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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MPC1 Pure Core 1

Mark Scheme

2006 examination - January 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.

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.

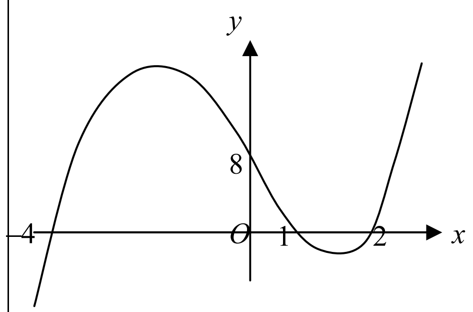
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

MPC1

Q	Solution	Marks	Total	Comments
1(a)	$\left(\sqrt{5}\right)^2 + 2\sqrt{5} - 2\sqrt{5} - 4 = 1$	M1 A1	 2	Multiplying out or difference of two squares attempted Full marks for correct answer /no working
(b)	$\sqrt{8} = 2\sqrt{2}$; $\sqrt{18} = 3\sqrt{2}$ Answer $= 5\sqrt{2}$	M1 A1	 2	Either correct Full marks for correct answer /no working
	Total		**4**	
2(a)(i)	$15 + 4k = 7 \quad \Rightarrow 4k = -8 \quad \Rightarrow k = -2$	B1	1	**AG** (condone verification or $y = -2$)
(ii)	$\frac{1}{2}(x_1 + x_2)$ or $\frac{1}{2}(y_1 + y_2)$ Midpoint coordinates $\left(3, -\frac{1}{2}\right)$	M1 A1	 2	 One coordinate correct implies M1
(b)	Attempt at $\Delta y / \Delta x$ or $y = -\frac{3}{4}x + \frac{7}{4}$ Gradient $AB = -\frac{3}{4}$	M1 A1	 2	(Not *x* over *y*)(may use *M* instead of *A*/*B*) –0.75 etc any correct equivalent
(c)(i)	$m_1 m_2 = -1$ used or stated Hence gradient $AC = \frac{4}{3}$	1 A1√	 2	 Follow through their gradient of *AB* from part (b)
(ii)	$y - 1 = \frac{4}{3}(x - 1)$ or $3y = 4x - 1$ etc	B1√	1	Follow through their gradient of *AC* from part (c) (i) must be **normal** & (1,1) used
(iii)	$y = 0 \qquad \Rightarrow x - 1 = -\frac{3}{4}$ $x = \frac{1}{4}$	M1 A1	 2	Putting $y = 0$ in their *AC* equation and attempting to find *x* **CSO**. *C* has coordinates $\left(\frac{1}{4}, 0\right)$
	Total		**10**	
3(a)(i)	$(x - 2)^2$ $+ 5$	B1 B1	 2	$p = 2$ $q = 5$
(ii)	Minimum point (2, 5) or $x = 2$, $y = 5$	B2√	2	B1 for each coordinate correct or ft **Alt method** M1, A1 sketch, differentiation
(b)(i)	$12 - 2x = x^2 - 4x + 9$ $\Rightarrow x^2 - 2x - 3 = 0$	 B1	 1	Or $x^2 - 4x + 9 + 2x = 12$ **AG** (be convinced) (must have = 0)
(ii)	$(x - 3)(x + 1) = 0$ $x = 3, \quad -1$ Substitute one value of *x* to find *y* Points are (3, 6) and (–1, 14)	M1 A1 M1 A1	 4	Attempt at factors or quadratic formula or one value spotted Both values correct & simplified May substitute into equation for *L* or *C* *y*-coordinates correct linked to *x* values
	Total		**9**	

MPC1 (cont)

Q	Solution	Marks	Total	Comments
4(a)	$(m+4)^2 = m^2 + 8m + 16$	B1		Condone $4m + 4m$
	$b^2 - 4ac = (m+4)^2 - 4(4m+1) = 0$	M1		$b^2 - 4ac$ (attempted and involving m's and no x's) or $b^2 - 4ac = 0$ stated
	$m^2 + 8m + 16 - 16m - 4 = 0$			
	$\Rightarrow m^2 - 8m + 12 = 0$	A1	3	**AG** (be convinced – all working correct- $= 0$ appearing more than right at the end)
(b)	$(m-2)(m-6) = 0$	M1		Attempt at factors or quadratic formula
	$m = 2$, $m = 6$	A1	2	**SC B1** for 2 or 6 only without working
	Total		**5**	
5(a)	$(x-4)^2 + (y+3)^2$	B2		B1 for one term correct
	$(11+16+9=36)$ RHS $= 6^2$	B1	3	Condone 36
(b)(i)	Centre $(4, -3)$	B1$\surd$	1	Ft their a and b from part (a)
(ii)	Radius = 6	B1$\surd$	1	Ft their r from part (a)
(c)(i)	$CO^2 = (-4)^2 + 3^2$	M1		Accept + or – with numbers but must add
	$CO = 5$	A1$\surd$	2	Full marks for answer only
(ii)	Considering CO and radius	M1		
	$CO < r \Rightarrow O$ is **inside** the circle	A1$\surd$	2	Ft outside circle when 'their CO' $> r$ or on the circle when 'their CO' $= r$ **SC** B1$\surd$ *if no explanation given*
	Total		**9**	
6(a)(i)	$\text{p}(2) = 8 + 4 - 20 + 8$	M1		Finding p(2) M0 *long division*
	$= 0$, $\Rightarrow x - 2$ is a factor	A1	2	Shown = 0 **AND** conclusion/ statement about $x - 2$ being a factor
(ii)	Attempt at quadratic factor	M1		or factor theorem again for 2nd factor
	$x^2 + 3x - 4$	A1		or $(x+4)$ or $(x-1)$ proved to be a factor
	$\text{p}(x) = (x-2)(x+4)(x-1)$	A1	3	
(b)		B1		Graph through (0,8) 8 marked
		B1$\surd$		Ft "their factors" 3 roots marked on x-axis
		M1		Cubic curve through their 3 points
		A1	4	Correct including x- intercepts correct Condone max on y-axis etc or slightly wrong concavity at ends of graph
	Total		**9**	

MPC1 (cont)

Q	Solution	Marks	Total	Comments
7(a)(i)	$\frac{dV}{dt} = 2t^5 - 8t^3 + 6t$	M1 A1 A1	3	One term correct unsimplified Further term correct unsimplified All correct unsimplified (no + c etc)
(ii)	$\frac{d^2V}{dt^2} = 10t^4 - 24t^2 + 6$	M1 A1	2	One term FT correct unsimplified **CSO**. All correct simplified
(b)	Substitute $t = 2$ into their $\frac{dV}{dt}$	M1		
	(= 64 – 64 + 12) = 12	A1	2	**CSO**. Rate of change of volume is $12\text{m}^3\ \text{s}^{-1}$
(c)(i)	$t = 1 \Rightarrow \frac{dV}{dt} = 2 - 8 + 6$	M1		Or putting their $\frac{dV}{dt} = 0$
	= 0 $\Rightarrow$ Stationary value	A1	2	**CSO**. Shown to = 0 **AND** statement (If solving equation must obtain $t = 1$)
(ii)	$t = 1 \Rightarrow \frac{d^2V}{dt^2} = -8$	M1		Sub t =1 into their second derivative or equivalent full test.
	Maximum value	A1√	2	Ft if their test implies minimum
	Total		**11**	
8(a)	$y_D = 3 + 1 = 4$ or $y_C = 12 - 8 = 4$	M1		Attempt at either y coordinate
	Area $ABCD$ $= 3 \times 4 = 12$	A1	2	
(b)(i)	$x^3 - \frac{x^4}{4}$ $(+C)$	M1 A1 A1	3	Increase one power by 1 One term correct unsimplified All correct unsimplified (condone no +C)
(ii)	Sub limits –1 and 2 into their (b) (i) ans	M1		May use both –1, 0 and 0, 2 instead
	$[8-4] - \left[-1 - \frac{1}{4}\right] = 5\frac{1}{4}$	A1		
	Shaded area = “their” (rectangle– integral)	M1		Alt method: difference of two integrals
	$= 12 - 5\frac{1}{4} = 6\frac{3}{4}$	A1	4	**CSO**. Attempted M2, A2
(c)(i)	$\frac{dy}{dx} = 6x - 3x^2$	M1 A1	2	One term correct All correct (no +C etc)
(ii)	When x =1, y =2 when x = 1,	B1		May be implied by correct tgt equation
	$\frac{dy}{dx} = 3$ as ‘their’ grad of tgt	M1√		Ft their derivative when $x = 1$
	Tangent is $y - 2 = 3(x-1)$	A1	3	Any correct form $y = 3x - 1$ etc
(iii)	Decreasing when $\frac{dy}{dx} = 6x - 3x^2 < 0$	M1		Watch no fudging here!! May work backwards in proof.
	$3(2x - x^2) < 0 \Rightarrow x^2 - 2x > 0$	A1	2	**AG** (be convinced no step incorrect)
(d)	Two critical points 0 and 2	M1		Marked on diagram or in solution
	$x > 2$, $x < 0$ ONLY	A1	2	or M1 A0 for $0 < x < 2$ or $0 > x > 2$ **SC** B1 for $x > 2$ (or $x < 0$)
	Total		**18**	
	TOTAL		**75**	