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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MPC2 Pure Core 2

Mark Scheme

2008 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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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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		
$\surd$ 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)	$\sqrt{x^3} = x^{\frac{3}{2}}$	B1	1	OE; accept '$k = 1.5$'
(b)(i)	$\frac{\mathrm{d}y}{\mathrm{d}x} = 2x - \frac{3}{2}x^{\frac{1}{2}}$	M1 B1 A1F	3	At least one index reduced by 1 and no term of the form $\sqrt{ax^2}$. For $2x$ For $-1.5\,x^{0.5}$ .Ft on ans (a) non-integer k
(ii)	When $x = 4$, $y = 8$ $y\,'(4) =$; $= 2(4) - 1.5(\sqrt{4}) = 5$ Tangent: $y - 8 = 5(x - 4)$ $y = 5x - 12$	B1 M1 A1F m1 A1	5	Attempt to find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 4$ Ft on one earlier error provided non-integer powers in (a) and (b)(i) $y - y(4) = y\,'(4)[x - 4]$ OE CSO; must be $y = 5x - 12$
	Total		**9**	
2(a)	Arc $PQ = r\theta$ $= 6\pi$ (cm)	M1 A1	2	$r\theta$ Condone missing units throughout the paper
(b)	$\alpha + \alpha + \frac{3\pi}{7} = \pi$ $\alpha = \frac{2\pi}{7}$	M1 A1	2	OE Accept equivalent fractions eg $\frac{4\pi}{14}$ and condone 0.286π or better
(c)	Chord $PQ = 2\times 14\times\cos\alpha$ Perimeter = 17.45… + 6π = 36.307… = 36.3 (cm)	M1 A1	2	OE eg $2\times 14\times\sin\frac{3\pi}{14}$ or 17.45-17.5 inclusive or $\sqrt{14^2 + 14^2 - 2\times 14^2\times\cos\frac{3\pi}{7}}$ Condone > 3sf
	Total		**6**	
3(a)	$r = 16 \div 20 = 0.8$	B1	1	OE
(b)	$\frac{a}{1-r} = \frac{20}{1-0.8}$ $= 100$	M1 A1F	2	OE Using a correct formula with $a = 20$ or $r =$ c's 0.8 ft on c's value of r provided $\lvert r\rvert < 1$
(c)	$\{S_{20} =\}\frac{a\left(1-r^{20}\right)}{1-r}$ $= 100\left(1-0.8^{20}\right) = 98.847\{07..\}$	M1 A1	2	OE Using a correct formula with $n = 20$ Condone > 3dp
(d)	nth term $= 20\,r^{n-1} = 20(0.8)^{n-1}$ $= 20\times 0.8^{-1}\times 0.8^{n}$ $= 25\times 0.8^{n}$	M1 A1	2	Ft on c's r . Award even if 16^{n-1} seen CSO; AG
	Total		**7**	

MPC2 (cont)

Q	Solution	Marks	Total	Comments
4(a)	$\{BC^2 =\}\ 7.6^2 + 8.3^2 - 2\times 7.6\times 8.3\cos 65$	M1		RHS of cosine rule used
	….. $= 57.76 + 68.89 - 53.3175...$	m1		Correct order of evaluation
	$BC = \sqrt{73.33..} = 8.563..$ $(= 8.56\text{ m})$	A1	3	AG; must see $\sqrt{73.33....}$ or > 3sf value
(b)	Area triangle $= \frac{1}{2}\times 7.6\times 8.3\times \sin 65$	M1		Use of $\frac{1}{2}bc\sin A$ OE
	= 28.58… = 28.6 (m^2)	A1	2	Condone > 3sf
(c)	Area of triangle = 0.5× BC × AD	M1		Or valid method to find sin$B$ or sin$C$
	AD = [Ans (b)] ÷ [0.5×Ans (a)]	m1		Or AD = 7.6sin$B$; Or AD = 8.3sin$C$
	AD = 6.67.. = 6.7 (m)	A1	3	If not 6.7 accept 6.65 to 6.69 inclusive.
	Total		**8**	
5(a)(i)	$\log_a 1 = 0$	B1	1	
(ii)	$\log_a a = 1$	B1	1	
(b)	$\log_a x = \log_a(5\times 6) - \log_a 1.5$	M1		One law of logs used correctly
	$\log_a x = \log_a\left(\frac{5\times 6}{1.5}\right)$	M1		A second law of logs used correctly
	$\log_a x = \log_a 20 \Rightarrow x = 20$	A1	3	
	Total		**5**	
6(a)	$8 = -8p + q$	M1		Either equation. PI eg by combined eqn.
	$4 = 8p + q$	A1		Both (condone embedded values for the M1A1)
		m1		Valid method to solve two simultaneous equations in p **and** q to find either p or q
	$q = 6$	A1		AG (condone if left as a fraction)
	$p = -0.25$	B1	5	OE
(b)	$u_4 = 5$	B1F	1	Ft on (6 + 4p)
(c)(i)	$L = pL + q$; $(L = -0.25L + 6)$	M1	1	OE
(ii)	$L = \frac{q}{1-p}$	m1		Rearranging
	$L = \frac{6}{1.25} = 4.8$	A1F	2	Ft on $\frac{6}{1-p}$ Dependent on previous two marks
	Total		**9**	

MPC2 (cont)

Q	Solution	Marks	Total	Comments
7(a)	$\left(1+\frac{4}{x^2}\right)^3 =$			
	$\left[1^3\right]+3(1^2)\left(\frac{4}{x^2}\right)+3(1)\left(\frac{4}{x^2}\right)^2+\left[\left(\frac{4}{x^2}\right)^3\right]$	M1		Any valid method as far as term(s) in $1/x^2$ and term(s) in $1/x^4$
	$=[1]+\frac{12}{x^2}+\frac{48}{x^4}+\left[\frac{64}{x^6}\right]$	A1		p = 12 Accept $\frac{12}{x^2}$ even within a series
		A1	3	q = 48 Accept $\frac{48}{x^4}$ even within a series
(b)(i)	$\int\left(1+\frac{4}{x^2}\right)^3\,dx$			
	$=\int\ (1+\frac{p}{x^2}+\frac{q}{x^4}+\frac{64}{x^6})\,dx$	M1		Integral of an 'expansion', at least 3 terms PI by the next line
	$= x-px^{-1}-\frac{q}{3}x^{-3}-\frac{64}{5}x^{-5}\ (+c)$	m1 A2F,1	4	At least two powers correctly obtained Ft on c's non-zero integer values for p and q (A1F for two terms correct; can be unsimplified) Condone missing c but check that signs have been simplified at some stage before the award of both A marks.
	$= x-12x^{-1}-16x^{-3}-\frac{64}{5}x^{-5}\ (+c)$			
(ii)	$\left(2-\frac{p}{2}-\frac{q}{3(8)}-\frac{64}{5(32)}\right)-$ $\left(1-p-\frac{q}{3}-\frac{64}{5}\right)$	M1		F(2) − F(1), where F(x) is cand's answer or the correct answer to (b)(i).
	$=$ 33.4	A1	2	CSO
	Total		**9**	

MPC2 (cont)

Q	Solution	Marks	Total	Comments
8(a)(i)	$h = 0.5$ Integral = $h/2$ {……}	B1		PI
	$\{..\}=\mathrm{f}(0)+2[\,\mathrm{f}\left(\frac{1}{2}\right)+\mathrm{f}(1)+\mathrm{f}\left(\frac{3}{2}\right)]+\mathrm{f}(2)$	M1		OE summing of areas of the four traps.
	$\{\}= 1+2\left[\sqrt{6}+6+6\sqrt{6}\right]+36$ = 1+2[2.449..+ 6 + 14.6969..] + 36 = 37 + 2 × 23.146.. = 83.292…	A1		Condone 1 numerical slip. Accept 3sf values if not exact.
	Integral = 0.25 × 83.292.. = 20.8 (3sf)	A1	4	CAO; must be 20.8
(ii)	Relevant trapezia drawn on a copy of given graph	M1		Accept single trapezium with its sloping side above the curve
	{Approximation is an}overestimate	A1	2	Dep. on 4 trapezia with each of their upper vertices lying on the curve
(b)(i)	Stretch **(I)** in x-direction **(II)**	M1		Need **(I)** and one of **(II)**, **(III)** M0 if more than one transformation
	(scale factor) $\frac{1}{3}$ **(III)**	A1	2	
(ii)	$6^{3x}=84$	M1		PI
	$\log_{10}6^{3x}=\log_{10}84$	M1		Take logs of both sides of $a^x = b$, PI by 'correct' value(s) later or $3x=\log_6 84$
	$3x\log_{10}6=\log_{10}84$	m1		Use of $\log 6^{3x}=3x\log 6$ OE or $3x=\log_6 84$ seen
	$x=\frac{\lg 84}{3\lg 6}$			
	$x =$ 0.82429…. = 0.824 (to 3dp)	A1	4	Must see that logs have been used before any of the last 3 marks are awarded in (b)(ii). Condone > 3dp
(c)	$\mathrm{f}(x) = 6^{x-1}-2$	B2,1	2	B1 for either $6^{x-1}+2$ or for $6^{x+1}-2$
	Total		**14**	
9(a)	$2x = 48$	B1		PI by $x = 24°$
	$2x = 180 - 48$	M1		Accept equivalents for x
	$2x = 360 + 48$ and $2x = 360+180-48$	M1		Accept equivalents for x
	$x = 24°$, $66°$, $204°$, $246°$	A1	4	CAO; need all four, no extras in given interval
(b)	$\frac{\sin\theta}{\cos\theta}=\tan\theta$	M1		Stated or used
	$2\sin\theta-3\cos\theta=0\Rightarrow$ $\tan\theta = 1.5$	A1		
	$\theta = 56.3°$	A1		Condone > 1dp
	$\theta = 56.3° + 180° = 236.3°$	A1F	4	Ft on c's PV+180° dep only on the M1 provided no 'extra' solutions in the given interval.
	Total		**8**	
	TOTAL		**75**	