AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1   Further Pure 1

Mark Scheme

2007 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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.

Jan 07

MFP1

Q	Solution	Marks	Total	Comments
1(a)(i)	Roots are $\pm 4i$	M1A1	2	M1 for one correct root or two correct factors
(ii)	Roots are $1 \pm 4i$	M1A1	2	M1 for correct method
(b)(i)	$(1 + x)^3 = 1 + 3x + 3x^2 + x^3$	M1A1	2	M1A0 if one small error
(ii)	$(1 + i)^3 = 1 + 3i - 3 - i = -2 + 2i$	M1A1	2	M1 if $i^2 = -1$ used
(iii)	$(1 + i)^3 + 2(1 + i) - 4i$	M1		with attempt to evaluate
	$\ldots = (-2 + 2i) + (2 - 2i) = 0$	A1	2	convincingly shown (**AG**)
	Total		10	
2(a)(i)	$\mathbf{A} + \mathbf{B} = \begin{bmatrix} \sqrt{3} & 0 \\ 1 & 0 \end{bmatrix}$	M1A1	2	M1A0 if 3 entries correct; Condone $\dfrac{2\sqrt{3}}{2}$ for $\sqrt{3}$
(ii)	$\mathbf{BA} = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$	B3,2,1	3	Deduct one for each error; **SC** B2,1 for **AB**
(b)(i)	Rotation 30° anticlockwise (abt O)	M1A1	2	M1 for rotation
(ii)	Reflection in $y = (\tan 15°)x$	M1A1	2	M1 for reflection
(iii)	Reflection in x-axis	B2F	2	1/2 for reflection in y-axis ft (M1A1) only for the **SC**
	Alt: Answer to (i) followed by answer to (ii)	M1A1F	(2)	M1A0 if in wrong order or if order not made clear
	Total		11	
3(a)	$\alpha + \beta = -2, \alpha\beta = \dfrac{3}{2}$	B1B1	2	
(b)	Use of expansion of $(\alpha + \beta)^2$	M1		
	$\alpha^2 + \beta^2 = (-2)^2 - 2\left(\dfrac{3}{2}\right) = 1$	m1A1	3	convincingly shown (**AG**); m1A0 if $\alpha + \beta = 2$ used
(c)	$\alpha^4 + \beta^4$ given in terms of $\alpha + \beta, \alpha\beta$ and/or $\alpha^2 + \beta^2$	M1A1		M1A0 if num error made
	$\alpha^4 + \beta^4 = -\dfrac{7}{2}$	A1	3	OE
	Total		8	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
4(a)	$\lg y = \lg a + b \lg x$	M1A1	2	M1 for use of one log law
(b)	Use of above result	M1		
	$a = 10$	A1		
	b = gradient	m1		OE; PI by answer $\pm\frac{1}{2}$
	$\ldots = -\frac{1}{2}$	A1	4	
	Total		**6**	
5(a)	Asymptotes $y = 0$, $x = -1$, $x = 1$	B1 × 3	3	
(b)	Three branches approaching two vertical asymptotes	B1		Asymptotes not necessarily drawn
	Middle branch passing through O	B1		with no stationary points
	Curve approaching $y = 0$ as $x \to \pm \infty$	B1		
	All correct	B1	4	with asymptotes shown and curve approaching all asymptotes correctly
(c)	Critical values $x = -1$, 0 and 1	B1		
	Solution set $-1 < x < 0,\ x > 1$	M1A1	3	M1 if one part correct or consistent with c's graph
	Total		**10**	
6(a)(i)	$(2r-1)^2 = 4r^2 - 4r + 1$	B1	1	
(ii)	$\sum(2r-1)^2 = 4\sum r^2 - 4\sum r + \sum 1$	M1		
	$\ldots = \frac{4}{3}n^3 - \frac{4}{3}n + \sum 1$	m1A1		
	$\sum 1 = n$	B1		
	Result convincingly shown	A1	5	**AG**
(b)	Sum = f(100) − f(50)	M1A1		M1 for 100 ± 1 and 50 ± 1
	$\ldots = 1\,166\,650$	A2	4	**SC** f(100) − f(51) = 1 156 449: 3/4
	Total		**10**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
7(a)	Particular solution, eg $-\dfrac{\pi}{6}$ or $\dfrac{5\pi}{6}$	B1		Degrees or decimals penalised in 3rd mark only
	Introduction of $n\pi$ or $2n\pi$	M1		
	GS $\quad x = -\dfrac{\pi}{6} + n\pi$	A1F	3	OE(accept unsimplified); ft incorrect first solution
(b)(i)	$f(0.05) \approx 0.542\ 66$	B1		either value AWRT 0.5427
	$g(0.05) \approx 0.542\ 68$	B1	2	both values correct to 4DP
(ii)	$\dfrac{g(h) - g(0)}{h} = \dfrac{\sqrt{3}}{2} - \dfrac{1}{4}h$	M1A1	2	M1A0 if num error made
(iii)	As $h \to 0$ this gives $g'(0) = \dfrac{\sqrt{3}}{2}$	A1F	1	AWRT 0.866; ft num error
	Total		**8**	
8(a)	$x = 10 \Rightarrow 4 - \dfrac{y^2}{9} = 1$	M1		
	$\Rightarrow y^2 = 27$	A1		PI
	$\Rightarrow y = \pm 3\sqrt{3}$	A1	3	
(b)	One branch generally correct	B1		Asymptotes not needed
	Both branches correct	B1		With implied asymptotes
	Intersections at $(\pm 5, 0)$	B1	3	
(c)	Required tangent is $x = 5$	B1F	1	ft wrong value in (b)
(d)(i)	y correctly eliminated	M1		
	Fractions correctly cleared	m1		
	$16x^2 - 200x + 625 = 0$	A1	3	convincingly shown (**AG**)
(ii)	$x = \dfrac{25}{4}$	B1		No need to mention repeated root, but B0 if other values given as well
	Equal roots $\Rightarrow$ tangency	E1	2	Accept 'It's a tangent'
	Total		**12**	
	TOTAL		**75**	