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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

Mark Scheme

2006 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.

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(a)	$\alpha+\beta=2,\ \alpha\beta=\frac{2}{3}$	B1B1	2	**SC** 1/2 for answers 6 and 2
(b)(i)	$(\alpha+\beta)^3=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3$	B1	1	Accept unsimplified
(ii)	$\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$	M1		
	Substitution of numerical values	m1		
	$\alpha^3+\beta^3=4$	A1	3	convincingly shown AG
(c)	$\alpha^3\beta^3=\frac{8}{27}$	B1		
	Equation of form $px^2\pm 4px+r=0$	M1		
	Answer $27x^2-108x+8=0$	A1√	3	ft wrong value for $\alpha^3\beta^3$
	Total		**9**	
2	1st increment is 0.2 lg 2 ...	M1		or 0.2 lg 2.1 or 0.2 lg 2.2
	... ≈ 0.06021	A1		PI
	$x=2.2\Rightarrow y\approx 3.06021$	A1√		PI; ft numerical error
	2nd increment is 0.2 lg 2.2	m1		consistent with first one
	... ≈ 0.06848	A1		PI
	$x=2.4\Rightarrow y\approx 3.12869\approx 3.129$	A1√	6	ft numerical error
	Total		**6**	
3	$\Sigma(r^2-r)=\Sigma r^2-\Sigma r$	M1		
	At least one linear factor found	m1		
	$\Sigma(r^2-r)=\frac{1}{6}n(n+1)(2n+1-3)$	m1		OE
	$...=\frac{1}{3}n(n+1)(n-1)$	A1	4	
	Total		**4**	
4	$\cos\frac{\pi}{6}=\frac{\sqrt{3}}{2}$ stated or used	B1		Condone decimals and/or degrees until final mark
	Appropriate use of ±	B1		
	Introduction of $2n\pi$	M1		
	Division by 3	M1		Of $\alpha+kn\pi$ or $\pm\alpha+kn\pi$
	$x=\pm\frac{\pi}{18}+\frac{2}{3}n\pi$	A1	5	
	Total		**5**	
5(a)(i)	$\mathbf{M}^2=\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}$	M1 A2,1	3	M1 if 2 entries correct M1A1 if 3 entries correct
(ii)	$\mathbf{M}^4=\begin{bmatrix}-1 & 0\\ 0 & -1\end{bmatrix}$	B1√	1	ft error in $\mathbf{M}^2$ provided no surds in $\mathbf{M}^2$
(b)	Rotation (about the origin)	M1		
	... through 45° clockwise	A1	2	
(c)	Awareness of $\mathbf{M}^8=\mathbf{I}$	M1		OE; NMS 2/3
	$\mathbf{M}^{2006}=\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}$	m1 A1√	3	complete valid method ft error in $\mathbf{M}^2$ as above
	Total		**9**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
6(a)	$(z+\mathrm{i})^* = x - \mathrm{i}y - \mathrm{i}$	B2	2	
(b)	... $= 2\mathrm{i}x - 2y + 1$	M1		$\mathrm{i}^2 = -1$ used at some stage
	Equating R and I parts	M1		involving at least 5 terms in all
	$x = -2y + 1,\ -y - 1 = 2x$	A1√		ft one sign error in (a)
	$z = -1 + \mathrm{i}$	m1A1√	5	ditto; allow $x = -1$, $y = 1$
	Total		**7**	
7(a)	Stretch parallel to y axis ...	B1		
	... scale-factor $\frac{1}{2}$ parallel to y axis	B1	2	
(b)	$(x-2)^2 - y^2 = 1$	M1A1		
	Translation in x direction ...	A1		
	... 2 units in positive x direction	A1	4	
	Total		**6**	
8(a)(i)	$(1+h)^3 = 1 + 3h + 3h^2 + h^3$	B1		
	$\mathrm{f}(1+h) = 1 + 5h + 4h^2 + h^3$	M1A1√		PI; ft wrong coefficients
	$\mathrm{f}(1+h) - \mathrm{f}(1) = 5h + 4h^2 + h^3$	A1√	4	ft numerical errors
(ii)	Dividing by h	M1		
	$\mathrm{f}'(1) = 5$	A1√	2	ft numerical errors
(b)(i)	$x^2(x+1) = 1$, hence result	B1	1	convincingly shown (AG)
(ii)	$x_2 = 1 - \frac{1}{5} = \frac{4}{5}$	M1A1√ A1√	3	ft c's value of f′(1)
(c)	Area $= \int_1^\infty x^{-2}\,\mathrm{d}x$	M1		
	... $= \left[-x^{-1}\right]_1^\infty$	M1		Ignore limits here
	... $= 0 - -1 = 1$	A1	3	
	Total		**13**	
9(a)(i)	Intersections at $(-1, 0)$, $(3, 0)$	B1B1	2	Allow $x = -1$, $x = 3$
(ii)	Asymptotes $x = 0$, $x = 2$, $y = 1$	B1 × 3	3	
(b)(i)	$y = k \Rightarrow kx^2 - 2kx = x^2 - 2x - 3$	M1A1		M1 for clearing denominator
	... $\Rightarrow (k-1)x^2 + (-2k+2)x + 3 = 0$	A1√		ft numerical error
	$\Delta = 4(k-1)(k-4)$, hence result	m1A1	5	convincingly shown (AG)
(ii)	$y = 4$ at SP	B1		
	$3x^2 - 6x + 3 = 0$, so $x = 1$	M1A1	3	A0 if other point(s) given
(c)	Curve with three branches	B1		approaching vertical asymptotes
	Middle branch correct	B1		Coordinates of SP not needed
	Other two branches correct	B1	3	3 asymptotes shown
	Total		**16**	
	TOTAL		**75**	