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# GCE

## Edexcel GCE

## Core Mathematics C2 (6664)

Summer 2005

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Mark Scheme (Results)

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Core Mathematics C2 (6664)

# June 2005
# 6664 Core Mathematics C2
# Mark Scheme

| Question number | Scheme | Marks |
|---|---|---|
| 1. | $\frac{dy}{dx} = 4x - 12$ | B1 |
| | $4x - 12 = 0 \quad x = 3$ | M1 A1ft |
| | $y = -18$ | A1 (4) |
| | | **4** |
| | M1: Equate $\frac{dy}{dx}$ (not just $y$) to zero and proceed to $x = \ldots$<br>A1ft: Follow through only from a linear equation in $x$.<br><br><u>Alternative:</u><br>$y = 2x(x-6) \Rightarrow$ Curve crosses $x$-axis at 0 and 6 — B1<br>(By symmetry) $x = 3$ — M1 A1ft<br>$y = -18$ — A1<br><br><u>Alternative:</u><br>$(x-3)^2$ — B1 for $(x-3)^2$ seen somewhere<br>$y = 2(x^2 - 6x) = 2\{(x-3)^2 - 9\}$ $\quad x = 3$<br>M1 for attempt to complete square and deduce $x = \ldots$<br>A1ft [ $(x-a)^2 \Rightarrow x = a$ ]<br>$y = -18$ — A1 | |

| Question number | Scheme | Marks |
|---|---|---|
| 2. | (a) $x\log 5 = \log 8$, $x = \frac{\log 8}{\log 5}$, = 1.29 | M1, A1, A1 (3) |
| | (b) $\log_2 \frac{x+1}{x}$ (or $\log_2 7x$ ) | B1 |
| | $\frac{x+1}{x} = 7$ $x = \ldots$, $\frac{1}{6}$ (Allow 0.167 or better) | M1, A1 (3) |
| | | **6** |
| | (a) Answer only 1.29 : Full marks.<br>Answer only, which rounds to 1.29 (e.g. 1.292): M1 A1 A0<br>Answer only, which rounds to 1.3 : M1 A0 A0<br>Trial and improvement: Award marks as for "answer only".<br>(b) M1: Form (by legitimate log work) and solve an equation in *x*.<br>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 $(2x^2 + ax + b),\ a \neq 0, b \neq 0$.<br>Second M for the attempt to factorise the quadratic.<br><br><u>Alternative:</u><br>$(x+4)(2x^2 + ax + b) = 2x^3 + (8+a)x^2 + (4a+b)x + 4b = 0$, then compare coefficients to find <u>values</u> of *a* and *b*. [M1]<br>$a = -7,\ b = 3$ [A1]<br><br><u>Alternative:</u><br>Factor theorem: Finding that $f\left(\frac{1}{2}\right) = 0, \therefore (2x-1)$ is a factor [M1, A1]<br>n.b. Finding that $f\left(\frac{1}{2}\right) = 0, \therefore (x - \frac{1}{2})$ is a factor scores M1, A0 ,unless the factor 2 subsequently appears.<br>Finding that $f(3) = 0, \therefore (x-3)$ is a factor [M1, A1] | | |

| Question number | Scheme | Marks |
|---|---|---|
| 4. | (a) $1+12px,\ +\dfrac{12\times 11}{2}(px)^2$ | B1, B1 (2) |
| | (b) $12p(x) = -q(x)$ $\quad 66p^2(x^2) = 11q(x^2)$ (Equate terms, or coefficients) | M1 |
| | $\Rightarrow \quad 66p^2 = -132p$ (Eqn. in $p$ or $q$ only) | M1 |
| | $p = -2, \quad q = 24$ | A1, A1 (4) |
| | | **6** |
| | (a) Terms can be listed rather than added.<br>First B1: Simplified form must be seen, but may be in (b).<br><br>(b) First M: May still have $\binom{12}{2}$ or ${}^{12}C_2$<br>Second M: <u>Not</u> with $\binom{12}{2}$ or ${}^{12}C_2$. Dependent upon having $p$'s in each term.<br>Zero solutions must be rejected for the final A mark. | |

| Question number | Scheme | Marks |
|---|---|---|
| 5. | (a) $(x+10=)$ 60 $\alpha$ | 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 $\beta$ 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.<br>(b) First M: Must be subtracting from 360 <u>before</u> dividing by 2, <u>or</u> dividing by 2 then subtracting from 180.<br><br>In each part:<br>Extra solutions outside 0 to 180 : Ignore.<br>Extra solutions between 0 and 180 : A0.<br><br><u>Alternative for (b): (double angle formula)</u><br>$1-2\sin^2 x = -0.9$ $2\sin^2 x = 1.9$ B1<br>$\sin x = \sqrt{0.95}$ M1<br>$x = 77.1$<br>$x = 180 - 77.1 = 102.9$ M1 A1 | |

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

| Question number | Scheme | | Marks | |
| --- | --- | --- | --- | --- |
| 7. | (a) | $\frac{\sin x}{8} = \frac{\sin 0.5}{7}$ or $\frac{8}{\sin x} = \frac{7}{\sin 0.5}$, $\sin x = \frac{8\sin 0.5}{7}$ | M1 A1ft | |
| | | $\sin x = 0.548$ | A1 | (3) |
| | (b) | $x = 0.58$ $(\alpha)$ (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").<br>A1ft: follow through from sides/angles are the "wrong way round".<br><br><u>Too many d.p. given:</u><br>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) $(x \pm a)^2 \pm b \pm 9 + (y \pm c)^2 = 0 \Rightarrow r^2 = \ldots$ or $r = \ldots$ ,     Radius = 4 | M1, A1 | (2) |
| | (c) (1, 0),  (9, 0)     Allow just $x = 1$, $x = 9$ | B1ft, B1ft | (2) |
| | (d) Gradient of $AT = -\frac{2}{7}$ | B1 | |
| | $y = -\frac{2}{7}(x-5)$ | M1 A1ft | (3) |
| | | | **9** |
| | (a) (0, 5) scores B1 B0.<br><br>(d) M1: Equation of straight line through centre, <u>any</u> gradient (except 0 or $\infty$) (The equation can be in any form).<br><br>A1ft: Follow through from centre, but gradient must be $-\frac{2}{7}$. | | |

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

| Question number | Scheme | Marks |
|---|---|---|
| 10. | (a) $\int (2x + 8x^{-2} - 5)\,dx = x^2 + \frac{8x^{-1}}{-1} - 5x$ | M1 A1 A1 |
| | $\left[x^2 + \frac{8x^{-1}}{-1} - 5x\right]_1^4 = (16 - 2 - 20) - (1 - 8 - 5)$ (= 6) | M1 |
| | $x = 1$: $y = 5$ and $x = 4$: $y = 3.5$ | B1 |
| | Area of trapezium = $\frac{1}{2}(5 + 3.5)(4 - 1)$ $(= 12.75)$ | M1 |
| | Shaded area = 12.75 – 6 = 6.75 (M: Subtract either way round) | M1 A1 (8) |
| | (b) $\frac{dy}{dx} = 2 - 16x^{-3}$ | M1 A1 |
| | (Increasing where) $\frac{dy}{dx} > 0$; For $x > 2$, $\frac{16}{x^3} < 2$, $\therefore \frac{dy}{dx} > 0$ (Allow ≥) | dM1; A1 (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. | |
| | Alternative: | |
| | $x = 1$: $y = 5$ and $x = 4$: $y = 3.5$ | B1 |
| | Equation of line: $y - 5 = -\frac{1}{2}(x - 1)$ $y = \frac{11}{2} - \frac{1}{2}x$, subsequently used in integration with limits. | 3rd M1 |
| | $\left(\frac{11}{2} - \frac{1}{2}x\right) - \left(2x + \frac{8}{x^2} - 5\right)$ (M: Subtract either way round) | 4th M1 |
| | $\int \left(\frac{21}{2} - \frac{5x}{2} - 8x^{-2}\right)dx = \frac{21x}{2} - \frac{5x^2}{4} - \frac{8x^{-1}}{-1}$ (Penalise integration mistakes, not algebra for the ft marks) | 1st M1 A1ft A1ft |
| | $\left[\frac{21x}{2} - \frac{5x^2}{4} - \frac{8x^{-1}}{-1}\right]_1^4 = (42 - 20 + 2) - \left(\frac{21}{2} - \frac{5}{4} + 8\right)$ (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.) | |
| | Alternative for the last 2 marks in (b): M1: Show that $x = 2$ is a minimum, using, e.g., 2nd derivative. A1: Conclusion showing understanding of "increasing", with accurate working. | |