GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
(MBP1)

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

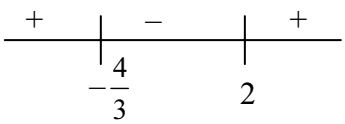
More than one method/choice of solution:

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 — do not mark unless it has not been replaced

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

Mathematics and Statistics B Pure 1 MBP1 January 2005

Question Number and Part	Solution	Marks	Total	Comments
1(a)	Attempt at product of two brackets $(3x + 4)(x - 2)$	M1 A1	2	$(3x...)(x....)$ Correct (ignore further work e.g. roots)
(b)	Use of critical points **AND** sketch or sign diagram  $-\frac{4}{3} < x < 2$	M1 A1	 2	ft their factors M0 for $x < 2$, $3x < -4$ etc Accept $x < 2$, $x > -\frac{4}{3}$ M1, A0 for $-\frac{4}{3} \le x \le 2$ Correct without working scores M1,A1
	Total		**4**	
2(a)(i)	$a + 5d = 19$ $a + 9d = 55$ $= 36 \Rightarrow \quad d = 9$	M1 A1 A1	 3	Use of nth term $= a + (n - 1)d$ condone $a + 6d$ or $a + 10d$ Both correct **ag** be convinced
(ii)	first term, $a = -26$	B1	1	
(b)	$S_n = \frac{n}{2}[2a + (n-1)\mathrm{d}]$ $= 200[-52 + 9 \times 399]$ $= 707\,800$	M1 m1 A1	 3	Condone one slip in formula $n = 400$, $d = 9$ and 'their a' substituted
	Total		**7**	
3(a)(i)	$3^{\frac{1}{2}}$	B1	1	
(ii)	3^{x+2}	B1	1	
(b)	Equating "their" powers of 3 $x + 2 = \frac{1}{2}$ $\Rightarrow x = -1\frac{1}{2}$	M1 A1	 2	or $3^x = \frac{\sqrt{3}}{9} = 3^{\frac{1}{2}-2}$ attempt or $x\log 3 + 2\log 3 = \frac{1}{2}\log 3$
	Total		**4**	

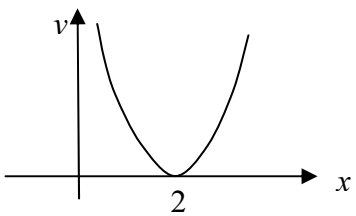
MBP1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)(i)	Gradient $AB = \frac{5}{2}$	B1	1	
(ii)	$y-3=\frac{5}{2}(x-1)$ or $y-8=\frac{5}{2}(x-3)$	M1 A1√		y = "their m" $x + c$ AND attempt to find c ft their gradient
	$5x-2y+1=0$	A1	3	oe with integer coeffs and = 0
(b)(i)	$m_1m_2=-1$ used or stated	M1		
	Gradient $BC = \frac{k-8}{10}$	B1		Or BC equation $y=-\frac{2}{5}x+\frac{46}{5}$
	$\Rightarrow \quad k=4$	A1	3	Accept $y = 4$ or (13, 4)
(ii)	$AB=\sqrt{29}$ or $BC=\sqrt{(8-k)^2+100}$	B1		Either side correct ($BC = \sqrt{116}$)
	Area $= \frac{1}{2}(AB\times BC)$	M1		
	$= 29$	A1	3	cso. Condone calculator use if final answer correct
	Total		**10**	
5(a)	$\cos^{-1}(-0.5) = 120°$	B1		Condone radians (2.094 etc)
	$4x + 40° = A \Rightarrow x=\frac{A-40°}{4}$	M1		$\cos x = \frac{-0.5-40°}{4}$ etc scores M0
	$x = 20°$	A1		cso. A0 for mixture of degrees and radians
	$4x + 40° = 240° \Rightarrow x = 50°$	A1		cso
	$4x + 40° = 480° \Rightarrow x = 110°$ $4x + 40° = 600° \Rightarrow x = 140°$	A1√ A1√	6	ft 90° + their 20° ft 90° + their 50° Withhold last A1 √or last 2 A1√s if extra solutions in the interval
	Total		**6**	

MBP1(cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)(i)	$\frac{dy}{dx} = 6x - \frac{6}{x^4}$	M1 A1 A1	3	Power reduced by 1 in one term One term correct Other term correct
(ii)	'their' $\frac{dy}{dx} = 0 \quad \left(\Rightarrow 6x = \frac{6}{x^4}\right)$	M1		
	$x^5 = 1$	m1		Forming equation x^n = ...
	$\Rightarrow x = 1$	A1	3	
(b)(i)	'their' $\frac{dy}{dx} = 12 \quad \Rightarrow 6x - \frac{6}{x^4} = 12$	M1		
	leading to $x^5 - 2x^4 - 1 = 0$	A1	2	**ag** be convinced
	$f(x) = x^5 - 2x^4 - 1$			
(ii)	f(2) = – 1; f(2.1) = 0.9448...	M1		Attempt at f(2) and f(2.1)
	Change of sign $\Rightarrow$ root between 2 and 2.1	A1	2	Must at least say f(2) < 0 and f(2.1) > 0
(c)(i)	$x^3 - x^{-2}$ (+ constant)	M1 A1 A1	3	Power increased by 1 in one term One term correct Other term correct (ignore + *c*)
(ii)	$\left[8 - \frac{1}{4}\right] - [1 - 1]$	M1		Limits F(2) – F(1) - generous if F(1) = 0
	$= 7\frac{3}{4}$	A1	2	Any equivalent
	Total		**15**	

MBP1(cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	Translation of $\begin{bmatrix}2\\0\end{bmatrix}$	M1 A1		Substantially correct attempt for M1 Shift 2 units across gets M1, A0 etc
	Stretch in y-direction SF 3	M1 A1	4	
(b)(i)	Parabola roughly as drawn	B1	1	
(ii)	Least value 0	M1		
	Range: $f(x) \geqslant 0$	A1	2	NOT $x \geqslant 0$
(c)	$3(x-2)^2 = 15 \Rightarrow (x-2)^2 = 5$	M1		Or multiplying out to $3x^2 - 12x - 3 = 0$
	$x - 2 = \pm\sqrt{5}$ (condone no $\pm$)	m1		Or use of formula on $3x^2 - 12x - 3 = 0$
	$x = 2 \pm \sqrt{5}$	A1	3	oe as FINAL surd answer offered
(d)	f is many-one (or not one-one)	E1	1	Two values of x when $y = 15$ etc
(e)(i)	$f(h) - f(0) = 3(h-2)^2 - 12 = \ldots$	M1		And attempt to multiply out
	$\frac{f(h) - f(0)}{h} = \frac{3h^2 - 12h}{h} = 3h - 12$	A1	2	**ag** be convinced
(ii)	Letting h tend to zero			
	$f'(0) = -12$	B1	1	No marks if simply differentiating f(x)
	Total		**14**	
	TOTAL		**60**	