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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MPC2 Pure Core 2

Mark Scheme

2007 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation

√ or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	or equivalent	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
$-x$ EE	deduct x marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

MPC2

Q	Solution	Marks	Total	Comments
1(a)(i)	x^2	B1	1	
(ii)	$x^{\frac{1}{2}} = \sqrt{x}$	B1	1	Accept either form
(iii)	x^3	B1	1	
(b)(i)	$\int 3x^{\frac{1}{2}}\,\mathrm{d}x = \frac{3}{\frac{3}{2}}x^{\frac{3}{2}}\ \{+c\}$	M1 A1		Index raised by 1 Simplification not yet required
	$= 2x^{\frac{3}{2}} + c$	A1	3	Need simplification **and** the $+\,c$ OE
(ii)	$\int_1^9 3x^{\frac{1}{2}}\,\mathrm{d}x = (2 \times 9^{\frac{3}{2}}) - (2 \times 1^{\frac{3}{2}})$	M1		F(9) – F(1), where F(x) is candidate's answer to (b)(i) [or clear recovery]
	$= 52$	A1ft	2	Ft on (b)(i) answer of form $kx^{1.5}$ i.e. $26k$
	Total		**8**	
2(a)	$u_1 = 12$ $u_2 = 3 \times 4^2 = 48$	B1 B1	2	CSO AG (be convinced)
(b)	$r = 4$	B1	1	
(c)(i)	$\{S_{12} =\}\dfrac{a\left(1-r^{12}\right)}{1-r}$	M1		OE Using a correct formula with $n = 12$
	$= \dfrac{12\left(1-4^{12}\right)}{1-4}$	A1ft		Ft on answer for u_1 in (a) and r in (b)
	$= \dfrac{12\left(1-4^{12}\right)}{-3} = -4(1-4^{12}) = 4^{13} - 4$	A1	3	CAO Accept $k = 13$ for 4^{13} term
(ii)	$\sum_{n=2}^{12} u_n = (4^{13} - 4) - u_1$ $= 67108848$	B1	1	
	Total		**7**	

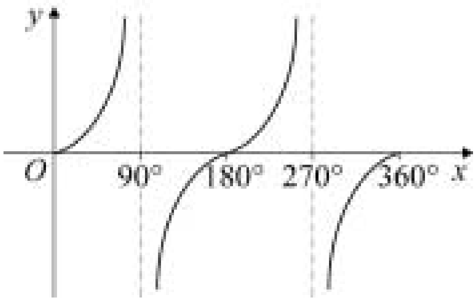
MPC2 (cont)

Q	Solution	Marks	Total	Comments
3(a)	Arc = $r\theta$	M1		For $r\theta$ or 20θ or PI by 20×1.4
	$28 = 20\theta \Rightarrow \theta = 1.4$	A1	2	AG
(b)	Area of sector = $\frac{1}{2}r^2\theta$	M1		$\frac{1}{2}r^2\theta$ OE seen
	$= \frac{1}{2}20^2(1.4) = 280$ (cm^2.)	A1	2	Condone absent cm^2.
(c)(i)	Area triangle $= \frac{1}{2}\times 15\times 20\times \sin 1.4$ (= 147.8….)	M1		Use of $\frac{1}{2}ab\sin C$ OE
	Shaded area = Area of sector – area of triangle	M1		
	= 280 – 147.8 = 132 (cm^2.) (3sf)	A1ft	3	Ft on [ans (b) – 147.8…] to 3sf provided [….] > 0
(ii)	$\{BD^2 =\}15^2 + 20^2 - 2\times 15\times 20\cos 1.4$	M1		RHS of cosine rule used
	$= 225 + 400 - 101.98...$	m1		Correct order of evaluation
	$\Rightarrow BD = \sqrt{523.019...} = 22.86..$ $= 22.9$ (cm) to 3 sf	A1	3	Condone absent cm
	Total		**10**	
4(a)	$\{S_{29} =\}\frac{29}{2}[2a + 28d]$	M1		Formula for S_n with $n = 29$ substituted and with a and d
	$29(a + 14d) = 1102$	m1		Equation formed then some manipulation
	$a + 14d = \frac{1102}{29} \Rightarrow a + 14d = 38$	A1	3	CSO AG
(b)	$u_2 = a + d \quad u_7 = a + 6d$	B1		Either expression correct
	$u_2 + u_7 = 13 \Rightarrow 2a + 7d = 13$	M1		Forming equation using u_2 & u_7 both in form $a + kd$
	e.g. $21d = 63$; $3a = -12$	m1		Solving $a + 14d = 38$ with candidate's '$2a + 7d = 13$' to at least stage of elimination of either a or d
	$a = -4 \quad d = 3$	A1	4	Both correct
	Total		**7**	

MPC2 (cont)

Q	Solution	Marks	Total	Comments
5(a)	$y_P = 4$	B1	1	
(b)	$y = 1 + \frac{2}{x} + \frac{2}{x} + \frac{4}{x^2}$ $y = 1 + 4x^{-1} + 4x^{-2}$	B2,1,0	2	(B1 if only one error in the expansion) For B2 the last line of the candidate's solution must be correct
(c)	$\frac{dy}{dx} = -4x^{-2} - 8x^{-3}$	M1 A1ft A1	3	Index reduced by 1 after differentiating x to a negative power At least 1 term in x correct ft on expn CSO Full correct solution. ACF
(d)	When $x = 2$, $\frac{dy}{dx} = -4 \times 2^{-2} - 8 \times 2^{-3}$ Gradient $= -1 \ -1 = -2$	M1 A1	2	Attempt to find $y'(2)$. AG (be convinced-no errors seen)
(e)	$-2 \times m' = -1$ $y - 4 = m(x-2)$ $y - 4 = \frac{1}{2}(x-2)$ $x - 2y + 6 = 0$	M1 M1 A1ft A1	4	$m_1 \times m_2 = -1$ OE stated or used. PI C's y_P from part (**a**) if not recovered; m must be numerical. Ft on candidate's y_P from part (**a**) if not recovered. CAO Must be this or $0 = x - 2y + 6$
	Total		**12**	
6(a)	$y_A = 3(2^0 + 1)$ $= 6$	M1 A1	2	Substituting $x = 0$ PI
(b)	$h = 2$ Integral $= h/2\ \{......\}$ $\{....\} = f(0) + 2[f(2) + f(4)] + f(6)$ $\{\} = 6 + 2[3 \times 5 + 3 \times 17] + 3 \times 65$ $= 6 + 2[15 + 51] + 195$ Integral = 333	B1 M1 A1 A1	4	PI OE summing of areas of the three traps. Condone 1 numerical slip {ft on (**a**) for f(0) if not recovered} [Sum of 3 traps. = 21 + 66 + 246] CAO
(c)(i)	$21 = 3(2^x + 1) \Rightarrow 2^x = 6$	B1	1	AG (be convinced)
(ii)	$\log_{10} 2^x = \log_{10} 6$ $x \log_{10} 2 = \log_{10} 6$ $x = \frac{\lg 6}{\lg 2} = 2.5849... = 2.58$ to 3sf	M1 m1 A1	3	Take ln or $\log_{10}$ of both sides of $a^x = b$ or other relevant base if clear. The equation $a^x = b$ used must be correct. Use of $\log 2^x = x \log 2$ OE Both method marks must have been awarded.
	Total		**10**	

MPC2 (cont)

Q	Solution	Marks	Total	Comments
7(a)		M1 A1 A1	 3	Correct shape of branch from O {to 90°} **or** correct shapes of branches from 90°-360° Complete graph for $0^\circ \le x \le 360^\circ$ (Asymptotes not explicitly required but graphs should show 'tendency') Correct scaling on x-axis $0^\circ \le x \le 360^\circ$
(b)	61° ; 241°	B1 B1	 2	For 61° For 241° and no 'extras' in the interval $0^\circ \le x \le 360^\circ$
(c)(i)	$\sin\theta = -\cos\theta \Rightarrow \dfrac{\sin\theta}{\cos\theta} = -1$ $\Rightarrow \tan\theta = -1.$	B1	1	AG; be convinced that the identity $\dfrac{\sin\theta}{\cos\theta} = \tan\theta$ is known and validly used
(ii)	$\Rightarrow \tan(x - 20°) = -1$ $x - 20° = \tan^{-1}(-1)$ $x - 20° = 135°, 315° \ldots$ $x = 155°$; 335°	M1 m1 A1 A1ft	 4	 Ft on (180 + "155") and no 'extras' in the given interval.
(d)	Translation $\begin{bmatrix} 20 \\ 0 \end{bmatrix}$	B1 B1	 2	'Translation'/'translate(d)' Accept equivalent in words provided linked to 'translation/move/shift' (Note: B0B1 is possible)
(e)	$f(x) = \tan 4x$	B1	1	For $\tan 4x$
	Total		**13**	
8(a)	$\log_a n = \log_a 3(2n-1)$ $\Rightarrow n = 3(2n-1)$ $\Rightarrow 3 = 5n \Rightarrow n = \dfrac{3}{5}$	M1 m1 A1	 3	OE Log law used PI by next line OE, but must **not** have any logs.
(b)(i)	$\log_a x = 3 \Rightarrow x = a^3$	B1	1	
(ii)	$\log_a y - \log_a 2^3 = 4$ $\log_a \dfrac{y}{2^3} = 4 \begin{cases} xy = a^7 \times a^{(3\log_a 2)} \\ \text{or} \\ y = a^4 \times a^{(3\log_a 2)} \end{cases}$ $\dfrac{y}{2^3} = a^4 \quad \begin{cases} xy = a^7 \times 2^3 \\ \text{or} \\ y = a^4 \times 2^3 \end{cases}$ $by = a^3 \times 8a^4$ or $8a^7$	M1 M1 ml A1	 4	$3\log 2 = \log 2^3$ seen or used any time in **(ii)** Correct method leading to an equation involving y (or xy) and a log but **not** involving + or − Correct method to eliminate **ALL** logs e.g. using $\log_a N = k \Rightarrow N = a^k$ or using $a^{\log_a c} = c$
	Total		**8**	
	TOTAL		**75**	