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General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

Mark Scheme

2009 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.

MFP1

Q	Solution	Marks	Totals	Comments
1(a)	$\alpha+\beta=-\frac{1}{2}$, $\alpha\beta=-4$	B1B1	2	
(b)	$\alpha^2+\beta^2=(-\frac{1}{2})^2-2(-4)=8\frac{1}{4}$	M1A1F	2	M1 for substituting in correct formula; ft wrong answer(s) in (a)
(c)	Sum of roots = $4(8\frac{1}{4})=33$ Product = $16(\alpha\beta)^2=256$ Equation is $x^2-33x+256=0$	B1F B1F B1F	 3	ft wrong answer in (b) ft wrong answer in (a) ft wrong sum and/or product; allow '$p=-33$, $q=256$'; condone omission of '= 0'
	Total		**7**	
2(a)	When $x=2$, $y=-3$ Use of $(2+h)^2=4+4h+h^2$ Correct method for gradient Gradient = $\dfrac{-3-2h+h^2+3}{h}=-2+h$	B1 M1 M1 A2,1	 5	PI A1 if only one small error made
(b)	As h tends to 0, ... the gradient tends to -2	E2,1 B1F	 3	E1 for '$h=0$' dependent on at least E1 ft small error in (a)
	Total		**8**	
3(a)(i)	$z^2=(x^2-4)+\mathrm{i}(4x)$ R and I parts clearly indicated	M1A1 A1F	 3	M1 for use of $\mathrm{i}^2=-1$ Condone inclusion of i in I part ft one numerical error
(ii)	$z^2+2z^*=(x^2+2x-4)+\mathrm{i}(4x-4)$	M1A1F	2	M1 for correct use of conjugate ft numerical error in (i)
(b)	z^2+2z^* real if imaginary part zero ... ie if $x=1$	M1 A1F	 2	 ft provided imaginary part linear
	Total		**7**	
4(a)	$\lg(ab^x)=\lg a+\lg(b^x)$ ... $=\lg a+x\lg b$ Correct relationship established [SC After M0M0, B2 for correct form]	M1 M1 A1	 3	Use of one log law Use of another log law
(b)(i)	When $x=2.3$, $Y\approx 1.1$, so $y\approx 12.6$	M1A1		Allow 12.7; allow NMS
(ii)	When $y=80$, $Y\approx 1.90$, so $x\approx 1.1$	M1A1	4	M1 for $Y\approx 1.9$, allow NMS
	Total		**7**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
5(a)	$\cos\frac{\pi}{3}=\frac{1}{2}$	B1		Decimals/degrees penalised at 6th mark only
	Appropriate use of ±	B1		OE
	Introduction of $2n\pi$	M1		(or $n\pi$) at any stage
	Going from $3x-\pi$ to x	m1		including dividing all terms by 3
	$x=\frac{\pi}{3}\pm\frac{\pi}{9}+\frac{2}{3}n\pi$	A2,1F	6	OE; A1 with decimals and/or degrees; ft wrong first solution
(b)	At least one value in given range	M1		compatible with c's GS
	Correct values $\frac{92}{9}\pi$, $\frac{94}{9}\pi$, $\frac{98}{9}\pi$	A2,1	3	A1 if one omitted or wrong values included; A0 if only one correct value given
	Total		**9**	
6(a)	Ellipse with centre of origin	B1		Allow unequal scales on axes
	$(\pm\sqrt{3},0)$ and (0 ± 2) shown on diagram	B2,1	3	Condone AWRT 1.7 for $\sqrt{3}$; B1 for incomplete attempt
(b)	y replaced by $\frac{1}{2}y$	M1A1		M1A0 for $2y$ instead of $\frac{1}{2}y$
	Equation is now $\frac{x^2}{3}+\frac{y^2}{16}=1$	A1	3	
(c)	Attempt at completing the square	M1		
	$4(x-1)^2+3(y+1)^2\ldots$	A1A1		
	[Alt: replace x by $x-a$ and y by $y-b$	(M1)		M1 if one replacement correct
	$4x^2-8ax+3y^2-6by\ldots$]	(m1A1)		Condone errors in constant terms
	$a=1$ and $b=-1$	A1A1	5	
	Total		**11**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
7(a)(i)	Matrix is $\begin{bmatrix} \sqrt{3}/2 & -1/2 \\ 1/2 & \sqrt{3}/2 \end{bmatrix}$	M1A1	2	M1 for $\begin{bmatrix} \cos 30° & \sin 30° \\ -\sin 30° & \cos 30° \end{bmatrix}$ (PI)
(ii)	Matrix is $\begin{bmatrix} 1/2 & \sqrt{3}/2 \\ \sqrt{3}/2 & -1/2 \end{bmatrix}$	M1A1	2	M1 for $\begin{bmatrix} \cos 60° & \sin 60° \\ \sin 60° & -\cos 60° \end{bmatrix}$ (PI)
(b)	SF 2, line $y = \frac{1}{\sqrt{3}}x$	B1B1	2	OE
(c)	Attempt at **BA** or **AB**	M1		
	BA = $\begin{bmatrix} 0 & 4 \\ 4 & 0 \end{bmatrix}$	m1A1		m1 if zeros in correct positions
	Enlargement SF 4	B1F		ft use of **AB** (answer still 4) or after **BA** = $\begin{bmatrix} 0 & k \\ k & 0 \end{bmatrix}$
	... and reflection in line $y = x$	B1F	5	ft only from **BA** = $\begin{bmatrix} 0 & k \\ k & 0 \end{bmatrix}$
	Total		**11**	
8(a)	Asymptotes $x = 1$, $x = 5$, $y = 1$	B1 × 3	3	
(b)	$y = -1 \Rightarrow (x-1)(x-5) = -x^2$	M1		OE
	$\ldots \Rightarrow 2x^2 - 6x + 5 = 0$	m1		OE
	Disc't = 36 − 40 < 0, so no pt of int'n	A1	3	convincingly shown (AG)
(c)(i)	$y = k \Rightarrow x^2 = k(x^2 - 6x + 5)$	M1		OE
	$\ldots \Rightarrow (k-1)x^2 - 6kx + 5k = 0$	A1	2	convincingly shown (AG)
(ii)	Discriminant = $36k^2 - 20k(k-1)$	M1		OE
	... = 0 when $k(4k + 5) = 0$	A1	2	convincingly shown (AG)
(d)	$k = 0$ gives $x = 0$, $y = 0$	B1		
	$k = -\frac{5}{4}$ gives $-\frac{9}{4}x^2 + \frac{30}{4}x - \frac{25}{4} = 0$	M1A1		OE
	$(3x-5)^2 = 0$, so $x = \frac{5}{3}$	A1		
	$y = -\frac{5}{4}$	B1	5	
	Total		**15**	
	TOTAL		**75**	