

Version 1.0: 0608



# **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.

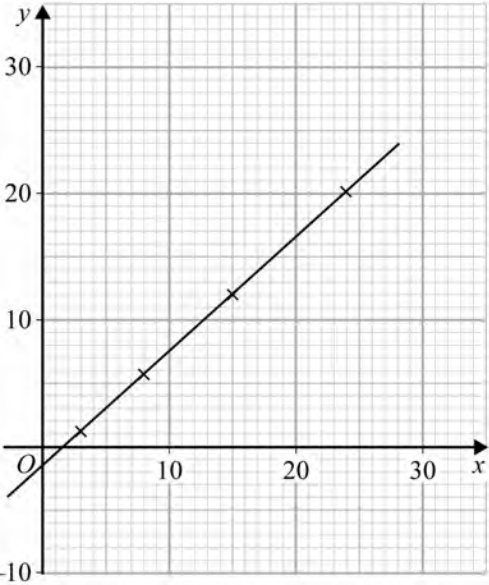
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

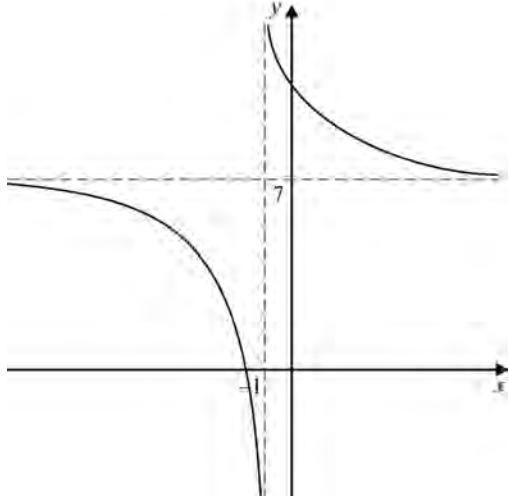
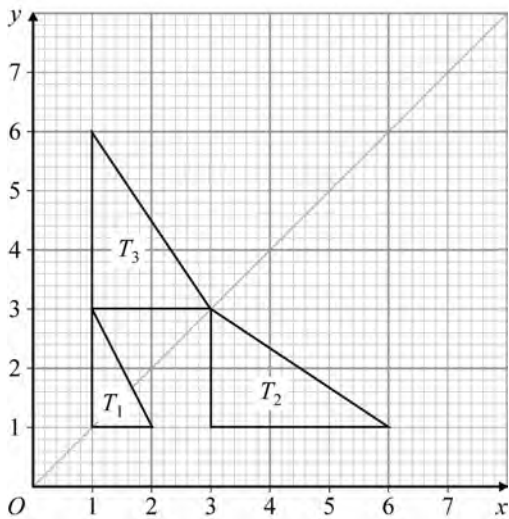
MFP1

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

**MFP1 (cont)**

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

**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)	 <p>At least one branch Complete graph All correct including asymptotes</p>	B1 B1 B1	3	of correct shape translation of $y = 1/x$ in roughly correct positions
<b>Total</b>			<b>10</b>	
8(a)	Matrix is $\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix}$	M1A1	2	M1 if zeros in correct positions; allow NMS
(b)	 <p>Third triangle shown correctly</p>	M1A1	2	M1A0 if one point wrong

**MFP1 (cont)**

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