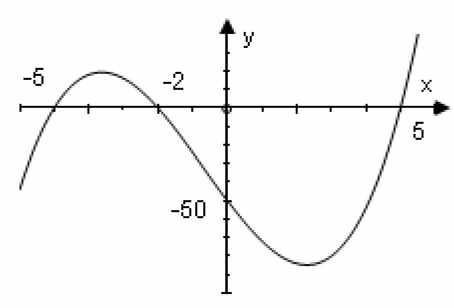
4721 Core Mathematics 1

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 [1]	oe
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
			$\boxed{5}$	
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**	
			$\boxed{3}$	
	(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
			$\boxed{3}$	
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**	
			$\boxed{3}$	
	(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**	
			$\boxed{4}$	

8	**(i)**	$\frac{dy}{dx} = 3x^2 - 2kx + 1$	**B1**	One term correct
			B1	Fully correct
			$\boxed{2}$	
	(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√**	
			$\boxed{3}$	
	(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**
			$\boxed{2}$	
	(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
			$\boxed{3}$	

9	**(i)**		**B1**	$(x-2)^2$ and $(y-1)^2$ seen
		$(x-2)^2+(y-1)^2=100$	**B1**	$(x\pm 2)^2+(y\pm 1)^2=100$
		$x^2+y^2-4x-2y-95=0$	**B1**	correct form
			$\boxed{3}$	
	(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
			$\boxed{3}$	
	(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
			$\boxed{3}$	
	(iv)	gradient of radius $=\dfrac{9-1}{8-2}$	**M1**	uses $\dfrac{y_2-y_1}{x_2-x_1}$
		$=\dfrac{4}{3}$	**A1**	oe
		gradient of tangent $=-\dfrac{3}{4}$	**B1√**	oe
		$y-9=-\dfrac{3}{4}(x-8)$	**M1**	correct equation of straight line through (8, 9), any non-zero gradient
		$y-9=-\dfrac{3}{4}x+6$		
		$y=-\dfrac{3}{4}x+15$	**A1**	oe 3 term equation
			$\boxed{5}$	

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 $r=\frac{13}{2}$
		$\boxed{4}$
(ii)	$\left(\frac{3}{2},\frac{13}{2}\right)$	**B1√**
		B1√
		$\boxed{2}$
(iii)	$36-4\times2\times11$	**M1** uses b^2-4ac
	$=-52$	**A1**
		$\boxed{2}$
(iv)	0 real roots	**B1** cao
		$\boxed{1}$
(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**
		$\boxed{5}$