Version 1.0

General Certificate of Education
June 2010

Mathematics MFP1

Further Pure 1

Mark Scheme

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	Total	Comments
1	First increment is 0.1×2 (= 0.2)	M1		variations possible here
	So next value of y is 3.2	A1		PI
	Second inc't is $0.1(1 + 1.1^3) = 0.2331$	m1A1		PI
	Third inc't is $0.1(1 + 1.2^3) = 0.2728$	A1		PI
	So $y \approx 3.7059 \approx 3.706$	A1F	6	ft one numerical error
	Total		**6**	
2(a)	Use of $z^* = x - \mathrm{i}y$	M1		
	Use of $\mathrm{i}^2 = -1$	M1		
	$(1 - 2\mathrm{i})z - z^* = 2y + \mathrm{i}(2y - 2x)$	A2,1	4	A1 if one numerical error made
(b)	$2y = 20$, $2y - 2x = 10$	M1		equate and attempt to solve
	so $z = 5 + 10\mathrm{i}$	A1	2	allow $x = 5$, $y = 10$
	Total		**6**	
3	Introduction of $360n°$	M1		(or $180n°$) at any stage; condone $2n\pi$ (or $n\pi$)
	$5x - 20° = \pm 40°$ $(+360n°)$	B1		OE, eg RHS '40° or 320°'
	Going from $5x - 20°$ to x	m1		including division of all terms by 5
	GS is $x = 4° \pm 8° + 72n°$	A2,1	5	OE; A1 if radians present in answer
	Total		**5**	
4(a)	4, 16, 36, 64 entered in table	B1	1	
(b)	Four points plotted accurately	B1F		ft wrong values in (a)
	Linear graph drawn	B1	2	
(c)(i)	Finding X for $y = 15$ and taking sq root	M1		
	$x \approx 5.3$	A1	2	AWRT 5.2 or 5.3; NMS 1/2
(ii)	Calculation of gradient	M1		
	a = gradient ≈ 0.37	A1		AWRT 0.36 to 0.38; NMS 1/2
	b = y-intercept ≈ 4.5	B1F	3	can be found by calculation; ft c's y-intercept
	Total		**8**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
5(a)	At B, $y = (2 + h)^3 - 12(2 + h)$	M1		with attempt to expand and simplify
	$= (8 + 12h + 6h^2 + h^3) - (24 + 12h)$ $(= -16 + 6h^2 + h^3)$	B1		correct expansion of $(2 + h)^3$
	Grad $AB = \dfrac{(-16 + 6h^2 + h^3) - (-16)}{(2 + h) - 2}$	m1		
	$= \dfrac{6h^2 + h^3}{h} = 6h + h^2$	A1	4	convincingly shown (AG)
(b)	As $h \to 0$ this gradient $\to 0$ so gradient of curve at A is 0	E2,1	2	E1 for '$h = 0$'
	Total		**6**	
6(a)	Rotation 45° (anticlockwise)(about O)	M1A1	2	M1 for 'rotation'
(b)	Reflection in $y = x \tan 22.5°$	M1A1	2	M1 for 'reflection'
(c)	Rotation 90° (anticlockwise)(about O)	M1A1F	2	M1 for 'rotation' or correct matrix; ft wrong angle in (a)
(d)	Identity transformation	B2,1F	2	ft wrong mirror line in (b); B1 for $\mathbf{B}^2 = \mathbf{I}$
(e)	$\mathbf{AB} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	M1A1		allow M1 if two entries correct
	Reflection in $y = x$	A1	3	
	Total		**11**	
7(a)(i)	Asymptotes $x = 3$ and $y = 0$	B1,B1	2	may appear on graph
(ii)	Complete graph with correct shape	B1		
	Coordinates $\left(0, -\dfrac{1}{3}\right)$ shown	B1	2	
(iii)	Correct line, (0, −5) and (2.5, 0) shown	B1	1	
(b)(i)	$2x^2 - 11x + 14 = 0$	B1		
	$x = 2$ or $x = 3.5$	M1A1	3	M1 for valid method for quadratic
(ii)	$2 < x < 3$, $x > 3.5$	B2,1F	2	B1 for partially correct solution; ft incorrect roots of quadratic (one above 3, one below 3)
	Total		**10**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
8(a)	$\alpha + \beta = 4,\ \alpha\beta = 10$	B1,B1	2	
(b)	$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta}$	M1		
	$= \frac{4}{10} = \frac{2}{5}$	A1	2	convincingly shown (AG)
(c)	Sum of roots = $(\alpha + \beta) + 2$(ans to (b))	M1		
	$= 4\frac{4}{5}$	A1F		ft wrong value for $\alpha + \beta$
	Product = $\alpha\beta + 4 + \frac{4}{\alpha\beta}$	M1A1		M1 for attempt to expand product (at least two terms correct)
	$= 14\frac{2}{5}$	A1F		ft wrong value for $\alpha\beta$
	Equation is $5x^2 - 24x + 72 = 0$	A1F	6	integer coeffs and '= 0' needed here; ft one numerical error
	Total		**10**	
9(a)(i)	Parabola drawn passing through (2, 0)	M1 A1	2	with x-axis as line of symmetry
(ii)	Two tangents passing through (−2, 0)	B1B1	2	to c's parabola
(b)(i)	Elimination of y	M1		
	Correct expansion of $(x + 2)^2$	B1		
	Result	A1	3	convincingly shown (AG)
(ii)	Correct discriminant	B1		
	$16m^4 - 8m^2 + 1 = 16m^4 + 8m^2$	M1		OE
	Result	A1	3	convincingly shown (AG)
(iii)	$\frac{1}{16}x^2 - \frac{3}{4}x + \frac{9}{4} = 0$	M1		OE
	$x = 6,\ y = \pm 2$	A1,A1	3	
	Total		**13**	
	TOTAL		**75**	