GCE

Mathematics

Advanced GCE **A2 7890 - 2**

Advanced Subsidiary GCE **AS 3890 - 2**

Mark Schemes for the Units
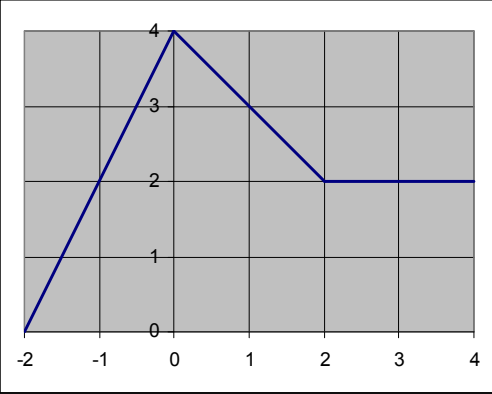
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MARK SCHEMES FOR THE UNITS

4721 Core Mathematics 1

1	$\left[(x-6)^2 - 36\right] + 1$	**B1**		$(x-6)^2$
	$= (x-6)^2 - 35$	**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 $(4,2)$

	(ii)	Translation	**B1**		
		1 unit right parallel to x axis	**B1**	2	Allow: 1 unit right, 1 along the x axis, 1 in x **direction**, allow vector notation e.g. $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$, 1 unit horizontally
				4	

3	$\dfrac{dy}{dx} = 3x^2 - 8x$	**M1**		Attempt to differentiate (one of $3x^2$, $-8x$)
		A1		Correct derivative
	When $x = 2$, $\dfrac{dy}{dx} = -4$	**M1**		Substitutes $x = 2$ into their $\dfrac{dy}{dx}$
		A1		
	$\therefore$ Gradient of normal to curve $= \dfrac{1}{4}$	**B1 ft**		Must be numerical $= -1 \div \text{their } m$
	$y + 1 = \dfrac{1}{4}(x - 2)$	**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	

4	(i)	$m = 4$	**B1**	1	May be embedded
	(ii)	$6p^2 = 24$	**M1**		$(\pm)6p^2 = 24$ or $36p^4 = 576$
		$p^2 = 4$			
		$p = 2$	**A1**		
		or $p = -2$	**A1**	3	
	(iii)	$5^{2n+4} = 25$	**M1**		Addition of indices as powers of 5
		$\therefore 2n + 4 = 2$	**M1**	3	Equate powers of 5 or 25
		$n = -1$	**A1**	7	

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 $k = \dfrac{8 \pm \sqrt{(-8)^2 - 4 \times 1 \times 13}}{2}$	**M1** **dep** **A1**		Correct method to solve resulting quadratic
		$k = 4 \pm \sqrt{3}$	**A1**		$k = 4 \pm \sqrt{3}$ or $k = \dfrac{8 \pm \sqrt{12}}{2}$ or $k = 4 \pm \dfrac{\sqrt{12}}{2}$
		$\therefore x = (4 + \sqrt{3})^2$ or $x = (4 - \sqrt{3})^2$	**M1**		Recognise the need to square to obtain x
			M1		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)	$\dfrac{dy}{dx} = 2x$	**B1***		
		When $x = 1$, $\dfrac{dy}{dx} = 2$	**B1** **dep**	2	
	(ii)	$\dfrac{a^2 + 5 - 6}{a - 1} = 2.3$	**M1**		uses $\dfrac{y_2 - y_1}{x_2 - x_1}$
			A1		correct expression
		$a^2 - 2.3a + 1.3 = 0$	**M1**		correct method to solve a quadratic or correct factorisation and cancelling to get $a + 1 = 2.3$
		$(a - 1.3)(a - 1) = 0$			
		$a = 1.3$	**A1**	4	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**	1 7	$2 <$ value < 2.3 (strict inequality signs)
7	**(i)**	(a) Fig 3 (b) Fig 1 (c) Fig 4	**B1** **B1** **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**	2 5	Completely correct equation for **Fig 2**
8	**(i)**	Centre $(-3, 2)$ $(x+3)^2 - 9 + (y-2)^2 - 4 - 4 = 0$ $r^2 = 17$ $r = \sqrt{17}$	**B1** **M1** **A1**	 3	Correct method to find r^2 Correct radius
	(ii)	$x^2 + (3x+4)^2 + 6x - 4(3x+4) - 4 = 0$ $10x^2 + 18x - 4 = 0$ $(5x-1)(x+2) = 0$ $x = \dfrac{1}{5}$ or $x = -2$ $y = \dfrac{23}{5}$ or $y = -2$	**M1*** **A1** **A1** **M1** **dep** **A1** **A1**	 6 9	substitute for x/y or attempt to get an equation in 1 variable only correct unsimplified expression obtain correct 3 term quadratic correct method to solve their quadratic **SR** If A0 A0, one correct pair of values, spotted or from correct factorisation **www** **B1**
9	**(i)**	$f'(x) = -x^{-2} - \dfrac{1}{2}x^{-\frac{1}{2}}$	**M1** **A1** **A1**	 3	Attempt to differentiate $-x^{-2}$ or $-\dfrac{1}{2}kx^{-\frac{1}{2}}$ **www** Fully correct expression

(ii)	$f''(x) = 2x^{-3} + \dfrac{1}{4}x^{-\frac{3}{2}}$		**M1**		Attempt to differentiate their $f'(x)$
			A1 ft		One correctly differentiated term
			A1		Fully correct expression **www** in either part of the question
	$f''(4) = \dfrac{2}{4^3} + \dfrac{1}{4} \cdot \dfrac{1}{8}$		**M1**		Substitution of $x = 4$ into their $f''(x)$
	$= \dfrac{1}{16}$		**A1**	**5** **8**	oe single fraction **www** in either part of the question

10	$(-30)^2 - 4 \times k \times 25k = 0$		**M1**		Attempts $b^2 - 4ac$ involving k
	$900 - 100k^2 = 0$		**M1**		States their discriminant = 0
	$k = 3$		**B1**	**4**	
	or $k = -3$		**B1**	**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
	(ii)	Area of rectangle $= 3x(2 + x) = 6x + 3x^2$	**M1**		Correct method – splitting or formula for area of trapezium
		Area of triangle $= \dfrac{1}{2}(3x)(4x) = 6x^2$			
		Total area $= 9x^2 + 6x$	**A1**	**2**	Convincing working leading to given expression **AG**
	(iii)	$14x + 4 \geq 39$	**B1 ft**		ft on their expression for P from (i) unless restarted in (iii). (Allow >)
		$\dfrac{5}{2}$	**B1**		o.e. (e.g. $\dfrac{35}{14}$) soi by subsequent working
		$9x^2 + 6x < 99$	**B1**		
		$3x^2 + 2x - 33 < 0$			Allow $\leq$
		$(3x + 11)(x - 3) < 0$	**M1**		
		$\left(-\dfrac{11}{3} < \right)x < 3$			Correct method to find critical values
			B1		$x < 3$ identified
			M1		root from linear $< x <$ upper root from quadratic
		$\therefore \dfrac{5}{2} \leq x < 3$	**A1**	**7** **11**	Fully correct including inequality signs or exact equivalent in words **cwo**

	Total	**72**	