

Mark Scheme (Results) Summer 2010

GCE

Core Mathematics C4 (6666)

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6666 Core Mathematics C4
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Question Number	Scheme	Marks
1.	(a) $y\left(\frac{\pi}{6}\right) \approx 1.2247, y\left(\frac{\pi}{4}\right) = 1.1180$ accept awrt 4 d.p.	B1 B1 (2)
	(b)(i) $I \approx \left(\frac{\pi}{12}\right)(1.3229 + 2 \times 1.2247 + 1)$ ≈ 1.249	B1 for $\frac{\pi}{12}$ B1 M1 A1
	(ii) $I \approx \left(\frac{\pi}{24}\right)(1.3229 + 2 \times (1.2973 + 1.2247 + 1.1180) + 1)$ ≈ 1.257	B1 for $\frac{\pi}{24}$ B1 M1 A1 (6) [8]

Question Number	Scheme	Marks
2.	$\frac{du}{dx} = -\sin x$ $\int \sin x e^{\cos x+1} dx = -\int e^u du$ $= -e^u$ $= -e^{\cos x+1}$ $\left[-e^{\cos x+1}\right]_0^{\frac{\pi}{2}} = -e^1 - (-e^2)$ $= e(e-1) *$	<p>B1</p> <p>M1 A1</p> <p>A1ft</p> <p>ft sign error</p> <p>or equivalent with u</p> <p>M1</p> <p>A1</p> <p>cso</p> <p>(6)</p> <p>[6]</p>

Question Number	Scheme	Marks
3.	$\frac{d}{dx}(2^x) = \ln 2 \cdot 2^x$ $\ln 2 \cdot 2^x + 2y \frac{dy}{dx} = 2y + 2x \frac{dy}{dx}$ <p>Substituting (3, 2)</p> $8 \ln 2 + 4 \frac{dy}{dx} = 4 + 6 \frac{dy}{dx}$ $\frac{dy}{dx} = 4 \ln 2 - 2$ <p style="text-align: right;">Accept exact equivalents</p>	<p>B1</p> <p>M1 A1= A1</p> <p>M1</p> <p>M1 A1 (7)</p> <p>[7]</p>

Question Number	Scheme	Marks
4.	<p>(a) $\frac{dx}{dt} = 2 \sin t \cos t, \frac{dy}{dt} = 2 \sec^2 t$</p> <p>$\frac{dy}{dx} = \frac{\sec^2 t}{\sin t \cos t} \left(= \frac{1}{\sin t \cos^3 t} \right)$ or equivalent</p> <p>(b) At $t = \frac{\pi}{3}, x = \frac{3}{4}, y = 2\sqrt{3}$</p> <p>$\frac{dy}{dx} = \frac{\sec^2 \frac{\pi}{3}}{\sin \frac{\pi}{3} \cos \frac{\pi}{3}} = \frac{16}{\sqrt{3}}$</p> <p>$y - 2\sqrt{3} = \frac{16}{\sqrt{3}} \left(x - \frac{3}{4} \right)$</p> <p>$y = 0 \Rightarrow x = \frac{3}{8}$</p>	<p>B1 B1</p> <p>M1 A1 (4)</p> <p>B1</p> <p>M1 A1</p> <p>M1</p> <p>M1 A1 (6)</p> <p>[10]</p>

Question Number	Scheme	Marks
5.	<p>(a) $A = 2$ $2x^2 + 5x - 10 = A(x-1)(x+2) + B(x+2) + C(x-1)$ $x \rightarrow 1 \quad -3 = 3B \Rightarrow B = -1$ $x \rightarrow -2 \quad -12 = -3C \Rightarrow C = 4$</p> <p>(b) $\frac{2x^2 + 5x - 10}{(x-1)(x+2)} = 2 + (1-x)^{-1} + 2\left(1 + \frac{x}{2}\right)^{-1}$ $(1-x)^{-1} = 1 + x + x^2 + \dots$ $\left(1 + \frac{x}{2}\right)^{-1} = 1 - \frac{x}{2} + \frac{x^2}{4} + \dots$ $\frac{2x^2 + 5x - 10}{(x-1)(x+2)} = (2+1+2) + (1-1)x + \left(1 + \frac{1}{2}\right)x^2 + \dots$ $= 5 + \dots$ ft their $A - B + \frac{1}{2}C$ $= \dots + \frac{3}{2}x^2 + \dots$ $0x$ stated or implied</p>	<p>B1</p> <p>M1 A1</p> <p>A1 (4)</p> <p>M1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1 ft</p> <p>A1 A1 (7)</p> <p>[11]</p>

Question Number	Scheme	Marks
<p>6.</p>	<p>(a)</p> $f(\theta) = 4\cos^2\theta - 3\sin^2\theta$ $= 4\left(\frac{1}{2} + \frac{1}{2}\cos 2\theta\right) - 3\left(\frac{1}{2} - \frac{1}{2}\cos 2\theta\right)$ $= \frac{1}{2} + \frac{7}{2}\cos 2\theta \quad *$	<p>M1 M1</p> <p>cso A1 (3)</p>
	<p>(b)</p> $\int \theta \cos 2\theta \, d\theta = \frac{1}{2}\theta \sin 2\theta - \frac{1}{2} \int \sin 2\theta \, d\theta$ $= \frac{1}{2}\theta \sin 2\theta + \frac{1}{4}\cos 2\theta$ $\int \theta f(\theta) \, d\theta = \frac{1}{4}\theta^2 + \frac{7}{4}\theta \sin 2\theta + \frac{7}{8}\cos 2\theta$ $\left[\dots \right]_0^{\frac{\pi}{2}} = \left[\frac{\pi^2}{16} + 0 - \frac{7}{8} \right] - \left[0 + 0 + \frac{7}{8} \right]$ $= \frac{\pi^2}{16} - \frac{7}{4}$	<p>M1 A1</p> <p>A1</p> <p>M1 A1</p> <p>M1</p> <p>A1 (7)</p> <p>[10]</p>

Question Number	Scheme	Marks
7.	<p>(a) j components $3 + 2\lambda = 9 \Rightarrow \lambda = 3$ $(\mu = 1)$ Leading to $C : (5, 9, -1)$ accept vector forms</p> <p>(b) Choosing correct directions or finding \overline{AC} and \overline{BC} $\begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 5 \\ 0 \\ 2 \end{pmatrix} = 5 + 2 = \sqrt{6}\sqrt{29} \cos \angle ACB$ use of scalar product $\angle ACB = 57.95^\circ$ awrt 57.95°</p> <p>(c) $A : (2, 3, -4)$ $B : (-5, 9, -5)$ $\overline{AC} = \begin{pmatrix} 3 \\ 6 \\ 3 \end{pmatrix}, \quad \overline{BC} = \begin{pmatrix} 10 \\ 0 \\ 4 \end{pmatrix}$ $AC^2 = 3^2 + 6^2 + 3^2 \Rightarrow AC = 3\sqrt{6}$ $BC^2 = 10^2 + 4^2 \Rightarrow BC = 2\sqrt{29}$ $\Delta ABC = \frac{1}{2} AC \times BC \sin \angle ACB$ $= \frac{1}{2} 3\sqrt{6} \times 2\sqrt{29} \sin \angle ACB \approx 33.5$ $15\sqrt{5}$, awrt 34</p>	<p>M1 A1 A1 (3)</p> <p>M1 M1 A1 A1 (4)</p> <p>M1 A1 A1 M1 A1 (5) [12]</p>
	<p><i>Alternative method for (b) and (c)</i></p> <p>(b) $A : (2, 3, -4)$ $B : (-5, 9, -5)$ $C : (5, 9, -1)$ $AB^2 = 7^2 + 6^2 + 1^2 = 86$ $AC^2 = 3^2 + 6^2 + 3^2 = 54$ $BC^2 = 10^2 + 0^2 + 4^2 = 116$ Finding all three sides $\cos \angle ACB = \frac{116 + 54 - 86}{2\sqrt{116}\sqrt{54}} (= 0.53066 \dots)$ $\angle ACB = 57.95^\circ$ awrt 57.95°</p> <p>If this method is used some of the working may gain credit in part (c) and appropriate marks may be awarded if there is an attempt at part (c).</p>	<p>M1 M1 A1 A1 (4)</p>

Question Number	Scheme	Marks
<p>8.</p>	<p>(a)</p> $\frac{dV}{dt} = 0.48\pi - 0.6\pi h$ $V = 9\pi h \Rightarrow \frac{dV}{dt} = 9\pi \frac{dh}{dt}$ $9\pi \frac{dh}{dt} = 0.48\pi - 0.6\pi h$ <p>Leading to $75 \frac{dh}{dt} = 4 - 5h$ *</p> <p>(b)</p> $\int \frac{75}{4-5h} dh = \int 1 dt$ <p style="text-align: right;">separating variables</p> $-15 \ln(4-5h) = t (+C)$ $-15 \ln(4-5h) = t + C$ <p>When $t = 0, h = 0.2$</p> $-15 \ln 3 = C$ $t = 15 \ln 3 - 15 \ln(4-5h)$ <p>When $h = 0.5$</p> $t = 15 \ln 3 - 15 \ln 1.5 = 15 \ln \left(\frac{3}{1.5} \right) = 15 \ln 2$ <p>awrt 10.4</p> <p><i>Alternative for last 3 marks</i></p> $t = \left[-15 \ln(4-5h) \right]_{0.2}^{0.5}$ $= -15 \ln 1.5 + 15 \ln 3$ $= 15 \ln \left(\frac{3}{1.5} \right) = 15 \ln 2$ <p>awrt 10.4</p>	<p>M1 A1</p> <p>B1</p> <p>M1</p> <p>cs0 A1 (5)</p> <p>M1</p> <p>M1 A1</p> <p>M1</p> <p>M1 A1</p> <p>M1 M1</p> <p>A1 (6)</p>

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