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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

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.

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

√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.

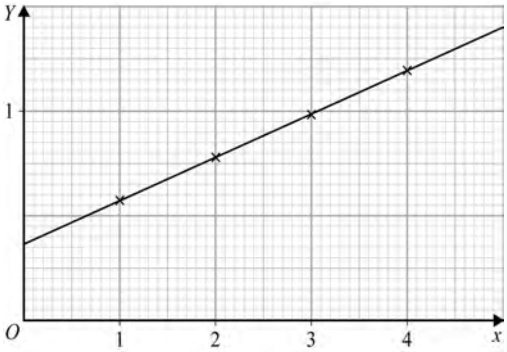
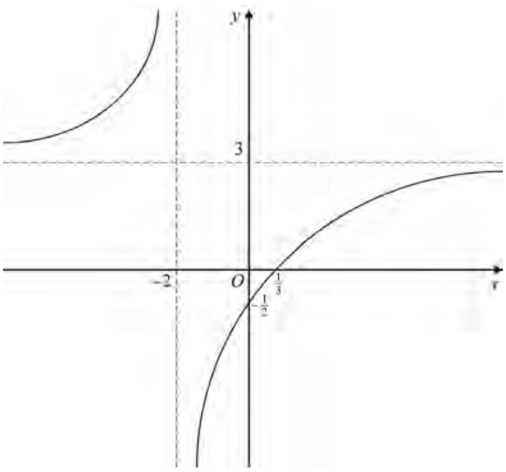
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

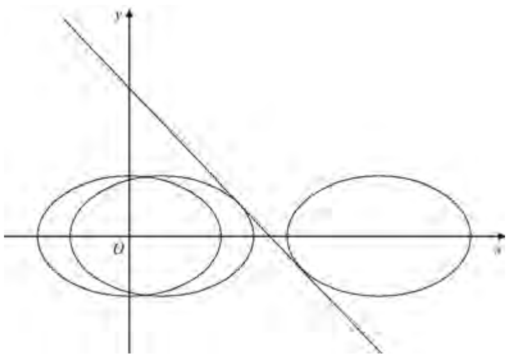
MFP1

Q	Solution	Mark	Total	Comments
1(a)	$\mathbf{M} = \begin{bmatrix} 0 & -3 \\ -3 & 0 \end{bmatrix}$	B2,1	2	B1 if subtracted the wrong way round
(b)	$p = 3$	B1F		ft after B1 in (a)
	L is $y = -x$	B1	2	Allow $p = -3$, L is $y = x$
(c)	$\mathbf{M}^2 = \begin{bmatrix} 9 & 0 \\ 0 & 9 \end{bmatrix}$	B1F		Or by geometrical reasoning; ft as before
	$\ldots = 9\mathbf{I}$	B1F	2	ft as before
	Total		**6**	
2(a)	f(1.6) = −1.304, f(1.8) = 0.632	B1,B1		Allow 1 dp throughout
	Sign change, so root between	E1	3	
(b)	f(1.7) considered first	M1		
	f(1.7) = −0.387, so root > 1.7	A1		
	f(1.75) = 0.109375, so root ≈ 1.7	m1A1	4	m1 for f(1.65) after error
	Total		**7**	
3(a)	Use of $z^* = x - \mathrm{i}y$	M1		
	$z - 3\mathrm{i}z^* = x + \mathrm{i}y - 3\mathrm{i}x - 3y$	m1		Condone sign error here
	R = $x - 3y$, I = $-3x + y$	A1	3	Condone inclusion of i in I Allow if correct in (b)
(b)	$x - 3y = 16$, $-3x + y = 0$	M1		
	Elimination of x or y	m1		
	$z = -2 - 6\mathrm{i}$	A1F	3	Accept $x = -2$, $y = -6$; ft $x + 3y$ for $x - 3y$
	Total		**6**	
4(a)	$\alpha + \beta = \frac{1}{2}$, $\alpha\beta = 2$	B1B1	2	
(b)	$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta}$	M1		
	$\ldots = \frac{\frac{1}{2}}{2} = \frac{1}{4}$	A1	2	Convincingly shown (AG)
(c)	Sum of roots = 1	B1F		PI by term $\pm x$; ft error(s) in (a)
	Product of roots = $\frac{16}{\alpha\beta} = 8$	B1F		ft wrong value of $\alpha\beta$
	Equation is $x^2 - x + 8 = 0$	B1F	3	ft wrong sum/product; "= 0" needed
	Total		**7**	

MFP1 (cont)

Q	Solution	Mark	Total	Comments
5(a)	Values 0.788, 0.992, 1.196 in table	B2,1	2	B1 if one correct (or if wrong number of dp given)
(b)	$\lg ab^x = \lg a + \lg b^x$	M1		
	$\lg b^x = x \lg b$	M1		
	So $Y = (\lg b)\,x + \lg a$	A1	3	Allow NMS
(c)		B1F		Four points plotted; ft wrong values in (a)
		B1F	2	Good straight line drawn; ft incorrect points
(d)	a = antilog of y-intercept	M1A1		Accept 2.23 to 2.52
	b = antilog of gradient	M1A1	4	Accept 1.58 to 1.62
	Total		**11**	
6	One value of $2x - \frac{\pi}{2}$ is $\frac{\pi}{3}$	B1		OE (PI); degrees/decimals penalised in 6th mark only
	Another value is $\pi - \frac{\pi}{3} = \frac{2\pi}{3}$	B1F		OE (PI); ft wrong first value
	Introduction of $2n\pi$ or $n\pi$	M1		
	General solution for x	m1		
	GS $x = \frac{5\pi}{12} + n\pi$ or $x = \frac{7\pi}{12} + n\pi$	A2,1	6	OE; A1 if one part correct
	Total		**6**	
7(a)	Asymptotes $x = -2$, $y = 3$	B1,B1	2	
(b)		B1		Curve approaching asymptotes
		B1,B1		Passing through $\left(\frac{1}{3}, 0\right)$ and $\left(0, -\frac{1}{2}\right)$
		B1,B1	5	Both branches generally correct B1 if two branches shown
(c)	Solution set is $x > \frac{1}{3}$	B2,1F	2	B1 for good attempt; ft wrong point of intersection
	Total		**9**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
8(a)	$\int\left(x^{\frac{1}{3}}+x^{-\frac{1}{3}}\right)\mathrm{d}x=\frac{3}{4}x^{\frac{4}{3}}+\frac{3}{2}x^{\frac{2}{3}}\,(+c)$	M1A1		M1 for adding 1 to index at least once
	$\int_0^1 \ldots=\left(\frac{3}{4}+\frac{3}{2}\right)-0=\frac{9}{4}$	m1A1	4	Condone no mention of limiting process; m1 if "− 0" stated or implied
(b)	Second term is $x^{-\frac{4}{3}}$	B1		
	Integral of this is $-3x^{-\frac{1}{3}}$	M1A1		M1 for correct index
	$x^{-\frac{1}{3}}\to\infty$ as $x\to 0$, so no value	E1	4	
	Total		**8**	
9(a)	Intersections $\left(\pm\sqrt{2},0\right)$, $(0,\pm 1)$	B1B1	2	Allow B1 for $\left(\sqrt{2},0\right)$, $(0,1)$
(b)	Equation is $\frac{(x-k)^2}{2}+y^2=1$	M1A1	2	M1 if only one small error, eg $x+k$ for $x-k$
(c)	Correct elimination of y Correct expansion of squares Correct removal of denominator Answer convincingly established	M1 M1 M1 A1	4	AG
(d)	Tgt $\Rightarrow 4(k+4)^2-12(k^2+6)=0$	M1		
	$\ldots\Rightarrow k^2-4k+1=0$	m1A1		OE
	$\ldots\Rightarrow k=2\pm\sqrt{3}$	A1	4	
(e)		B1 B2	 3	Curve to left of line Curve to right of line Curves must touch the line in approx correct positions SC 1/3 if both curves are incomplete but touch the line correctly
	Total		**15**	
	TOTAL		**75**	