GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics A
(MAP1)

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.

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Key to Mark Scheme

M ..... mark is for ..... method
m ..... 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
CAO ..... correct answer only
AWFW ..... anything which falls within
AWRT ..... anything which rounds to
AG ..... answer given
SC ..... special case
OE ..... or equivalent
A2,1 ..... 2 or 1 (or 0) accuracy marks
-*x* EE ..... deduct *x* marks for each error
NMS ..... no method shown
PI ..... possibly implied
SCA ..... substantially correct approach
c ..... candidate
SF ..... significant figure(s)
DP ..... decimal place(s)

Abbreviations used in Marking

MC – *x* ..... deducted *x* marks for mis-copy
MR – *x* ..... deducted *x* marks for mis-read
ISW ..... ignored subsequent working
BOD ..... given benefit of doubt
WR ..... work replaced by candidate
FB ..... formulae booklet

Application of Mark Scheme

No method shown:
Correct answer without working ..... mark as in scheme
Incorrect answer without working ..... zero marks unless specified otherwise

More than one method/choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

Crossed out work replaced — do not mark unless it has not been

Alternative solution using a correct or partially correct method — award method and accuracy marks as appropriate

MAP1

Q	Solution	Marks	Total	Comments
1(a)	Formula for *n*th term of AP	M1		Stated or used
	$n = \frac{1}{3}(800-101)+1 = 234$	A1	2	Shown, not verified (AG)
(b)	Formula for sum of AP	M1		Stated or used
	$S = \frac{234}{2}(101+800)$			
	or $S = \frac{234}{2}(2(101)+3(233))$	m1		Allow one error here
	$\ldots = 105\,417$	A1	3	
(c)	$S = \frac{117}{2}(104+800)$			
	Or $S = \frac{117}{2}(2(104) + 6\,(116))$	M1		Allow one error here
	…= 52 884	A1	2	
	Total		**7**	
2(a)(i)	$y' = 4\ldots$	B1		
	$\ldots - 9x^{-2}$	M1A1	3	M1 for kx^{-2}
(ii)	At SP $4 = 9x^{-2}$	M1		
	$\Rightarrow x^2 = \frac{9}{4}$	m1		OE
	SPs are $(\frac{3}{2}, 12)$...	A1A1		
	…and $\left(-\frac{3}{2}, -12\right)$	A1	5	
(b)(i)	$\int y\,dx = 2x^2 + 9\ln x\ (+c)$	M1A1	2	M1 if one term correct
(ii)	Substitutions and subtraction	M1		F(2) – F(1) in c's F(x) (not in y or y')
	Area = (8 + 9 ln 2) – 2	m1		Condone one small error, e.g. use of decimals
	= 6 + 9 ln 2	A1	3	
	Total		**13**	

MAP1 (cont)

Q	Solution	Marks	Total	Comments
3(a)	$\tan\frac{\pi}{4}=1,\ \tan\frac{3\pi}{4}=-1$	B1B1	2	
(b)(i)	$\tan x=\frac{\sin x}{\cos x}$	M1		Stated or used
	$2\tan^2 x+\tan x-1=0$	A1	2	Convincingly shown (AG)
(ii)	$\tan x=-1$ or $\tan x=\frac{1}{2}$	M1A1	2	NMS 2/2 $\tan x = 1$ or $\tan x = -$ $\tan x=-\frac{1}{2}$ M1A0
(iii)	$x\approx 0.464$ or $x=\frac{3\pi}{4}\approx 2.36$	B2,1F	2	B1 for one correct value(AWRT); B2 for both correct and no extras in domain; allow 26.6, 135; ignore values outside domain; ft **only** for the case $\tan x = 1$ or $\tan x=-\frac{1}{2}$
	Total		**8**	
4(a)	Reasonable sketch	B1		with y-axis as asymptote
	(1, 0) clearly indicated	B1	2	
(b)(i)	$y'=\frac{1}{x}$	B1	1	
(ii)	Grad at $x=1$ is 1	B1	1	
(c)(i)	Attempt to reflect in $y=x$	M1		Clearly indicated
	Correct shape near (1, 1)	A1	2	Including tangency; Condone incorrect shape further from (1, 1)
(ii)	e^z appearing in c's solution	M1		Where z is a function of x or y
	Complete correct method	m1		
	$f^{-1}(x)=e^{x-1}$	A1	3	
	Total		**9**	

MAP1 (cont)

Q	Solution	Marks	Total	Comments
5(a)	Arc length formula	M1		Stated or used
	Arc length 2π (cm)	A1	2	Accept unsimplified answers throughout
(b)(i)	Sector area formula	M1		Stated or used
	Sector area 6π (cm^2)	A1	2	Allow AWRT 18.8 or 18.9
(ii)	Appropriate use of $\sin\frac{\pi}{3}$	M1		
	Triangle area $9\sqrt{3}$ (cm^2)	A1	2	Allow AWRT 15.6
(iii)	Segment area $6\pi - 9\sqrt{3}$ (cm^2)	A1F	1	Allow AWRT 3.3 or 3.2 ft wrong answers, dependant on both M1s
(c)	Area = $2(\pi r^2$ – segment area)	M1		
	…= $72\pi - (12\pi - 18\sqrt{3})\,cm^2$	m1		Allow 226 – twice answer to (b)(iii)
	… $\approx 219.67\,cm^2 \approx 220\,cm^2$	A1	3	AG but condone minor accuracy errors provided answer rounds to 220 (3SF)
	Total		**10**	

MAP1 (cont)

Q	Solution	Marks	Total	Comments
6(a)(i)	Stretch parallel to x-axis	M1		
	…SF $\frac{1}{2}$	A1		
	Translation parallel to y-axis	M1		
	…1 unit in neg y direction	A1	4	
(ii)	Range is $f(x) > -1$	B1	1	Condone $\geq$; allow any symbol for $f(x)$
(b)(i)	$y' = 2e^{2x}$	M1A1	2	M1 for ke^{2x}
(ii)	$y'' = 4e^{2x}$	A1	1	
(c)(i)	$gf(x) = \lvert e^{2x} - 1 \rvert$	B1	1	
(ii)	Attempt at reflection in x-axis	M1		For $x < 0$ only
	Correct graph	A1	2	Sharp point and correct curvature needed; (condone incorrect shape as $x \to -\infty$)
(iii)	For $x < 0$, $gf(x) < 1$	E1		
	For $x \geq 0$, $gf(x) = f(x)$			
	So when $gf(x) > 1$, $f(x) > 1$	E1	2	
	Total		**13**	
	Total		**60**	