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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

Mark Scheme

2009 examination – January 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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Registered address: AQA, Devas Street, Manchester M15 6EX *Dr Michael Cresswell Director General*

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.

MFP1

Q	Solution	Marks	Total	Comments
1	First increment is 0.2, so $y \approx 1.2$	B1B1		PI; variations possible here
	Second increment is $0.2\sqrt{1+0.2^2}$	M1		
	... $\approx 0.203\ 961$, so $y \approx 1.403\ 96$	A2,1F	5	A1 if accuracy lost; ft num error
	Total		**5**	
2(a)	Other root is $2 - 3\text{i}$	B1	1	
(b)	Sum of roots = 4	B1F		ft error in (a)
	So $b = -4$	B1F		ft wrong value for sum
	Product is 13	B1		
	So $c = 13$	B1F	4	ft wrong value for product
	Alternative:			
	Substituting $2 + 3\text{i}$ into equation	M1		
	Equating R and I parts	m1		
	$12 + 3b = 0$, so $b = -4$	A1		
	$-5 + 2b + c = 0$, so $c = 13$	A1F	(4)	ft wrong value for b
	Total		**5**	
3	$\tan\frac{\pi}{3} = \sqrt{3}$	B1		Decimals/degrees penalised at 5th mark
	Introduction of $n\pi$	M1		(or $2n\pi$) at any stage
	Going from $\frac{\pi}{2} - 3x$ to x	m1		Including dividing all terms by 3
	$x = \frac{\pi}{18} + \frac{1}{3}n\pi$	A2,1F	5	Allow +, − or ±; A1 with dec/deg; ft wrong first solution
	Total		**5**	
4(a)	$S_n = 3\Sigma r^2 - 3\Sigma r + \Sigma 1$	M1		
	Correct expressions substituted	m1		At least for first two terms
	Correct expansions	A1		
	$\Sigma 1 = n$	B1		
	Answer convincingly obtained	A1	5	AG
(b)	$S_{2n} - S_n$ attempted	M1		Condone $S_{2n} - S_{n+1}$ here
	Answer $7n^3$	A1	2	
	Total		**7**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
5(a)(i)	$\mathbf{A}+\mathbf{B}=\begin{bmatrix}0 & 2k\\ 2k & 0\end{bmatrix}$	B1	1	
(ii)	$\mathbf{A}^2=\begin{bmatrix}2k^2 & 0\\ 0 & 2k^2\end{bmatrix}$	B2,1	2	B1 if three entries correct
(b)	$(\mathbf{A}+\mathbf{B})^2==\begin{bmatrix}4k^2 & 0\\ 0 & 4k^2\end{bmatrix}$	B2,1		B1 if three entries correct
	$\mathbf{B}^2=\mathbf{A}^2$, hence result	B1B1	4	
(c)(i)	$\mathbf{A}^2$ is an enlargement (centre O)	M1		
	with SF 2	A1	2	Condone $2k^2$
(ii)	Scale factor is now $\sqrt{2}$	B1		Condone $\sqrt{2}k$
	Mirror line is $y=x\tan 22\tfrac{1}{2}°$	M1A1	3	
	Total		**12**	
6(a)(i)	Asymptotes $x=0$, $x=2$, $y=1$	B1×3	3	
(ii)	Intersections at (1, 0) and (3, 0)	B1	1	
(iii)	At least one branch approaching asymptotes	B1		
	Each branch	B1×3	4	
(b)	$0<x<1,\ 2<x<3$	B1,B1	2	Allow B1 if one repeated error occurs, eg $\le$ for $<$
	Alternative: Complete correct algebraic method	M1A1	(2)	
	Total		**10**	
7(a)	Use of similar triangles or algebra	M1		Some progress needed
	Correct relationship established	m1A1		eg $\dfrac{r-a}{c}=\dfrac{b-a}{c-d}$
	Hence result convincingly shown	A1	4	AG
(b)(i)	$c=\mathrm{f}(a)=24,\ d=\mathrm{f}(b)=-21$	B1,B1		
	$r=\dfrac{38}{15}$ (≈ 2.5333)	B1F	3	Allow AWRT 2.53; ft small error
(ii)	$\beta=20^{\frac{1}{3}}\approx 2.714(4)$	M1A1		Allow AWRT 2.71
	So $\beta-r\approx 0.181\approx 0.18$ (AG)	A1	3	Allow only 2dp if earlier values to 3dp
	Total		**10**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
8(a)	$\int x^{-\frac{3}{4}}\,dx = 4x^{\frac{1}{4}}\ (+\,c)$	M1A1		M1 if index correct
	This tends to ∞ as $x \to \infty$, so no value	A1F	3	ft wrong coefficient
(b)	$\int x^{-\frac{5}{4}}\,dx = -4x^{-\frac{1}{4}}\ (+\,c)$	M1A1		M1 if index correct
	$\int_1^\infty x^{-\frac{5}{4}}\,dx = 0-(-4) = 4$	A1F	3	ft wrong coefficient
(c)	Subtracting 4 leaves ∞, so no value	B1F	1	ft if c has 'no value' in (a) but has a finite answer in (b)
	Total		**7**	
9(a)	Asymptotes are $y = \pm\sqrt{2}x$	M1A1	2	M1A0 if correct but not in required form
(b)	Asymptotes correct on sketch	B1F		With gradients steeper than 1; ft from $y = \pm\, mx$ with $m > 1$
	Two branches in roughly correct positions	B1		
	Approaching asymptotes correctly	B1	3	Asymptotes $y = \pm\, mx$ needed here
(c)(i)	Elimination of y	M1		
	Clearing denominator correctly	M1		
	$x^2 - 2cx - (c^2 + 2) = 0$	m1A1	4	Convincingly found (AG)
(ii)	Discriminant = $8c^2 + 8$	B1		Accept unsimplified
	… > 0 for all c, hence result	E1	2	OE
(iii)	Solving gives $x = c \pm \sqrt{2(c^2+1)}$	M1A1		
	$y = x + c = 2c \pm \sqrt{2(c^2+1)}$	A1	3	Accept $y = c + \dfrac{2c \pm \sqrt{8c^2+8}}{2}$
	Total		**14**	
	TOTAL		**75**	