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EDEXCEL

GENERAL CERTIFICATE OF EDUCATION

Advanced Subsidiary/Advanced Level

Core Mathematics C2

MARKING SCHEME

January 2005

Principal Examiner:

Mr. G Attwood
4 The Pastures
Repton
Derbyshire
DE65 6GG

Tel.: 01283 702804

Marking should be completed by **16 Feburary 2005.**

General Instructions

1. The total number of marks for the paper is 75.

2. Method (M) marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.

3. Accuracy (A) marks can only be awarded if the relevant method (M) marks have been earned.

4. (B) marks are independent of method marks.

5. Method marks should not be subdivided.

6. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected. Indicate this action by 'MR' in the body of the script (but see also note 10).

7. If a candidate makes more than one attempt at any question:

   (a) If all but one attempt is crossed out, mark the attempt which is NOT crossed out.

   (b) If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

8. Marks for each question, or part of a question, must appear in the right-hand margin and, in addition, total marks for each question, even where zero, must be ringed and appear in the right-hand margin and on the grid on the front of the answer book. It is important that a check is made to ensure that the totals in the right-hand margin of the ringed marks and of the unringed marks are equal. The total mark for the paper must be put on the top right-hand corner of the front cover of the answer book.

9. For methods of solution not in the mark scheme, allocate the available M and A marks in as closely equivalent a way as possible, and indicate this by the letters 'OS' (outside scheme) put alongside in the body of the script.

10. All A marks are 'correct answer only' (c.a.o.) unless shown, for example, as A1 f.t. to indicate that previous wrong working is to be followed through. In the body of the script the symbol $\sqrt{}$ should be used for correct f.t. and $\cancel{\sqrt{}}$ for incorrect f.t. After a misread, however, the subsequent A marks affected are treated as A f.t., but manifestly absurd answers should never be awarded A marks.

11. Ignore wrong working or incorrect statements following a correct answer.

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Mark Scheme

Question Number	Scheme	Marks
1.	$(3+2x)^5 = (3^5) + \binom{5}{1}3^4 \cdot (2x) + \binom{5}{2}3^3(2x)^2 + \cdots$ $= \underline{\underline{243, +810x, +1080x^2}}$	M1 B1, A1, A1 (4)
	M1: Use of binomial leading to correct expression for x <u>or</u> x^2 term. $\binom{n}{r}$ is ok can be implied.	

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Question Number	Scheme	Marks
2.	(a) $(\frac{5+13}{2}, \frac{-1+11}{2}), = \underline{\underline{(9,5)}}$	M1, A1 (2)
	(b) $r^2 = (9-5)^2 + (5--1)^2 (= 52)$	M1
	Equation of circle: $(x-9)^2 + (y-5)^2 = 52$	M1, A1$\sqrt{}$A1 (4)
		(6)
	(a) M1 for some use of correct formula. can be implied Use of $(\frac{1}{2}(x_A - x_B), \frac{1}{2}(y_A - y_B)) \to (4,6)$ is M0A0 (b) M1 attempt to find r or r^2. $\sqrt{}$ their (9,5) $r = AB = \sqrt{208}$ is M0 2nd M1 for $(x-9)^2 + (y-5)^2 =$ constant. ($\sqrt{}$ their (9,5) A1$\sqrt{}$ for $(x-9)^2 + (y-5)^2 =$ their r^2.($\sqrt{}$their (9,5) and r^2) A1 for $(x-9)^2 + (y-5)^2 = 52$ only.	

Question Number	Scheme	Marks
3.	(a) $\log 3^x = \log 5$ $x = \frac{\log 5}{\log 3}$ $= 1.46$ (b) $\log_2 (\frac{2x+1}{x}) = 2$ $\frac{2x+1}{x} = 2^2$ or 4 $2x + 1 = 4x$ $x = \frac{1}{2}$ or 0.5	M1 A1 A1 cao (3) M1 M1 M1 A1 (4) (7)
	(a) M1 a correct attempt to take logs A1 an exact expression for x that can be evaluated on a calculator e.g. $x = \log_3 5$ scores M1 A0 (b) 1st M1 for use of $\log a (\pm) \log b$ rule 2nd M1 for getting out of logs 3rd M1 forming and solving a linear equation $\to x = \alpha$ A1 $\alpha = \frac{1}{2}$ or 0.5	

Question Number	Scheme	Marks
4.	(a) $5(1-\sin^2 x) = 3(1+\sin x)$	M1
	$5 - 5\sin^2 x = 3 + 3\sin x$	
	$\underline{\underline{0 = 5\sin^2 x + 3\sin x - 2}}$ *	A1 cso (2)
	(b) $0 = (5\sin x - 2)(\sin x + 1)$	M1
	$\sin x = \frac{2}{5}$, -1 (both)	A1
	$\sin x = \frac{2}{5} \Rightarrow x = \underline{\underline{23.6}}$ ($\alpha = 23.6$ or 156.4)	B1
	, $\underline{\underline{156.4}}$ (180- α)	M1
	$\sin x = -1 \Rightarrow x = \underline{\underline{270}}$	B1 (5)
		(7)
	(a) M1 for use of $\cos^2 x = 1 - \sin^2 x$. Condone missing ( ) (b) 1st M1 for attempt to solve $\rightarrow \sin x =$ 1st B1 for correct solution, α to $\sin x = \frac{2}{5}$. Must be 1 d.p. 2nd M1 for 180-α , accept nearest degree or awrt. Answer only in (b) scores M0A0 but then could score B1M1B1 Incorrect factorisation probably only gets $\frac{2}{5}$.	

Question Number	Scheme	Marks
5.	(a) $f(2)=1 \Rightarrow 8-2\times 4+2a+b=1$	M1 A1
	$f(-1)=28 \Rightarrow -1-2-a+b=28$	M1 A1
	solving $\left.\begin{cases} 2a+b=1 \\ -a+b=31 \end{cases}\right\} \Rightarrow \underline{a=-10, b=21}$	M1 A1 (6)
	(b) $f(3)=27-18+3a+b$	M1
	$=27-18-30+21=0$ $\quad\quad\therefore (x-3)$ is a factor	A1 c.s.o (2)
		(8)
	(a) 1st two M marks attempting $f(\pm 2)$ and $f(\pm 1)$ A1 A1 for each correct, unsimplified equation 3rd M1 for solving two linear equations $\rightarrow a=$ or b= A1 both values (b) M1 Attempting $f(3)$ A1 $=0$ with comment	

Question Number	Scheme	Marks
6.	(a) $ar = 7.2, ar^3 = 5.832 \Rightarrow\ r^2 = \frac{5.832}{7.2} (= 0.81)$ $r = 0.9$	M1 A1 (2)
	(b) $a = \frac{7.2}{(a)}, = \underline{\underline{8}}$	M1, A1 (2)
	(c) $s_{50} = \frac{8(1-(0.9)^{50})}{1-0.9}$	M1
	$= \underline{\underline{79.588}}$ (3dp)	A1 c.a.o (2)
	(d) $s_\infty = \frac{8}{1-0.9} (= 80)$ $s_\infty - s_{50} = 80 - (c) = 0.412$ (Awrt 3 dp)	M1 A1 $\sqrt{}$ (2) (8)
	(a) M1 for full method $\rightarrow r^2$ or r N.B. $ar^2 = 7.2, ar^4 = 5.832 \rightarrow r = 0.9$ scores M1A1 in part (a) but probably M0A0 in (b). (c) M1$\sqrt{}$ their "a", "r" in s_{50} formula (d) M1$\sqrt{}$ their "a", "r" in s_∞ A1$\sqrt{}$ for 80 – their (c) i.e.$\sqrt{}$ their (c) only	

Question Number	Scheme	Marks
7.	(a) $r\theta = 8 \times 0.7, = 5.6(cm)$	M1, A1
		(2)
	(b) $BC^2 = 8^2 + 11^2 - 2\times 8 \times 11 \times \cos 0.7$	M1
	$\Rightarrow$ $BC = 7.098$ or 7.10 (Awrt) or $\sqrt{(50.4)}$ or better	A1
	Perimeter = $(a) + (11-8) + BC, = 15.7(cm)$	M1, A1cao
		(4)
	(c) $\Delta = \frac{1}{2}ab\sin c =, \frac{1}{2}\times 11 \times 8 \times \sin 0.7$	M1, A1
	Sector $= \frac{1}{2}r^2\theta =, \frac{1}{2}\times 8^2 \times 0.7$	M1, A1
	Area of $R = 28.345..... - 22.4 = 5.9455 = 5.95(cm^2)$	A1 (5)
		(11)
	(c) Final A1 accept 3sf or better (a) and (c) M1 for quoting and attempting to use correct formula (b) 1st M1 for attempting to use cosine rule (formula given)	

Question Number	Scheme	Marks
8.	(a) $x^2 + 6x + 10 = 3x + 20$ $\Rightarrow\ x^2 + 3x - 10 = 0$ $(x+5)(x-2) = 0$ so $x =, -5$ or 2 sub for y in $y = 3x + 20, y = 5$ or 26	M1 M1, A1 M1, A1 (5)
	(b) line – curve =, $10 - 3x - x^2$ $\int (10 - 3x - x^2)dx = 10x - \frac{3}{2}x^2 - \frac{x^3}{3}$ $\left[10x - \frac{3}{2}x^2 - \frac{x^3}{3}\right]_{-5}^{2} = (20 - \frac{3}{2}\times 4 - \frac{8}{3}) - (-50 - \frac{3}{2}\times 25 + \frac{125}{3})$ $= 11\frac{1}{3} - -45\frac{5}{6} = \underline{\underline{57\frac{1}{6}}}$	M1, A1 M1 A2/1/0√ M1 A1 (7) (12)
ALT (b)	$\int (x^2 + 6x + 10)dx = \frac{x^3}{3} + 3x^2 + 10x$ use of limits $= (8/3 + 12 + 20) - (-\frac{125}{3} + 75 - 50) = (108\,1/2)$ Area of Trapezium $= \frac{1}{2}(5 + 26)(2 - -5) = (51\,1/3)$ Shaded area = Trapezium - $\int = 108\,1/2 - 51\,1/3 = 57\,1/6$	M1 A2 M1 B1√ M1 A1 (7)
	(a) 1st M1 for putting curve = line 3rd M1 for obtaining at least one y value. Don't need A and B identified. (b) 1st M1 for $\pm(10 - 3x - x^2)$ 3rd M1 (2nd on ALT) for using their limits, √ their x values from (a)	

Question Number	Scheme	Marks
9.	(a) Perimeter $\Rightarrow\ 2x+2y+\pi x=80$	B1
	Area $\rightarrow\ A=2xy+\frac{1}{2}\pi x^2$	B1
	$y=\frac{80-2x-\pi x}{2}$ and sub in to A	M1
	$\Rightarrow\ A=80x-2x^2-\pi x^2+\frac{1}{2}\pi x^2$	
	i.e. $A=80x-(2+\frac{\pi}{2})x^2$ *	A1 c.s.o (4)
	(b) $\frac{dA}{dx}=80-2(2+\frac{\pi}{2})x$	M1, A1
	$\frac{dA}{dx}=0\Rightarrow 40=(2+\frac{\pi}{2})x$ so $x=,\frac{40}{2+\frac{\pi}{2}}$ or $\frac{80}{4+\pi}$ or Awrt 11.2	M1, A1 (4)
	(c) $\frac{d^2A}{dx^2}=-4-\pi$	M1
	$<0\ \therefore A$ is Max	A1 (2)
	(d) Max Area $=80(b)-(2+\frac{\pi}{2})(b)^2$	M1
	$=\underline{\underline{448(m^2)}}$	A1 cao (2)
		(12)
	(b)2nd M1 for putting $\frac{dA}{dx}=0$ and attempting $x=\cdots$ (c) M1 for attempting $\frac{d^2A}{dx^2}$ (or equivalent method) A1 for a correct second derivative, < 0 and comment	