FOR EDEXCEL

GCE Examinations
Advanced Subsidiary

# Core Mathematics C4

## Paper A

## MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks could be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.

*Written by Shaun Armstrong*

# C4 Paper A – Marking Guide

**1.** $2x(2 + y) + x^2\frac{dy}{dx} - 2y\frac{dy}{dx} = 0$ M2 A2

$\frac{dy}{dx} = \frac{2x(2+y)}{2y-x^2}$ M1 A1 **(6)**

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**2.** *(a)* $f(\frac{1}{10}) = \frac{3}{\sqrt{1-\frac{1}{10}}} = \frac{3}{\sqrt{\frac{9}{10}}} = \frac{3}{(\frac{3}{\sqrt{10}})} = \sqrt{10}$ M1 A1

*(b)* $= 3(1 - x)^{-\frac{1}{2}} = 3[1 + (-\frac{1}{2})(-x) + \frac{(-\frac{1}{2})(-\frac{3}{2})}{2}(-x)^2 + \frac{(-\frac{1}{2})(-\frac{3}{2})(-\frac{5}{2})}{3\times 2}(-x)^3 + \ldots]$ M1

$= 3 + \frac{3}{2}x + \frac{9}{8}x^2 + \frac{15}{16}x^3 + \ldots$ A2

*(c)* $\sqrt{10} = f(\frac{1}{10}) \approx 3 + \frac{3}{20} + \frac{9}{800} + \frac{15}{16000} = 3.1621875$ (8sf) B1

*(d)* $= \frac{\sqrt{10} - 3.1621875}{\sqrt{10}} \times 100\% = 0.003\%$ (1sf) M1 A1 **(8)**

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**3.** *(a)* $1 + 3\lambda = -5 \quad \therefore \lambda = -2$ M1

$p - \lambda = 9 \quad \therefore p = 7$ A1

$-5 + 2\lambda = 11 \quad \therefore q = 2$ A1

*(b)* $1 + 3\lambda = 25 \quad \therefore \lambda = 8$ M1

when $\lambda = 8$, $\mathbf{r} = (\mathbf{i} + 7\mathbf{j} - 5\mathbf{k}) + 8(3\mathbf{i} - \mathbf{j} + 2\mathbf{k}) = (25\mathbf{i} - \mathbf{j} + 11\mathbf{k})$

$\therefore$ (25, –1, 11) lies on $l$ A1

*(c)* $\overrightarrow{OC} = [(1 + 3\lambda)\mathbf{i} + (7 - \lambda)\mathbf{j} + (-5 + 2\lambda)\mathbf{k}]$

$\therefore [(1 + 3\lambda)\mathbf{i} + (7 - \lambda)\mathbf{j} + (-5 + 2\lambda)\mathbf{k}].(3\mathbf{i} - \mathbf{j} + 2\mathbf{k}) = 0$ M1

$3 + 9\lambda - 7 + \lambda - 10 + 4\lambda = 0$ A1

$\lambda = 1 \quad \therefore \overrightarrow{OC} = (4\mathbf{i} + 6\mathbf{j} - 3\mathbf{k})$, $C$ (4, 6, –3) M1 A1

*(d)* $A : \lambda = -2$, $B : \lambda = 8$, $C : \lambda = 1 \quad \therefore AC : CB = 3 : 7$ M1 A1 **(11)**

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**4.** *(a)* $\int \frac{1}{(x-6)(x-3)}\, dx = \int 2\, dt$ M1

$\frac{1}{(x-6)(x-3)} \equiv \frac{A}{x-6} + \frac{B}{x-3}$

$1 \equiv A(x - 3) + B(x - 6)$ M1

$x = 6 \Rightarrow A = \frac{1}{3}$, $x = 3 \Rightarrow B = -\frac{1}{3}$ A2

$\frac{1}{3}\int (\frac{1}{x-6} - \frac{1}{x-3})\, dx = \int 2\, dt$

$\ln|x - 6| - \ln|x - 3| = 6t + c$ M1 A1

$t = 0$, $x = 0 \quad \therefore \ln 6 - \ln 3 = c$, $\quad c = \ln 2$ M1 A1

$x = 2 \Rightarrow \ln 4 - 0 = 6t + \ln 2$ M1

$t = \frac{1}{6}\ln 2 = 0.1155$ hrs $= 0.1155 \times 60$ mins $= 6.93$ mins $\approx 7$ mins A1

*(b)* $\ln\left|\frac{x-6}{2(x-3)}\right| = 6t, \quad t = \frac{1}{6}\ln\left|\frac{x-6}{2(x-3)}\right|$

as $x \to 3$, $t \to \infty \quad \therefore$ cannot make 3 g B2 **(12)**

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**5.** *(a)*

| $x$ | 0 | 0.5 | 1 | 1.5 | 2 |
|---|---|---|---|---|---|
| $y$ | 0 | 1.716 | 1.472 | 1.093 | ~~1.083~~ 0.766 |

B2

area $\approx \frac{1}{2} \times 0.5 \times [0 + $ ~~1.083~~ 0.766 $ + 2(1.716 + 1.472 + 1.093)] = $ ~~2.41~~ 2.33 (3sf) B1 M1 A1

*(b)* volume $= \pi \int_0^2 16x\,e^{-2x}\,dx$ M1

$u = 16x,\ u' = 16,\ v' = e^{-2x},\ v = -\frac{1}{2}e^{-2x}$ M1

$I = -8x\,e^{-2x} - \int -8e^{-2x}\,dx$ A2

$= -8x\,e^{-2x} - 4e^{-2x} + c$ A1

volume $= \pi[-8x\,e^{-2x} - 4e^{-2x}]_0^2$

$= \pi\{(-16e^{-4} - 4e^{-4}) - (0 - 4)\}$ M1

$= 4\pi(1 - 5e^{-4})$ A1 **(12)**

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**6.** *(a)* $= \int (\cos x - \cos 5x)\,dx$ M1 A1

$= \sin x - \frac{1}{5}\sin 5x + c$ M1 A1

*(b)* $u^2 = x + 1 \Rightarrow x = u^2 - 1,\ \frac{dx}{du} = 2u$ M1

$x = 0 \Rightarrow u = 1,\ x = 3 \Rightarrow u = 2$ B1

$I = \int_1^2 \frac{(u^2-1)^2}{u} \times 2u\,du = \int_1^2 (2u^4 - 4u^2 + 2)\,du$ M1 A1

$= [\frac{2}{5}u^5 - \frac{4}{3}u^3 + 2u]_1^2$ M1 A1

$= (\frac{64}{5} - \frac{32}{3} + 4) - (\frac{2}{5} - \frac{4}{3} + 2) = 5\frac{1}{15}$ M1 A1 **(12)**

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**7.** *(a)* $\cos 2t = \frac{1}{2},\ 2t = \frac{\pi}{3},\ t = \frac{\pi}{6}$ M1 A1

*(b)* $\frac{dx}{dt} = -2\sin 2t,\ \frac{dy}{dt} = -\text{cosec}\,t\cot t$ M1

$\frac{dy}{dx} = \frac{-\text{cosec}\,t\cot t}{-2\sin 2t}$ M1 A1

$t = \frac{\pi}{6},\ y = 2,\ \text{grad} = 2$

$\therefore\ y - 2 = 2(x - \frac{1}{2})$ M1

$y = 2x + 1$ A1

*(c)* $x = 0 \Rightarrow t = \frac{\pi}{4}$ B1

$\therefore$ area $= \int_{\frac{\pi}{4}}^{\frac{\pi}{6}} \text{cosec}\,t \times (-2\sin 2t)\,dt$ M1

$= -\int_{\frac{\pi}{4}}^{\frac{\pi}{6}} \text{cosec}\,t \times 4\sin t\cos t\,dt = \int_{\frac{\pi}{6}}^{\frac{\pi}{4}} 4\cos t\,dt$ M1 A1

*(d)* $= [4\sin t]_{\frac{\pi}{6}}^{\frac{\pi}{4}} = 2\sqrt{2} - 2 = 2(\sqrt{2} - 1)$ M2 A1 **(14)**

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Total **(75)**

# Performance Record – C4 Paper A

| Question no. | **1** | **2** | **3** | **4** | **5** | **6** | **7** | Total |
|---|---|---|---|---|---|---|---|---|
| Topic(s) | differentiation | binomial series | vectors | differential equation, partial fractions | trapezium rule, integration | integration | parametric equations | |
| Marks | 6 | 8 | 11 | 12 | 12 | 12 | 14 | 75 |
| Student | | | | | | | | |
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