

Mathematics

Advanced GCE A2 7890 - 2

Advanced Subsidiary GCE AS 3890 - 2

Mark Schemes for the Units

January 2010

3890-2/7890-2/MS/10J

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2010

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

CONTENTS

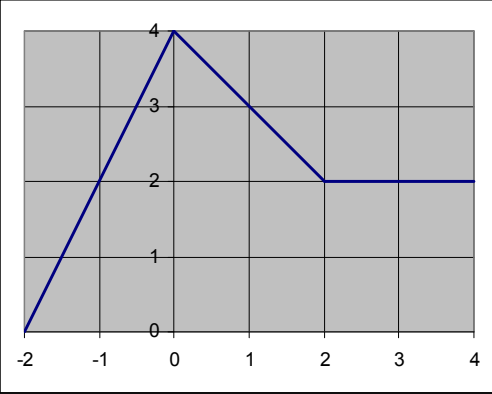
Advanced GCE Mathematics (7890)
Advanced GCE Pure Mathematics (7891)
Advanced GCE Further Mathematics (7892)

Advanced Subsidiary GCE Mathematics (3890)
Advanced Subsidiary GCE Pure Mathematics (3891)
Advanced Subsidiary GCE Further Mathematics (3892)

MARK SCHEMES FOR THE UNITS

Unit/Content	Page
4721 Core Mathematics 1	1
4722 Core Mathematics 2	5
4723 Core Mathematics 3	9
4724 Core Mathematics 4	13
4725 Further Pure Mathematics 1	17
4726 Further Pure Mathematics 2	21
4727 Further Pure Mathematics 3	24
4728 Mechanics 1	28
4729 Mechanics 2	31
4730 Mechanics 3	34
4732 Probability & Statistics 1	37
4733 Probability & Statistics 2	40
4734 Probability & Statistics 3	43
4736 Decision Mathematics 1	46
4737 Decision Mathematics 2	52
Grade Thresholds	58

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	$q = -35$
			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 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	Correct equation in required form
			7

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	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	
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 1 7 $2 < \text{value} < 2.3$ (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 Correct method to find r^2 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
		$10x^2 + 18x - 4 = 0$ $(5x-1)(x+2) = 0$ $x = \frac{1}{5}$ or $x = -2$	A1 obtain correct 3 term quadratic M1 correct method to solve their quadratic 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
			9
9	(i)	$f'(x) = -x^{-2} - \frac{1}{2}x^{-\frac{1}{2}}$	M1 Attempt to differentiate
			A1 $-x^{-2}$ or $-\frac{1}{2}kx^{-\frac{1}{2}}$ www
			A1 3 Fully correct expression

(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
	$f''(4) = \frac{2}{4^3} + \frac{1}{4} \cdot \frac{1}{8}$ $= \frac{1}{16}$	M1	Substitution of $x = 4$ into their $f''(x)$
		A1	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	
	or $k = -3$	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
	(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
	(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	
	$3x^2 + 2x - 33 < 0$		
	$(3x + 11)(x - 3) < 0$	M1	Allow \leq
	$\left(-\frac{11}{3} < \right)x < 3$		Correct method to find critical values
		B1	$x < 3$ identified
		M1	root from linear $< x <$ upper root from quadratic
	$\therefore \frac{5}{2} \leq x < 3$	A1	7
		11	Fully correct including inequality signs or exact equivalent in words cwo
Total			72