GCE

Edexcel GCE

Core Mathematics C2 (6664)

January 2006

advancing learning, changing lives

Mark Scheme (Results)

Edexcel GCE
Core Mathematics C2 (6664)

January 2006
6664 Core Mathematics C2
Mark Scheme

Question number	Scheme		Marks	
1.	(a) $2+1-5+c=0$ or $-2+c=0$		M1	
	$\underline{c=2}$		A1	(2)
	(b) f(x) = $(x-1)(2x^2+3x-2)$	$(x-1)$	B1	
		division	M1	
	$= \ldots\ \underline{(2x-1)(x+2)}$		M1 A1	(4)
	(c) $\text{f}\left(\frac{3}{2}\right)=2\times\frac{27}{8}+\frac{9}{4}-\frac{15}{2}+c$		M1	
	Remainder = $c+1.5$ $= \underline{3.5}$	ft their c	A1ft	(2)
				8

(a) M1 for evidence of substituting $x = 1$ leading to linear equation in c

(b) B1 for identifying $(x-1)$ as a factor

1st M1 for attempting to divide.

Other factor must be at least $\left(2x^2 + \text{ one other term}\right)$

2nd M1 for attempting to factorise a quadratic resulting from attempted division

A1 for just $(2x-1)(x+2)$.

(c) M1 for attempting $\text{f}\left(\pm\frac{3}{2}\right)$. If not implied by $1.5 + c$, we must see some substitution of $\pm\frac{3}{2}$.

A1 follow through their c only, but it must be a number.

Question number	Scheme	Marks
2.	(a) $(1+px)^9 = 1+9px$; $+\binom{9}{2}(px)^2$	B1 B1 (2)
	(b) $9p = 36$, so $\underline{p = 4}$	M1 A1
	$q = \frac{9\times 8}{2}p^2$ or $36p^2$ or $36p$ if that follows from their (a)	M1
	So $\underline{q = 576}$	A1cao (4)
		6
	(a) 2^{nd} B1 for $\binom{9}{2}(px)^2$ or better. Condone " ," not " +".	
	(b) 1^{st} M1 for a linear equation for p.	
	2^{nd} M1 for either printed expression, follow through their p.	
N.B.	$1+9px+36px^2$ leading to $p = 4$, $q = 144$ scores B1B0 M1A1M1A0 i.e 4/6	
3.	(a) $(AB)^2 = (4-3)^2 + (5)^2$ [= 26]	M1
	$AB = \underline{\sqrt{26}}$	A1 (2)
	(b) $p = \left(\frac{4+3}{2}, \frac{5}{2}\right)$	M1
	$= \underline{\left(\frac{7}{2}, \frac{5}{2}\right)}$	A1 (2)
	(c) $(x-x_p)^2 + (y-y_p)^2 = \left(\frac{AB}{2}\right)^2$ LHS	M1
	RHS	M1
	$(x-3.5)^2 + (y-2.5)^2 = 6.5$ oe	A1 c.a.o (3)
		7
	(a) M1 for an expression for AB or AB^2 N.B. $(x_1+x_2)^2+\ldots$ is M0	
	(b) M1 for a full method for x_p	
	(c) 1^{st} M1 for using their x_p and y_p in LHS	
	2^{nd} M1 for using their AB in RHS	
	N.B. $x^2+y^2-7x-5y+12=0$ scores, of course, 3/3 for part (c).	
	Condone use of calculator approximations that lead to correct answer given.	

Question number	Scheme	Marks
4.	(a) $\frac{a}{1-r} = 480$	M1
	$\frac{120}{1-r} = 480 \Rightarrow 120 = 480(1-r)$	M1
	$1 - r = \frac{1}{4} \Rightarrow \quad \underline{r = \frac{3}{4}}$ *	A1cso (3)
	(b) $u_5 = 120 \times \left(\frac{3}{4}\right)^4 [= 37.96875]$ $u_6 = 120 \times \left(\frac{3}{4}\right)^5 [= 28.4765625]$ either	M1
	Difference = <u>9.49</u> (allow $\pm$)	A1 (2)
	(c) $S_7 = \frac{120(1-(0.75)^7)}{1-0.75}$	M1
	= 415.9277… (AWRT) <u>416</u>	A1 (2)
	(d) $\frac{120(1-(0.75)^n)}{1-0.75} > 300$	M1
	$1 - (0.75)^n > \frac{300}{480}$ (or better)	A1
	$n > \frac{\log(0.375)}{\log(0.75)}$ (=3.409…)	M1
	<u>$n = 4$</u>	A1cso (4)
		11
	(a) 1st M1 for use of S_∞ 2nd M1 substituting for *a* and moving (1-*r*) to form linear equation in *r*. (b) M1 for some correct use of ar^{n-1}.[$120(\frac{3}{4})^5 - 120\left(\frac{3}{4}\right)^6$ is M0] (c) M1 for a correct expression (need use of *a* and *r*) (d) 1st M1 for attempting $S_n > 300$ [or = 300](need use of *a* and some use of *r*) 2nd M1 for valid attempt to solve $r^n = p(r, p < 1)$, must give linear eqn in *n*. Any correct log form will do.	<u>For Information</u> $u_1 = 120$ $u_2 = 90$ $u_3 = 67.5$ $u_4 = 50.625$ $S_2 = 210$ $S_3 = 277.5$ $S_4 = 328.125$ $S_5 = 366.09...$
Trial & Imp.	1st M1 for attempting at least 2 values of S_n, one n <4 and one $n \geq 4$. 2nd M1 for attempting S_3 and S_4. 1st A1 for both values correct to 2 s.f. or better. 2nd A1 for $n = 4$.	

Question number	Scheme	Marks
5.	(a) $\cos A\hat{O}B = \dfrac{5^2+5^2-6^2}{2\times5\times5}$ or	M1
	$\sin\theta = \frac{3}{5}$ with use of $\cos 2\theta = 1-2\sin^2\theta$ attempted	
	$= \underline{\dfrac{7}{25}}$ *	A1cso (2)
	(b) $A\hat{O}B = 1.2870022...$ radians 1.287 or better	B1 (1)
	(c) Sector $= \frac{1}{2}\times5^2\times(b)$, $= 16.087\ldots$ (AWRT) <u>16.1</u>	M1 A1 (2)
	(d) Triangle $= \frac{1}{2}\times5^2\times\sin(b)$ or $\frac{1}{2}\times6\times\sqrt{5^2-3^2}$	M1
	Segment = (their sector) – their triangle	dM1
	= (sector from c) – 12 = (AWRT)<u>4.1</u> (ft their part(c))	A1ft (3) **8**
	(a) M1 for a full method leading to $\cos A\hat{O}B$ [N.B. Use of calculator is M0] (usual rules about quoting formulae)	
	(b) Use of (b) in degrees is M0	
	(d) 1st M1 for full method for the area of triangle *AOB*	
	2nd M1 for their sector – their triangle. Dependent on 1st M1 in part (d).	
	A1ft for their sector from part (c) – 12 [or 4.1 following a correct restart].	

Question number	Scheme	Marks
6.	(a) t = 15 25 30 v = $\underline{3.80 \quad 9.72 \quad 15.37}$	B1 B1 B1 (3)
	(b) $S \approx \frac{1}{2}\times 5;[0+15.37+2(1.22+2.28+3.80+6.11+9.72)]$	B1 [M1]
	$= \frac{5}{2}[61.63] = 154.075 =$ AWRT $\underline{154}$	A1 (3)
		6
	(a) S.C. Penalise AWRT these values <u>once</u> at first offence, thus the following marks could be AWRT 2 dp (Max 2/3)	

Question number	Scheme	Marks
7.	(a) $\frac{dy}{dx} = 6x^2 - 10x - 4$	M1 A1 (2)
	(b) $6x^2 - 10x - 4 = 0$	M1
	$2(3x + 1)\left(x-2\right)$ [=0]	M1
	$\underline{x = 2 \text{ or } -\frac{1}{3}}$ (both x values)	A1
	Points are (2, $\underline{-10)}$ and $(-\frac{1}{3}, 2\frac{19}{27}$ or $\frac{73}{27}$ or 2.70 or better) (both y values)	A1 (4)
	(c) $\frac{d^2y}{dx^2} = 12x - 10$	M1 A1 (2)
	(d) $x = 2 \Rightarrow \frac{d^2y}{dx^2}(=14)\underline{> 0} \therefore$ [(2, - 10)] is a <u>Min</u>	M1
	$x = -\frac{1}{3} \Rightarrow \frac{d^2y}{dx^2}(=-14)\underline{< 0} \therefore$ $[\left(-\frac{1}{3}, \frac{73}{27}\right)]$ is a <u>Max</u>	A1 (2)
		10
	(a) M1 for some correct attempt to differentiate $x^n \to x^{n-1}$	
	(b) 1st M1 for setting their $\frac{dy}{dx}$ = 0	
	2nd M1 for attempting to solve 3TQ but it must be based on their $\frac{dy}{dx}$.	
	NO marks for answers only in part (b)	
	(c) M1 for attempting to differentiate their $\frac{dy}{dx}$	
	(d) M1 for one correct use of their second derivative or a full method to determine the nature of one of their stationary points	
	A1 both correct (=14 and = - 14) are not required	

Question number	Scheme		Marks	
8.	(a) $\sin(\theta + 30) = \dfrac{3}{5}$	($\frac{3}{5}$ on RHS)	B1	
	$\theta + 30 = 36.9$	(α = AWRT 37)	B1	
	or $=$ 143.1	$(180 - \alpha)$	M1	
	$\underline{\theta = 6.9,\ \ 113.1}$		A1cao	(4)
	(b) $\tan\theta = \pm 2$ or $\sin\theta = \pm\dfrac{2}{\sqrt{5}}$ or $\cos\theta = \pm\dfrac{1}{\sqrt{5}}$		B1	
	$(\tan\theta = 2 \Rightarrow)$ $\theta = \underline{63.4}$	(β = AWRT 63.4)	B1	
	or $\underline{243.4}$	$(180 + \beta)$	M1	
	$(\tan\theta = -2 \Rightarrow)$ $\theta = \underline{116.6}$	$(180 - \beta)$	M1	
	or $\underline{296.6}$	(180 + their 116.6)	M1	(5)
				9

(a) M1 for 180 – their first solution. Must be at the correct stage i.e. for $\theta + 30$

(b) ALL M marks in (b) must be for $\theta = ...$

1st M1 for 180 + their first solution
2nd M1 for 180 – their first solution
3rd M1 for 180+ their 116.6 or 360 – their first solution

<u>Answers Only</u> can score full marks in both parts

<u>Not 1 d.p.:</u> loses A1 in part (a). In (b) all answers are AWRT.

Ignore extra solutions outside range

<u>Radians</u> Allow M marks for consistent work with radians only, but all A and B marks for angles must be in degrees. Mixing degrees and radians is M0.

Question number	Scheme	Marks
9.	(a) $\frac{3}{2} = -2x^2 + 4x$	M1
	$4x^2 - 8x + 3 (= 0)$	A1
	$(2x-1)(2x-3) = 0$	M1
	$\underline{x = \tfrac{1}{2},\ \tfrac{3}{2}}$	A1 (4)
	(b) Area of $R = \int_{\frac{1}{2}}^{\frac{3}{2}} \left(-2x^2 + 4x\right)\,dx\ -\frac{3}{2}$ (for $-\frac{3}{2}$)	B1
	$\int \left(-2x^2 + 4x\right)\,dx = \left[-\frac{2}{3}x^3 + 2x^2\right]$ (Allow $\pm[\ ]$, accept $\frac{4}{2}x^2$)	M1 [A1]
	$\int_{\frac{1}{2}}^{\frac{3}{2}} \left(-2x^2 + 4x\right)\,dx = \left(-\frac{2}{3}\times\frac{3^3}{2^3} + 2\times\frac{3^2}{2^2}\right) - ,\ \left(-\frac{2}{3}\times\frac{1}{2^3} + 2\times\frac{1}{2^2}\right)$	M1 M1
	$\left(= \frac{11}{6}\right)$	
	Area of $R = \frac{11}{6} - \frac{3}{2} = \underline{\frac{1}{3}}$ (Accept exact equivalent but not 0.33…)	A1cao (6)
		10
	(a) 1st M1 for forming a correct equation 1st A1 for a correct 3TQ (condone missing =0 but must have all terms on one side) 2nd M1 for attempting to solve appropriate 3TQ (b) B1 for subtraction of $\frac{3}{2}$. Either "curve – line" or "integral – rectangle" 1st M1 for some correct attempt at integration $\left(x^n \to x^{n+1}\right)$ 1st A1 for $-\frac{2}{3}x^3 + 2x^2$ only i.e. can ignore $-\frac{3}{2}x$ 2nd M1 for some correct use of their $\frac{3}{2}$ as a limit in integral 3rd M1 for some correct use of their $\frac{1}{2}$ as a limit in integral and subtraction either way round	
Special Case	<u>Line – curve</u> gets B0 but can have the other A marks provided final answer is $+\frac{1}{3}$.	

GENERAL PRINCIPLES FOR C1 & C2 MARKING

Method mark for solving 3 term quadratic:

1. Factorisation

$(x^2 + bx + c) = (x + p)(x + q)$, where $|pq| = |c|$, leading to $x = \ldots$

$(ax^2 + bx + c) = (mx + p)(nx + q)$, where $|pq| = |c|$ and $|mn| = |a|$, leading to $x = \ldots$

2. Formula

Attempt to use correct formula (with values for a, b and c).

3. Completing the square

Solving $x^2 + bx + c = 0$: $(x \pm p)^2 \pm q \pm c$, $p \neq 0$, $q \neq 0$, leading to $x = \ldots$

Method marks for differentiation and integration:

1. Differentiation

Power of at least one term decreased by 1. ($x^n \to x^{n-1}$)

2. Integration

Power of at least one term increased by 1. ($x^n \to x^{n+1}$)

Use of a formula

Where a method involves using a formula that has been learnt, the advice given in recent examiners' reports is that the formula should be quoted first.

Normal marking procedure is as follows:

Method mark for quoting a correct formula and attempting to use it, even if there are mistakes in the substitution of values.

Where the formula is not quoted, the method mark can be gained by implication from correct working with values, but will be lost if there is any mistake in the working.

Exact answers

Examiners' reports have emphasised that where, for example, an exact answer is asked for, or working with surds is clearly required, marks will normally be lost if the candidate resorts to using rounded decimals.

Answers without working

The rubric says that these may gain no credit. Individual mark schemes will give details of what happens in particular cases. General policy is that if it could be done "in your head", detailed working would not be required. Most candidates do show working, but there are occasional awkward cases and if the mark scheme does not cover this, please contact your team leader for advice.

Misreads

A misread must be consistent for the whole question to be interpreted as such.

These are not common. In clear cases, please deduct the first 2 A (or B) marks which would have been lost by following the scheme. (Note that 2 marks is the maximum misread penalty, but that misreads which alter the nature or difficulty of the question cannot be treated so generously and it will usually be necessary here to follow the scheme as written).

Sometimes following the scheme as written is more generous to the candidate than applying the misread rule, so in this case use the scheme as written.

If in doubt please send to review or refer to Team Leader.