

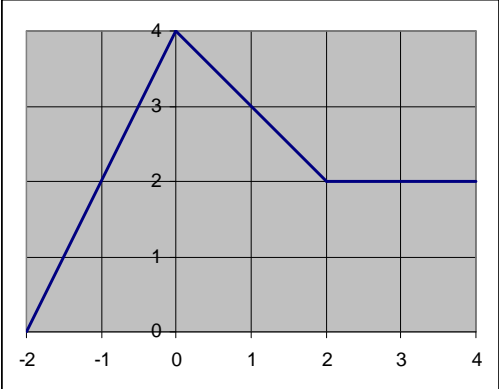
4721

Mark Scheme

January 2010

4721 Core Mathematics 1

1	$[(x-6)^2 - 36] + 1$ $= (x-6)^2 - 35$	B1 $(x-6)^2$ M1 $q = 1 - (\text{their } p)^2$ A1 3 $q = -35$	
		3	

2 (i)		B1 For $x < 0$, straight line joining $(-2, 0)$ and $(0, 4)$ B1 2 For $x > 0$, line joining $(0, 4)$ to $(2, 2)$ and horizontal line joining $(2, 2)$ and $(4, 2)$	
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(ii)	Translation 1 unit right parallel to x axis	B1 B1 2 Allow: 1 unit right, 1 along the x axis, 1 in direction , allow vector notation e.g. $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$, 1 unit horizontally	
		4	

3	$\frac{dy}{dx} = 3x^2 - 8x$	M1 Attempt to differentiate (one of $3x^2, -8x$) A1 Correct derivative	
	When $x = 2$, $\frac{dy}{dx} = -4$	M1 Substitutes $x = 2$ into their $\frac{dy}{dx}$ A1	
	\therefore Gradient of normal to curve = $\frac{1}{4}$	B1 ft Must be numerical $= -1 \div \text{their } m$	
	$y + 1 = \frac{1}{4}(x - 2)$	M1 Correct equation of straight line through $(2, -1)$, any non-zero numerical gradient	
	$x - 4y - 6 = 0$	A1 7 Correct equation in required form	
		7	

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4	(i) $m = 4$	B1	1	May be embedded
	(ii) $6p^2 = 24$ $p^2 = 4$ $p = 2$ or $p = -2$	M1 A1 A1	3	$(\pm)6p^2 = 24$ or $36p^4 = 576$
	(iii) $5^{2n+4} = 25$	M1		Addition of indices as powers of 5
	$\therefore 2n + 4 = 2$ $n = -1$	M1 A1	3 7	Equate powers of 5 or 25
5	$k = \sqrt{x}$ $k^2 - 8k + 13 = 0$	M1*		Use a substitution to obtain a quadratic (may be implied by squaring or rooting later) or factorise into 2 brackets each containing \sqrt{x}
	$k - 4 = \pm\sqrt{3}$ or $k = \frac{8 \pm \sqrt{(-8)^2 - 4 \times 1 \times 13}}{2}$	M1 dep A1		Correct method to solve resulting quadratic
	$k = 4 \pm \sqrt{3}$	A1		$k = 4 \pm \sqrt{3}$ or $k = \frac{8 \pm \sqrt{12}}{2}$ or $k = 4 \pm \frac{\sqrt{12}}{2}$
	$\therefore x = (4 + \sqrt{3})^2$ or $x = (4 - \sqrt{3})^2$	M1 M1		Recognise the need to square to obtain x Correct method for squaring $a + \sqrt{b}$ (3 or 4 term expansion)
	$x = 19 \pm 8\sqrt{3}$ or $19 \pm 4\sqrt{12}$	A1	7 7	
6	(i) $\frac{dy}{dx} = 2x$ When $x = 1$, $\frac{dy}{dx} = 2$	B1* B1 dep	2	
	(ii) $\frac{a^2 + 5 - 6}{a - 1} = 2.3$ $a^2 - 2.3a + 1.3 = 0$ $(a - 1.3)(a - 1) = 0$ $a = 1.3$	M1 A1 M1 A1	4	uses $\frac{y_2 - y_1}{x_2 - x_1}$ correct expression correct method to solve a quadratic or correct factorisation and cancelling to get $a + 1 = 2.3$ 1.3 only

Alternative method:				
Equation of straight line through (1,6) with $m = 2.3$ found then				
$a^2 + 5 = 2.3a + "c"$ seen M1				
with $c = 3.7$ A1				
then as main scheme				
(iii)	A value between 2 and 2.3	B1	$\frac{1}{7}$ $2 < \text{value} < 2.3$ (strict inequality signs)	
7	(i)	(a) Fig 3	B1	
		(b) Fig 1	B1	
		(c) Fig 4	B1 3	
(ii)	$-(x-3)^2$	M1	Quadratic expression with correct x^2 term and correct y-intercept and/or roots for their unmatched diagram (e.g. negative quadratic with y-intercept of -9 or root of 3 for Fig 2)	
	$y = -(x-3)^2$	A1	$\frac{2}{5}$ Completely correct equation for Fig 2	
8	(i)	Centre $(-3, 2)$	B1	
		$(x+3)^2 - 9 + (y-2)^2 - 4 - 4 = 0$	M1	
		$r^2 = 17$		
	$r = \sqrt{17}$	A1	3 Correct radius	
(ii)	$x^2 + (3x+4)^2 + 6x - 4(3x+4) - 4 = 0$	M1*	substitute for x/y or attempt to get an equation in 1 variable only	
		A1	correct unsimplified expression	
			obtain correct 3 term quadratic	
		$10x^2 + 18x - 4 = 0$	A1	correct method to solve their quadratic
		$(5x-1)(x+2) = 0$	M1	
	$x = \frac{1}{5}$ or $x = -2$	dep		
	$y = \frac{23}{5}$ or $y = -2$	A1	SR If A0 A0, one correct pair of values, spotted or from correct factorisation www B1	
			$\frac{6}{9}$	
9	(i)	$f'(x) = -x^{-2} - \frac{1}{2}x^{-\frac{1}{2}}$	M1	
			A1	
			A1 3 Fully correct expression	

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	(ii)	$f''(x) = 2x^{-3} + \frac{1}{4}x^{-\frac{3}{2}}$	M1	Attempt to differentiate their $f'(x)$
			A1 ft	One correctly differentiated term
			A1	Fully correct expression www in either part of the question
10	(i)	$f''(4) = \frac{2}{4^3} + \frac{1}{4} \cdot \frac{1}{8}$	M1	Substitution of $x = 4$ into their $f''(x)$
		$= \frac{1}{16}$	A1	oe single fraction www in either part of the question
			5 8	
10	(i)	$(-30)^2 - 4 \times k \times 25k = 0$	M1	Attempts $b^2 - 4ac$ involving k
		$900 - 100k^2 = 0$	M1	States their discriminant = 0
		$k = 3$ or $k = -3$	B1 B1	4 4
11	(i)	$P = 2 + x + 3x + 2 + 5x + 5x$ $= 14x + 4$	M1	Adds lengths of all 4 edges with attempt to use Pythagoras to find the missing length
			A1	2 May be left unsimplified
11	(ii)	Area of rectangle = $3x(2 + x) = 6x + 3x^2$	M1	Correct method – splitting or formula for area of trapezium
		Area of triangle = $\frac{1}{2}(3x)(4x) = 6x^2$		
		Total area = $9x^2 + 6x$	A1	2 Convincing working leading to given expression AG
11	(iii)	$14x + 4 \geq 39$	B1 ft	ft on their expression for P from (i) unless restarted in (iii). (Allow $>$)
		$\frac{5}{2}$	B1	o.e. (e.g. $\frac{35}{14}$) soi by subsequent working
		$9x^2 + 6x < 99$	B1	
		$3x^2 + 2x - 33 < 0$		Allow \leq
		$(3x + 11)(x - 3) < 0$	M1	
		$\left(-\frac{11}{3} < \right)x < 3$	B1	Correct method to find critical values
				$x < 3$ identified
		M1	root from linear $< x <$ upper root from quadratic	
		A1	7 11 Fully correct including inequality signs or exact equivalent in words cwo	
Total			72	