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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

Mark Scheme

2008 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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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.

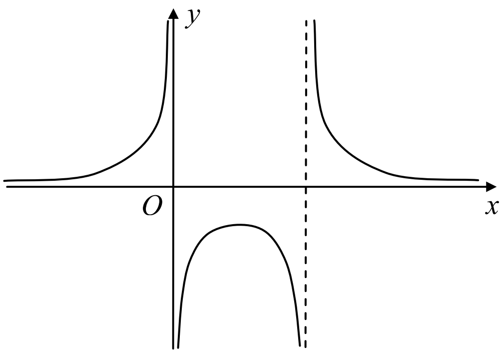
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

MFP1

Q	Solution	Marks	Totals	Comments
1	$z_1 + 4\text{i}\, z_1^* = (2+\text{i}) + 4\text{i}\,(2-\text{i})$	M1		Use of conjugate
	... $= (2+\text{i}) + (8\text{i}+4)$	M1		Use of $\text{i}^2 = -1$
	... $= 6 + 9\text{i}$, so $x = 6$ and $y = 3$	M1A1	4	M1 for equating Real and imaginary parts
	Total		**4**	
2	$0.01(2^1)$ added to value of y	M1		Variations possible here
	So $y(1.01) \approx 4.02$	A1		PI
	Second increment is $0.01(2^{1.01})$	m1		
	... $\approx 0.020\ 139$	A1		
	So $y(1.02) \approx 4.040\ 14$	A1	5	
	Total		**5**	
3	Use of $\tan\frac{\pi}{4} = 1$	B1		Degrees or decimals penalised in last mark only
	Introduction of $n\pi$	M1		or kn at any stage
	Division of all terms by 4	m1		
	Addition of $\pi/8$	m1		OE
	GS $x = \frac{3\pi}{16} + \frac{n\pi}{4}$	A1	5	OE
	Total		**5**	
4(a)	Use of formula for $\sum r^3$ or $\sum r$	M1		
	n is a factor of the expression	m1		clearly shown
	So is $(n + 1)$	m1		ditto
	$S_n = \frac{1}{4}n(n+1)(n^2+n-12)$	A1		
	... $= \frac{1}{4}n(n+1)(n+4)(n-3)$	A1F	5	ft wrong value for k
(b)	$n = 1000$ substituted into expression	m1		The factor 1004, or 1000 + 4, seen
	Conclusion convincingly shown	A1	2	not ‘2008 × 124749625’
	Need $\frac{1000}{4}$ is even, hence conclusion			OE
	Total		**7**	
5(a)	Asymptotes are $y = \pm\frac{1}{2}x$	M1A1	2	OE; M1 for $y = \pm mx$
(b)	$x = 4$ substituted into equation	M1		
	$y^2 = 3$ so $y = \pm\sqrt{3}$	A1	2	Allow NMS
(c)(i)	y-coords are $2 \pm \sqrt{3}$	B1F	1	ft wrong answer to (b)
(ii)	Hyperbola is $\frac{x^2}{4} - (y-2)^2 = 1$	M1A1		M1A0 if $y + 2$ used
	Asymptotes are $y = 2 \pm \frac{1}{2}x$	B1F	3	ft wrong gradients in (a)
	Total		**8**	
6(a)(i)	$\mathbf{M}^2 = \begin{bmatrix} 12 & 0 \\ 0 & 12 \end{bmatrix}$	M1A1		M1 if zeroes appear in the right places
	$= 12\mathbf{I}$	A1F	3	ft provided of right form
(ii)	$q\cos 60° = \frac{1}{2}q = \sqrt{3} \Rightarrow q = 2\sqrt{3}$	M1A1		OE **SC** $q = 2\sqrt{3}$ NMS 1/3
	Other entries verified	E1	3	surd for sin 60º needed
(b)(i)	SF $= q = 2\sqrt{3}$	B1F	1	ft wrong value for q
(ii)	Equation is $y = x\tan 30°$	B1	1	
(c)	$\mathbf{M}^4 = 144\mathbf{I}$	B1F		PI; ft wrong value in (a)(i)
	$\mathbf{M}^4$ gives enlargement SF 144	B1F	2	ft if c’s $\mathbf{M}^4 = k\mathbf{I}$
	Total		**10**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
7(a)(i)	$(-1+h)^3 = -1 + 3h - 3h^2 + h^3$	B1		PI
	$y_B = (-1 + 3h - 3h^2 + h^3) + 1 - h + 1$	B1F		ft numerical error
	$\ldots = 1 + 2h - 3h^2 + h^3$	B1	3	convincingly shown (AG)
(ii)	Subtraction of 1 and division by h	M1M1		
	Gradient of chord = $2 - 3h + h^2$	A1	3	
(iii)	As $h \to 0$, gr(chord) $\to$ gr(tgt) = 2	E1B1F	2	E0 if '$h = 0$' used; ft wrong value of p
(b)(i)	$x_2 = -1 - \frac{1}{2} = -1.5$	M1		
		A1F	2	ft wrong gradient
(ii)	Tangent at A drawn	M1		
	α and x_2 shown correctly	A1	2	dep't only on the last M1
	Total		**12**	
8(a)(i)	$\alpha + \beta = 2$, $\alpha\beta = 4$	B1B1		
	$\alpha^3 + \beta^3 = (2)^3 - 3(4)(2) = -16$	M1A1		
	$\alpha^3\beta^3 = (4)^3 = 64$, hence result	M1A1	6	convincingly shown (AG)
(ii)	Discriminant 0, so roots equal	B1E1	2	or by factorisation
(b)	$x = \dfrac{2 \pm \sqrt{4-16}}{2}$	M1		or by completing square
	$\ldots = 1 \pm \frac{1}{2}\mathrm{i}\sqrt{12}$	A1	2	
(c)	$\alpha, \beta = 1 \pm \mathrm{i}\sqrt{3}$			
	and $\alpha^3 = \beta^3$, hence result	E2	2	
	Total		**12**	
9(a)	Asymptotes $x = 0$, $x = 4$, $y = 0$	B1 × 3	3	
(b)	$y = k \Rightarrow 2 = kx(x-4)$	M1		
	$\ldots \Rightarrow 0 = kx^2 - 4kx - 2$	A1		
	Discriminant = $(4k)^2 + 8k$	m1		
	At SP $y = -\frac{1}{2}$	A1		not just $k = -\frac{1}{2}$
	$\ldots \Rightarrow 0 = -\frac{1}{2}x^2 + 2x - 2$	m1		
	So $x = 2$	A1	6	
(c)		B1 B1 B1	3	Curve with three branches approaching vertical asymptotes correctly Outer branches correct Middle branch correct
	Total		**12**	
	TOTAL		**75**	