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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP1 Further Pure 1

Mark Scheme

2008 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.

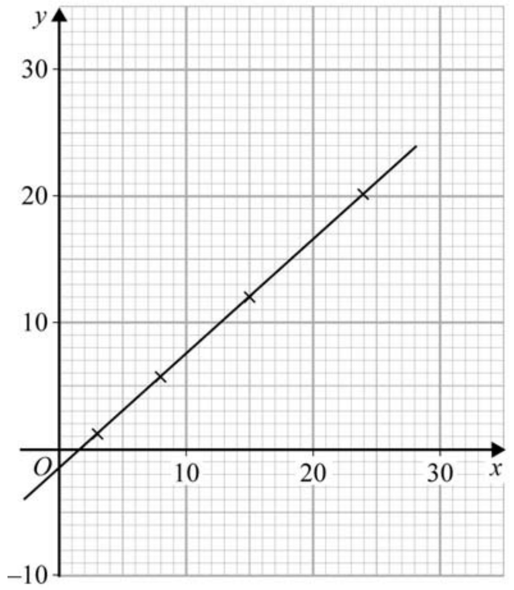
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

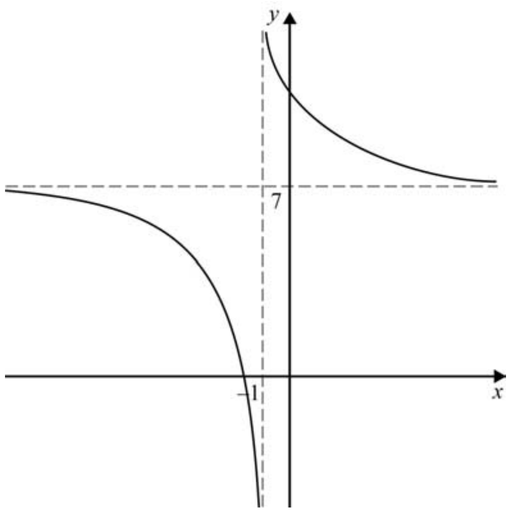
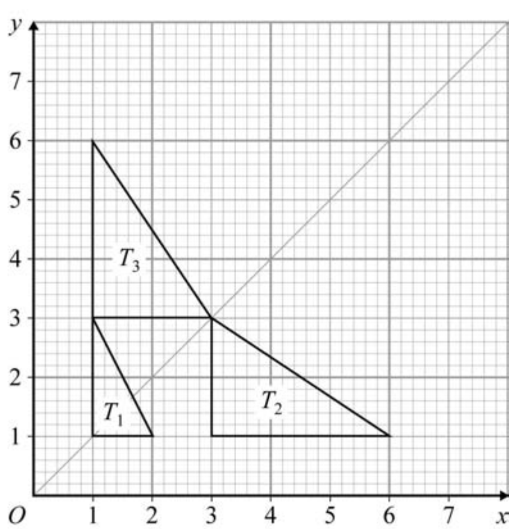
MFP1

Q	Solution	Marks	Total	Comments
1(a)	$\alpha + \beta = -1$, $\alpha\beta = 5$	B1B1	2	
(b)	$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$ $\ldots = 1 - 10 = -9$	M1 A1F	 2	with numbers substituted ft sign error(s) in (a)
(c)	$\dfrac{\alpha}{\beta} + \dfrac{\beta}{\alpha} = \dfrac{\alpha^2 + \beta^2}{\alpha\beta}$ $\ldots = -\dfrac{9}{5}$	M1 A1	 2	 AG: A0 if $\alpha + \beta = 1$ used
(d)	Product of new roots is 1 Eqn is $5x^2 + 9x + 5 = 0$	B1 B1F	 2	PI by constant term 1 or 5 ft wrong value for product
	Total		**8**	
2(a)	Use of $z^* = x - \mathrm{i}y$ Use of $\mathrm{i}^2 = -1$ $3\mathrm{i}z + 2z^* = (2x - 3y) + \mathrm{i}\,(3x - 2y)$	M1 M1 A1	 3	 Condone inclusion of i in I part
(b)	Equating R and I parts $2x - 3y = 7,\ \ 3x - 2y = 8$ $z = 2 - \mathrm{i}$	M1 m1 A1	 3	 with attempt to solve Allow $x = 2$, $y = -1$
	Total		**6**	
3(a)	$\int x^{-\frac{1}{2}}\ \mathrm{d}x = 2x^{\frac{1}{2}}(+c)$ $x^{\frac{1}{2}} \to \infty$ as $x \to \infty$, so no value	M1A1 E1	 3	M1 for correct power in integral
(b)	$\int x^{-\frac{3}{2}}\ \mathrm{d}x = -2x^{-\frac{1}{2}}(+c)$ $x^{-\frac{1}{2}} \to 0$ as $x \to \infty$ $\int_9^\infty x^{-\frac{3}{2}}\ \mathrm{d}x = -2(0 - \frac{1}{3}) = \frac{2}{3}$	M1A1 E1 A1	 4	M1 for correct power in integral PI Allow A1 for correct answer even if not fully explained
	Total		**7**	
4(a)	Multiplication by $x + 2$ $Y = aX + b$ convincingly shown	M1 A1	 2	applied to all 3 terms AG
(b)(i)	$X = 8, 15, 24$ in table $Y = 5.72, 12, 20.1$ in table	B1 B1	 2	 Allow correct to 2SF

MFP1 (cont)

Q	Solution	Marks	Total	Comments
4(b)(ii)				
	Four points plotted Reasonable line drawn	B1F B1F	2	ft incorrect values in table ft incorrect points
(iii)	Method for gradient a = gradient ≈ 0.9 b = Y-intercept ≈ −1.5	M1 A1 B1F	 3	or algebraic method for a or b Allow from 0.88 to 0.93 incl Allow from −2 to −1 inclusive; ft incorrect points/line **NMS** B1 for a, B1 for b
	Total		**9**	
5(a)	$\cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}$ stated or used	B1		Degrees or decimals penalised in 5th mark only
	Appropriate use of ± Introduction of $2n\pi$	B1 M1		OE OE
	Subtraction of $\frac{\pi}{3}$ and multiplication by 2	m1		All terms multiplied by 2
	$x = -\frac{2\pi}{3} \pm \frac{\pi}{2} + 4n\pi$	A1	5	OE
5(b)	$n = 1$ gives min pos $x = \frac{17\pi}{6}$	M1A1	2	**NMS** 1/2 provided (a) correct
	Total		**7**	
6(a)	$\mathbf{AB} = \begin{bmatrix} 0 & -4 \\ 4 & 0 \end{bmatrix}$	M1A1	2	M1A0 if 3 entries correct
(b)	$\mathbf{A}^2 = \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$	B1		
	... = 4**I**	B1	2	
(c)	$(\mathbf{AB})^2 = -16\mathbf{I}$ $\mathbf{B}^2 = 4\mathbf{I}$ so $\mathbf{A}^2\mathbf{B}^2 = 16\mathbf{I}$ (hence result)	B1 B1 B1	 3	 PI Condone absence of conclusion
	Total		**7**	

MFP1 (cont)

Q	Solution	Marks	Total	Comments
7(a)	Curve translated 7 in y direction ... and 1 in negative x direction	B1 B1	2	or answer in vector form
(b)(i)	Asymptotes $x = -1$ and $y = 7$	B1B1	2	
(ii)	Intersections at (0, 8) ... ... and $(-\frac{8}{7}, 0)$	B1 M1A1	3	Allow AWRT –1.14; NMS 1/2
(c)	 At least one branch Complete graph All correct including asymptotes	B1 B1 B1	3	of correct shape translation of $y = 1/x$ in roughly correct positions
	Total		**10**	
8(a)	Matrix is $\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix}$	M1A1	2	M1 if zeros in correct positions; allow NMS
(b)	 Third triangle shown correctly	M1A1	2	M1A0 if one point wrong

MFP1 (cont)

Q	Solution	Marks	Total	Comments
8(c)	Matrix of reflection is $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	B1		**Alt**: calculating matrix from the coordinates: M1 A2,1
	Multiplication of above matrices	M1		in correct order
	Answer is $\begin{bmatrix} 0 & 1 \\ 3 & 0 \end{bmatrix}$	A1F	3	ft wrong answer to (a); **NMS** 1/3
	Total		**7**	
9(a)	Equation is $y - 4 = m(x - 3)$	M1A1	2	OE; M1A0 if one small error
(b)	Elimination of x	M1		
	$4y - 16 = m(y^2 - 12)$	A1		OE (no fractions)
	Hence result	A1	3	convincingly shown (AG)
(c)	Discriminant equated to zero	M1		
	$(3m - 1)(m - 1) = 0$	m1A1		OE; m1 for attempt at solving
	Tangents $y = x + 1$, $y = \frac{1}{3}x + 3$	A1A1	5	OE
(d)	$m = 1 \Rightarrow y^2 - 4y + 4 = 0$	M1		OE; $m = 1$ needed for this
	so point of contact is (1, 2)	A1		
	$m = \frac{1}{3} \Rightarrow \frac{1}{3}y^2 - 4y + 12 = 0$	M1		OE; $m = \frac{1}{3}$ needed for this
	so point of contact is (9, 6)	A1	4	
	Total		**14**	
	TOTAL		**75**	