GCE 2005

January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics

MFP1

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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	OE	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)

MFP1

Q	Solution	Marks	Totals	Comments
1(a)	$\alpha+\beta=5, \alpha\beta=-2$	B1, B1	2	
(b)	$\alpha^2\beta+\alpha\beta^2=\alpha\beta(\alpha+\beta)=-10$	M1A1√	2	ft wrong values
(c)	$(\alpha^2\beta)(\alpha\beta^2)=(\alpha\beta)^3=-8$	M1A1√		ft wrong values
	Equation is $x^2+10x-8=0$	A1√	3	Dep on both M1s; ft wrong values; Condone omission of "= 0"
	Total		**7**	
2(a)	Correct shape	B1		
	Coordinates $(\pm3,0),\ (0,\pm2)$ shown	B2,1	3	Allow labels on sketch
(b)	Attempt to solve $\frac{1}{9}+\frac{y^2}{4}=1$	M1		
	At least one correct root	m1		Allow decimals; allow $\sqrt{\frac{32}{9}}$
	$y=\pm\frac{4}{3}\sqrt{2}$	A1	3	
(c)	Eqn is $\frac{(x-1)^2}{9}+\frac{y^2}{4}=1$	M1A1	2	M1A0 for eg wrong sign
	Total		**8**	
3(a)	$z^*=x-\mathrm{i}y$	B1	1	
(b)	$\mathrm{R}=2x-y$	B1		$\mathrm{i}^2=-1$ must be used
	$\mathrm{I}=-x+2y$	B1	2	Condone $\mathrm{I}=\mathrm{i}(x+2y)$; Answers may appear in (c)
(c)	Equating R and/or I parts	M1		
	Attempt to solve sim equations	m1		
	$z=1+2\mathrm{i}$	A1	3	Allow $x=1,\ y=2$
	Total		**6**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
4(a)	$\int x^{-3}\ \mathrm{d}x = kx^{-2}(+c)$	M1		
	$x^{-n} \to 0$ as $x \to \infty$	M1		
	Improper integral has value 1	A1	3	
(b)	No value as x term tends to ∞	B1	1	OE
(c)	$\int x^{-2}\ \mathrm{d}x = kx^{-1}(+c)$	M1		
	$x^{-1} \to 0$ as $x \to \infty$	m1		
	Improper integral has value 5	A1	3	
	Total		**7**	
5(a)	Transformation is a reflection in $y = x$	B2	2	
(b)	Matrix is $\begin{bmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{bmatrix}$	M1 A2,1	3	M1 for matrix for a rotation; A1 for correct trig expressions
(c)	Attempt to multiply the matrices	M1		
	... in the correct order	m1		
	Matrix is $\begin{bmatrix} -\frac{\sqrt{3}}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$	A1√	3	Wrong answer to (b)
	Total		**8**	
6(a)	Attempt at $\cos^{-1}\frac{1}{\sqrt{2}}$	M1		Allow degrees or decimals
	$\frac{\pi}{4}$ appearing in solution	A1		Must be exact
	Introduction of $\pm$	M1		
	Introduction of $\ldots + 2n\pi$	M1		Or $360n$
	Making x the subject	M1		From $2x + \frac{\pi}{6} = kn\pi + \alpha(\text{or} \pm \alpha)$
	$x = -\frac{\pi}{12} \pm \frac{\pi}{8} + n\pi$	A1	6	OE
(b)	No of roots is 4	M1A1√	2	M1 e.g. for answer consistent with c's general solution
	Total		**8**	

MFP1 (cont)

Q	Solution	Marks	Totals	Comments
7(a)	(X, Y) values: (2.25, 125), (16, 250), (25, 343), (42.25, 512), (64, 729)	B2,1		PI by c's graph
	Five points accurately plotted	B2,1√		ft wrong values
	Reasonable straight line drawn	B1√	5	ft errors in plotting
(b)	Calculation of gradient of line	M1		
	Value of a equal to gradient found	A1		
	Value of $b = y$-intercept of line	B1	3	
	Total		**8**	
8(a)	$f'(x) = 3x^2 - 2$	B1		
	$x_2 = 1 - \frac{-2}{1} = 3$	M1A1	3	
(b)	Tangent at P drawn	B1		
	x_1 and x_2 shown correctly	B1	2	
(c)	$f(2) = 3 > 0$, so root < 2	E2,1	2	E1 for incomplete explanation
(d)	$x_2 = 1.6 - \frac{-0.104}{5.68} \approx 1.618$	M1A1	2	
	Total		**9**	
9(a)	Asymptotes $x = 0,\ y = 1$	B1, B1	2	
(b)(i)	$\Delta = 4 - 8 < 0$, so num never 0	E2,1	2	OE; E1 for incomplete explanation
(ii)	Method for solving quadratic	M1		"i" must appear
	Roots $-1 \pm i$	A2,1	3	A1 if one error made
(c)(i)	$f(x) = k \Rightarrow x^2 + 2x + 2 = kx^2$	M1		
	$\ldots \Rightarrow (1-k)x^2 + 2x + 2 = 0$	m1		
	Equal roots $\Rightarrow 4 - 8(1-k) = 0$	A1	3	Convincingly shown (AG)
(ii)	$k = \frac{1}{2}$	B1		
	$y = \frac{1}{2}$ at SP	B1√		ft wrong value for k
	So $\frac{1}{2}x^2 + 2x + 2 = 0$	M1		
	and $x = -2$ at SP	A1	4	
	Total		**14**	
	TOTAL		**75**	