OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics

Advanced GCE **A2 7890 - 2**

Advanced Subsidiary GCE **AS 3890 - 2**

Mark Schemes for the Units

January 2009

3890-2/7890-2/MS/R/09

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, GCSEs, OCR Nationals, 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 syllabuses 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.

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

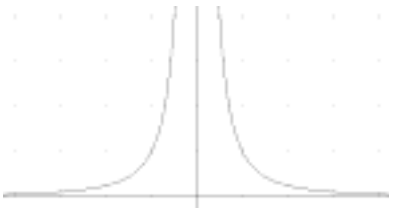
CONTENTS

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

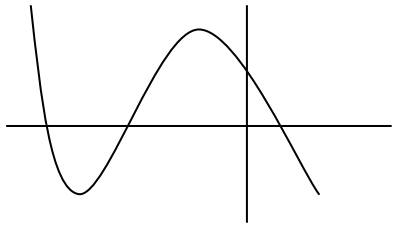
Advanced Subsidiary GCE Mathematics (3890)
Advanced Subsidiary GCE Pure Mathematics (3891)
Advanced Subsidiary GCE Further Mathematics (3892)

MARK SCHEMES FOR THE UNITS

4721 Core Mathematics 1

1	$3\sqrt{5}+\frac{20\sqrt{5}}{5}$ $=7\sqrt{5}$	B1 M1 A1 3 3	$3\sqrt{5}$ soi Attempt to rationalise $\frac{20}{\sqrt{5}}$ cao
2 (i)	x^2	B1 1	cao
(ii)	$\frac{3y^4\times1000y^3}{2y^5}$ $=1500y^2$	B1 B1 B1 3 4	$1000y^3$ soi 1500 y^2
3	*Let* $y=x^{\frac{1}{3}}$ $3y^2+y-2=0$ $(3y-2)(y+1)=0$ $y=\frac{2}{3},y=-1$ $x=\left(\frac{2}{3}\right)^3,x=(-1)^3$ $x=\frac{8}{27},x=-1$	*M1 DM1 A1 DM1 A1 ft 5 5	Attempt a substitution to obtain a quadratic or factorise with $\sqrt[3]{x}$ in each bracket Correct method to find roots Both values correct Attempt cube of at least one value Both answers correctly followed through **SR** If M1* not awarded, **B1** x = -1 from T & I
4 (i)		B1 B1 2	Excellent curve in one quadrant or roughly correct curves in correct 2 quadrants Completely correct
(ii)	$y=\frac{1}{(x+3)^2}$	M1 A1 2	$\frac{1}{(x\pm3)^2}$ $y=\frac{1}{(x+3)^2}$
(iii)	*(1, 4)*	B1 B1 2 6	Correct x coordinate Correct y coordinate

5 (i)	$\frac{dy}{dx} = -50x^{-6}$	M1 A1 2	kx^{-6} Fully correct answer
(ii)	$y = x^{\frac{1}{4}}$ $\frac{dy}{dx} = \frac{1}{4}x^{-\frac{3}{4}}$	B1 B1 B1 3	$\sqrt[4]{x} = x^{\frac{1}{4}}$ soi $\frac{1}{4}x^c$ $kx^{-\frac{3}{4}}$
(iii)	$y = (x^2 + 3x)(1 - 5x)$ $= 3x - 14x^2 - 5x^3$ $\frac{dy}{dx} = 3 - 28x - 15x^2$	M1 A1 M1 A1 4 **9**	Attempt to multiply out fully Correct expression (may have 4 terms) Two terms correctly differentiated from their expanded expression Completely correct (3 terms)
6(i)	$5(x^2 + 4x) - 8$ $= 5\left[(x+2)^2 - 4\right] - 8$ $= 5(x+2)^2 - 20 - 8$ $= 5(x+2)^2 - 28$	B1 B1 M1 A1 4	$p = 5$ $(x+2)^2$ seen or $q = 2$ $-8 - 5q^2$ or $-\frac{8}{5} - q^2$ $r = -28$
(ii)	$x = -2$	B1 ft 1	
(iii)	$20^2 - 4 \times 5 \times -8$ $= 560$	M1 A1 2	Uses $b^2 - 4ac$ 560
(iv)	2 real roots	B1 1 **8**	2 real roots
7(i)	$30 + 4k - 10 = 0$ $\therefore k = -5$	M1 A1 2	Attempt to substitute x = 10 into equation of line
(ii)	$\sqrt{(10-2)^2 + (-5-1)^2}$ $= \sqrt{64 + 36}$ $= 10$	M1 A1 2	Correct method to find line length using Pythagoras' theorem cao, dependent on correct value of k in (i)
(iii)	Centre (6, -2) Radius 5	B1 B1 2	
(iv)	Midpoint of AB = (6, -2) Length of AB = 2 x radius Both A and B lie on circumference Centre lies on line 3x + 4y – 10 = 0	B1 B1 2 **8**	One correct statement of verification Complete verification

8 (i)	$x = \dfrac{8 \pm \sqrt{(-8)^2 - (4 \times -1 \times 5)}}{-2}$	M1	Correct method to solve quadratic
	$= \dfrac{8 \pm \sqrt{84}}{-2}$	A1	$x = \dfrac{8 \pm \sqrt{84}}{-2}$
	$= -4 - \sqrt{21}$ or $= -4 + \sqrt{21}$	A1 3	Both roots correct and simplified
(ii)	$x \leq -4 - \sqrt{21}$, $x \geq -4 + \sqrt{21}$	M1	Identifying $x \leq$ their lower root, $x \geq$ their higher root
		A1 2	$x \leq -4 - \sqrt{21}$, $x \geq -4 + \sqrt{21}$ (not wrapped, no 'and')
(iii)		B1	Roughly correct negative cubic with max and min
		B1	(-4, 0)
		B1	(0, 20)
		B1	Cubic with 3 distinct real roots
		B1 5	Completely correct graph
		10	
9	$\dfrac{dy}{dx} = 3x^2 + 2px$	M1	Attempt to differentiate
		A1	Correct expression cao
	When $x = 4$, $\dfrac{dy}{dx} = 0$	M1	Setting their $\dfrac{dy}{dx} = 0$
	$\therefore 3 \times 4^2 + 8p = 0$	M1	Substitution of $x = 4$ into their $\frac{dy}{dx} = 0$ to evaluate p
	$8p = -48$		
	$p = -6$	A1	
	$\dfrac{d^2y}{dx^2} = 6x - 12$	M1	Looks at sign of $\dfrac{d^2y}{dx^2}$, derived correctly from their $\dfrac{dy}{dx}$, or other correct method
	When $x = 4$, $6x - 12 > 0$		
	Minimum point	A1 7	Minimum point CWO
		7	

10(i)	$\frac{dy}{dx} = 2x + 1$ $= 5$	M1 A1 2	Attempt to differentiate *y* cao
(ii)	Gradient of normal = $-\frac{1}{5}$ When $x = 2$, $y = 6$ $y - 6 = -\frac{1}{5}(x - 2)$ $x + 5y - 32 = 0$	B1 ft B1 M1 A1 4	ft from a non-zero numerical value in (i) May be embedded in equation of line Equation of line, any non-zero gradient, their *y* coordinate Correct equation in correct form
(iii)	$x^2 + x = kx - 4$ $x^2 + (1 - k)x + 4 = 0$ One solution => $b^2 - 4ac = 0$ $(1 - k)^2 - 4 \times 1 \times 4 = 0$ $(1 - k)^2 = 16$ $1 - k = \pm 4$ k = -3 or 5	*M1 DM1 DM1 A1 DM1 A1 6	Equating $y_1 = y_2$ Statement that discriminant = 0 Attempt (involving *k*) to use a, b, c from their equation Correct equation (may be unsimplified) Correct method to find *k*, dep on 1st 3Ms Both values correct
		12	