GCE 2004
November Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
MBP1

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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 mark 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		follow through from previous incorrect result
cao		correct answer only
cso		correct solution only
awfw		anything which falls within
awrt		anything which rounds to
acf		any correct form
ag		answer given
sc		special case
oe		or equivalent
sf		significant figure(s)
dp		decimal place(s)
A2,1		2 or 1 (or 0) accuracy marks
–*x* ee		deduct *x* marks for each error
PI		possibly implied
sca		substantially correct approach

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	gave benefit of doubt
wr	work replaced by candidate
fb	formulae book

Application of Mark Scheme

Correct answer without working	**mark as in scheme**
Incorrect answer without working	**zero marks unless specified otherwise**

Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

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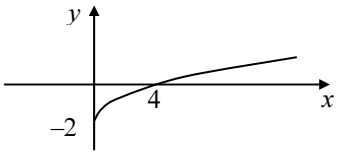
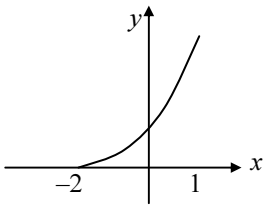
Question Number and Part	Solution	Marks	Total	Comments
1(a)	$a = 3$	B1		$(x+3)^2$
	$b = -5$	B1	2	-5
(b)	$(x+3)^2 = 5$ & attempt at square root	M1		Or use of formula – condone one slip
	$x = -3 \pm \sqrt{5}$	A1	2	oe unsimplified, but involving surd
	Total		**4**	
2(a)(i)	Gradient $PQ = -\frac{5}{3}$	B1	1	
(ii)	Grad of perp $= \frac{3}{5}$	M1		$m_1 \times m_2 = -1$ stated or used
	$y + 10 = \frac{3}{5}(x-8)$	A1	2	oe $5y - 3x + 74 = 0$ or $y = 0.6x - 14.8$
(b)	$5x + 3(x-6) = 10 \quad (\Rightarrow 8x = 28)$	M1		Attempt to eliminate x or y using $y = x - 6$ and one other equation
	$x = 3\frac{1}{2}$	A1		
	$y = -2\frac{1}{2}$	A1	3	$Q\,(3\frac{1}{2}, -2\frac{1}{2})$
(c)	Coordinates of S: $x = 4$	B1		
	$y = 2$	B1	2	$S\,(4, 2)$
	Total		**8**	
3(a)	$\frac{dy}{dx} = 3x^2 - 6x - 9$	M1 A1 A1	3	One term correctly differentiated 2 terms correct all correct (No "+c " etc)
(b)	$3x^2 - 6x - 9 = 0$	M1		their $\frac{dy}{dx} = 0$
	$3(x-3)(x+1) = 0$	m1		Attempt to solve/factorise
	$x = 3, \quad -1$	A1		
	Other stationary point is $(-1, -3)$	A1 √	4	ft their second point's y- coordinate **sc** M1 A1 only for *verification* that $x = 3$ is stat'ry point if no attempt at quadratic
(c)	Minimum point at P	B1		
	Correct analysis of their gradient or y-value either side of $x = 3$	E1	2	Or correct conclusion using second derivative
(d)	$f(5.0) = -3$ and $f(5.1) = 0.721$	M1		Both f(5.0) and f(5.1) attempted
	change of sign $\Rightarrow$ root between 5.0 and 5.1	A1	2	Must have statement and NO wrong values
	Total		**11**	

MBP1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)	$S_n = \frac{n}{2}[2a + (n-1)d]$	M1		Condone one slip in sum of n terms formula
	$S_n = \frac{n}{2}[10 + 6(n-1)]$	m1		Substituting $a = 5$ and $d = 6$
	$= 3n^2 + 2n$	A1	3	**ag** be convinced
(b)(i)	$3n^2 + 2n > 2640$ $(n+30)(3n-88) = 3n^2 + 2n - 2640 > 0$	B1	1	**ag** be convinced
(ii)	$3n > 88 \quad \Rightarrow n > 29\frac{1}{3}$	M1		Or $n = 29.3$ etc.
	n is integer so least value is 30 (or $n = 30$)	A1	2	$n = 30$ implies M1 A1 (**not** $n > 30$)
	Total		**6**	
5(a)	135° or −45° (or – 0.785 radians)	B1		Any correct value from $\tan^{-1}(-1)$
	$3x = angle \Rightarrow x = \frac{angle}{3}$	M1		
	$3x = -45° \quad \Rightarrow x = -15°$	A1		θ –0.262 rads
	$3x = 135° \quad \Rightarrow x = 45°$	A1√		Their $\theta + 60°$ 0.785 rads
	$3x = -225° \quad \Rightarrow x = -75°$	A1√	5	Their $\theta - 60°$ –1.309 rads
				e.g. $x = 15°$ *then* 75° *then* $-45°$ may score M1 A0 A1√ A1√
	Withhold final A1 or A2 for extra solutions in interval (condone radians)			
(b)	Stretch in the x-direction	M1		And no other transformation described
	scale factor $\frac{1}{3}$	A1	2	**sc**1 for stretch SF $\frac{1}{3}$
	Total		**7**	

MBP1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)(i)	f(0) = –2 and f(9) = 1	B1	1	Both
(ii)		B1 B1 B1	3	Graph translated so $y(0) < 0$ (4, 0) indicated or stated (0, –2) indicated or stated
(b)	End points of range; their f(0) and f(9) $-2 \le f(x) \le 1$	M1 A1	2	Or ... > –2 Must have f(x) or y or "range" **not** x
(c)(i)	$y = \sqrt{x} - 2$ and attempt at x = ... $x = (y+2)^2$ $f^{-1}(x) = (x+2)^2$	M1 A1 A1	3	Or flow diagram and reverse attempted $y = (x+2)^2$, if x & y interchanged first
(ii)	f(0) and f(9) as end points or values from their range	M1		Attempt to use their range or half the domain correct
	Domain : $-2 \le x \le 1$	A1√	2	Provided 2 limits and no letter other than x
(iii)		M1 A1	2	Attempt to reflect graph in $y = x$ Or to sketch $y = (x+2)^2$ Correct – only **half** a parabola drawn
	Total		**13**	
7(a)	$y_A = 16 + 14 = 30$; $y_B = 2 + 28 = 30$ Since points have same y-coordinate, AB is parallel to the x-axis.	M1 A1	2	Attempt at both y_A and y_B Both values must be correct for A1
(b)(i)	$7x^2 + \frac{16}{-2x^2} = 7x^2 - \frac{8}{x^2}$ $(+c)$	M1 A1 A1	3	Power increased by 1. Clearly integrating. One term correct All correct – need not be simplified
(ii)	$\left[28 - \frac{8}{4}\right] - [7 - 8]$ $= 27$ Area of rectangle = 30 Shaded region = rectangle – integral (= 3)	M1 A1 B1 B1√	4	F(2) and F(1) attempted Allow negative values etc.
(c)	f(–a) = $-14a + \frac{16}{-a^3}$ Shown to equal – f(a) $\Rightarrow$ odd function	M1 A1	2	Any variable, x, a, etc. but f(–a) attempted
	Total		**11**	
	TOTAL		**60**	