edexcel

Edexcel GCE

Mathematics

Core Mathematics C2 6664

Summer 2005

advancing learning, changing lives

Confidential Mark Scheme

Edexcel GCE

Mathematics

Question number	Scheme	Marks
1.	$\dfrac{dy}{dx} = 4x - 12$	B1
	$4x - 12 = 0 \quad x = 3$	M1 A1ft
	$\qquad\qquad y = -18$	A1 (4)
		4

M1: Equate $\dfrac{dy}{dx}$ (not just y) to zero and proceed to $x = \ldots$

A1ft: Follow through only from a linear equation in x.

Alternative:
$y = 2x(x - 6) \Rightarrow$ Curve crosses x-axis at 0 and 6   B1

(By symmetry) $x = 3$ M1 A1ft

$\qquad\qquad y = -18$ A1

Alternative:
$(x - 3)^2$ B1 for $(x - 3)^2$ seen somewhere

$y = 2(x^2 - 6x) = 2\{(x - 3)^2 - 9\} \qquad x = 3$

                   M1 for attempt to complete square and deduce $x = \ldots$

                   A1ft $[\,(x - a)^2 \Rightarrow x = a\,]$

$y = -18$ A1

Question number	Scheme	Marks
2.	(a) $x\log 5 = \log 8$, $\quad x = \dfrac{\log 8}{\log 5}$, $\qquad = 1.29$	M1, A1, A1 (3)
	(b) $\log_2 \dfrac{x+1}{x}$ $\qquad$ (or $\log_2 7x$)	B1
	$\quad \dfrac{x+1}{x} = 7 \qquad x = ..., \qquad \dfrac{1}{6}$ $\qquad$ (Allow 0.167 or better)	M1, A1 (3)
		6
	(a) Answer only 1.29 : Full marks.	
	$\quad$ Answer only, which rounds to 1.29 (e.g. 1.292): M1 A1 A0	
	$\quad$ Answer only, which rounds to 1.3 : M1 A0 A0	
	$\quad$ Trial and improvement: Award marks as for "answer only".	
	(b) M1: Form (by legitimate log work) and solve an equation in x.	
	$\quad$ Answer only: No marks unless verified (then full marks are available).	

Question number	Scheme	Marks
3.	(a) Attempt to evaluate $f(-4)$ or $f(4)$	M1
	$f(-4) = 2(-4)^3 + (-4)^2 - 25(-4) + 12 \quad (= 128 + 16 + 100 + 12) \ = 0$, so ..... is a factor.	A1 (2)
	(b) $(x + 4)(2x^2 - 7x + 3)$	M1 A1
	..........$(2x - 1)(x - 3)$	M1 A1 (4)
		6

	(b) First M requires $(2x^2 + ax + b)$, $a \neq 0, b \neq 0$.
	
	 Second M for the attempt to factorise the quadratic.
	
	 <u>Alternative:</u>
	 $(x + 4)(2x^2 + ax + b) = 2x^3 + (8 + a)x^2 + (4a + b)x + 4b = 0$, then compare
	 coefficients to find <u>values</u> of a and b. [M1]
	                 $a = -7, \ b = 3$ [A1]
	
	 <u>Alternative:</u>
	 Factor theorem: Finding that $f\left(\dfrac{1}{2}\right) = 0, \therefore (2x - 1)$ is a factor [M1, A1]
	
	 n.b. Finding that $f\left(\dfrac{1}{2}\right) = 0, \therefore (x - \dfrac{1}{2})$ is a factor scores M1, A0 ,unless the
	                     factor 2 subsequently appears.
	
	           Finding that $f(3) = 0, \therefore (x - 3)$ is a factor [M1, A1]	

Question number	Scheme	Marks
4.	(a) $1+12px, +\dfrac{12\times11}{2}(px)^2$	B1, B1 (2)
	(b) $12p(x)=-q(x)$ $66p^2(x^2)=11q(x^2)$ (Equate terms, or coefficients)	M1
	$\Rightarrow$ $66p^2=-132p$ (Eqn. in p or q only)	M1
	$p=-2,$ $q=24$	A1, A1 (4)
		6

	(a) Terms can be listed rather than added.
	   First B1: Simplified form must be seen, but may be in (b).
	
	(b) First M: May still have $\begin{pmatrix}12\\2\end{pmatrix}$ or $^{12}C_2$
	
	   Second M: <u>Not</u> with $\begin{pmatrix}12\\2\end{pmatrix}$ or $^{12}C_2$. Dependent upon having p's in each term.
	
	   Zero solutions must be rejected for the final A mark.	

Question number	Scheme	Marks
5.	(a) $(x + 10 =)$ 60 α	B1
	120 (M: $180 - \alpha$ or $\pi - \alpha$)	M1
	$x = 50$ $x = 110$ (or 50.0 and 110.0) (M: Subtract 10)	M1 A1 (4)
	(b) $(2x =)$ 154.2 β Allow a.w.r.t. 154 or a.w.r.t. 2.69 (radians)	B1
	205.8 (M: $360 - \beta$ or $2\pi - \beta$)	M1
	$x = 77.1$ $x = 102.9$ (M: Divide by 2)	M1 A1 (4)
		8

   (a) First M: Must be subtracting from 180 <u>before</u> subtracting 10.

   (b)   First M: Must be subtracting from 360 <u>before</u> dividing by 2,
                <u>or</u> dividing by 2 then subtracting from 180.

In each part:
Extra solutions outside 0 to 180 : Ignore.
Extra solutions between 0 and 180 : A0.

<u>Alternative for (b): (double angle formula)</u>

$1 - 2\sin^2 x = -0.9$ $2\sin^2 x = 1.9$ B1
                              $\sin x = \sqrt{0.95}$ M1
                                $x = 77.1$
                $x = 180 - 77.1 = 102.9$ M1 A1

Question number	Scheme	Marks
6.	(a) Missing y values: 1.6(00) 3.2(00) 3.394	B1 B1 (2)
	(b) $(A =)\ \dfrac{1}{2} \times 4,\ \{(0+0) + 2(1.6 + 2.771 + 3.394 + 3.2)\}$ = 43.86 (or a more accurate value) (or 43.9, or 44)	B1, M1 A1ft A1 (4)
	(c) Volume $= A \times 2 \times 60$ = 5260 (m^3) (or 5270, or 5280)	M1 A1 (2)
		8
	(b) Answer only: No marks. (c) Answer only: Allow. (The M mark in this part can be "implied").	

Question number	Scheme	Marks
7.	(a) $\dfrac{\sin x}{8} = \dfrac{\sin 0.5}{7}$ or $\dfrac{8}{\sin x} = \dfrac{7}{\sin 0.5}$, $\sin x = \dfrac{8\sin 0.5}{7}$	M1 A1ft
	$\sin x = 0.548$	A1 (3)
	(b) $x = 0.58$ (α) (This mark may be earned in (a)).	B1
	$\pi - \alpha = 2.56$	M1 A1ft (3)
		6
	(a) M: Sine rule attempt (sides/angles possibly the "wrong way round"). A1ft: follow through from sides/angles are the "wrong way round". Too many d.p. given: Maximum 1 mark penalty in the complete question. (Deduct on first occurrence).	

Question number	Scheme	Marks	
8.	(a) Centre (5, 0) (or $x = 5$, $y = 0$)	B1 B1	(2)
	(b) $(x \pm a)^2 \pm b \pm 9 + (y \pm c)^2 = 0 \Rightarrow r^2 = ...$ or $r = ...$, Radius $= 4$	M1, A1	(2)
	(c) (1, 0), (9, 0) Allow just $x = 1$, $x = 9$	B1ft, B1ft	(2)
	(d) Gradient of $AT = -\dfrac{2}{7}$	B1	
	$y = -\dfrac{2}{7}(x - 5)$	M1 A1ft	(3)
		9	

(a) (0, 5) scores B1 B0.

(d) M1: Equation of straight line through centre, <u>any</u> gradient (except 0 or ∞).
      (The equation can be in any form).

   A1ft: Follow through from centre, but gradient must be $-\dfrac{2}{7}$.

Question number	Scheme	Marks
9.	(a) $(S =)\ a + ar + ... + ar^{n-1}$ "$S =$" not required. Addition required.	B1
	$(rS =)\ ar + ar^2 + ... + ar^n$ "$rS =$" not required (M: Multiply by r)	M1
	$S(1-r) = a(1-r^n)$ $S = \dfrac{a(1-r^n)}{1-r}$ (M: Subtract and factorise) (*)	M1 A1cso (4)
	(b) $ar^{n-1} = 35000 \times 1.04^3 = 39400$ (M: Correct a and r, with $n = 3, 4$ or 5).	M1 A1 (2)
	(c) $n = 20$ (Seen or implied)	B1
	$S_{20} = \dfrac{35000(1-1.04^{20})}{(1-1.04)}$	M1 A1ft
	(M1: Needs <u>any</u> r value, $a = 35000$, $n = 19, 20$ or 21).	
	(A1ft: ft from $n = 19$ or $n = 21$, but r must be 1.04).	
	$= 1\ 042\ 000$	A1 (4)
		10
	(a) B1: At least the 3 terms shown above, and no extra terms. A1: Requires a completely correct solution. <u>Alternative for the 2 M marks:</u> M1: Multiply numerator and denominator by $1 - r$. M1: Multiply out numerator convincingly, and factorise. (b) M1 can also be scored by a "year by year" method. <u>Answer only:</u> 39 400 scores full marks, 39 370 scores M1 A0. (c) M1 can also be scored by a "year by year" method, <u>with terms added</u>. In this case the B1 will be scored if the correct number of years is considered. <u>Answer only:</u> Special case: 1 042 000 scores 2 B marks, scored as 1, 0, 0, 1 (Other answers score no marks). <u>Failure to round correctly in (b) and (c):</u> Penalise once only (first occurrence).	

Question number	Scheme	Marks
10.	**(a)** $\int \left(2x + 8x^{-2} - 5\right)dx = x^2 + \dfrac{8x^{-1}}{-1} - 5x$	M1 A1 A1
	$\left[x^2 + \dfrac{8x^{-1}}{-1} - 5x\right]_1^4 = (16 - 2 - 20) - (1 - 8 - 5)$ $\quad(=6)$	M1
	$x = 1:\ y = 5$ and $x = 4:\ y = 3.5$	B1
	Area of trapezium $= \dfrac{1}{2}(5 + 3.5)(4 - 1)$ $\quad(=12.75)$	M1
	Shaded area $= 12.75 - 6 = 6.75$ $\qquad$ (M: Subtract either way round)	M1 A1 $\quad$ (8)
	(b) $\dfrac{dy}{dx} = 2 - 16x^{-3}$	M1 A1
	(Increasing where) $\dfrac{dy}{dx} > 0$; $\quad$ For $x > 2,\ \dfrac{16}{x^3} < 2, \therefore \dfrac{dy}{dx} > 0$ $\quad$ (Allow $\geq$)	dM1; A1 $\quad$ (4)
		12
	(a) Integration: One term wrong M1 A1 A0; two terms wrong M1 A0 A0. Limits: M1 for substituting limits 4 and 1 into a changed function, and subtracting the right way round.	
	<u>Alternative:</u> $x = 1:\ y = 5$ and $x = 4:\ y = 3.5$	B1
	Equation of line: $y - 5 = -\dfrac{1}{2}(x - 1)$ $\quad y = \dfrac{11}{2} - \dfrac{1}{2}x$, subsequently used in integration with limits.	3rd M1
	$\left(\dfrac{11}{2} - \dfrac{1}{2}x\right) - \left(2x + \dfrac{8}{x^2} - 5\right)$ $\qquad$ (M: Subtract either way round)	4th M1
	$\int\left(\dfrac{21}{2} - \dfrac{5x}{2} - 8x^{-2}\right)dx = \dfrac{21x}{2} - \dfrac{5x^2}{4} - \dfrac{8x^{-1}}{-1}$	1st M1 A1ft A1ft
	(Penalise integration mistakes, not algebra for the ft marks)	
	$\left[\dfrac{21x}{2} - \dfrac{5x^2}{4} - \dfrac{8x^{-1}}{-1}\right]_1^4 = (42 - 20 + 2) - \left(\dfrac{21}{2} - \dfrac{5}{4} + 8\right)$ $\quad$ (M: Right way round)	2nd M1
	Shaded area $= 6.75$	A1
	(The follow through marks are for the subtracted version, and again deduct an accuracy mark for a wrong term: One wrong M1 A1 A0; two wrong M1 A0 A0.)	
	<u>Alternative for the last 2 marks in (b):</u> M1: Show that $x = 2$ is a minimum, using, e.g., 2nd derivative. A1: Conclusion showing understanding of "increasing", with accurate working.	