

Edexcel GCE
Core Mathematics C3
Silver Level S4
(Mark Scheme)

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Question Number	Scheme	Marks
1. (a)	$7 \cos x - 24 \sin x = R \cos(x + \alpha)$ $7 \cos x - 24 \sin x = R \cos x \cos \alpha - R \sin x \sin \alpha$ <p>Equate $\cos x$: $7 = R \cos \alpha$ Equate $\sin x$: $24 = R \sin \alpha$</p> $R = \sqrt{7^2 + 24^2} = 25$ $\tan \alpha = \frac{24}{7} \Rightarrow \alpha = 1.287002218\dots^{\circ}$ <p>Hence, $7 \cos x - 24 \sin x = 25 \cos(x + 1.287)$</p>	$R = 25$ B1 $\tan \alpha = \frac{24}{7}$ or $\tan \alpha = \frac{7}{24}$ M1 awrt 1.287 A1 (3)
(b)	Minimum value = <u>-25</u>	-25 or -R B1ft (1)
(c)	$7 \cos x - 24 \sin x = 10$ $25 \cos(x + 1.287) = 10$ $\cos(x + 1.287) = \frac{10}{25}$ <p>PV = 1.159279481...[°] or 66.42182152...[°]</p> <p>So, $x + 1.287 = \{1.159279\dots^{\circ}, 5.123906\dots^{\circ}, 7.442465\dots^{\circ}\}$ gives, $x = \{3.836906\dots, 6.155465\dots\}$</p>	$\cos(x \pm \text{their } \alpha) = \frac{10}{(\text{their } R)}$ M1 For applying $\cos^{-1}\left(\frac{10}{(\text{their } R)}\right)$ M1 either $2\pi +$ or $-$ their PV [°] or M1 $360^{\circ} +$ or $-$ their PV [°] awrt 3.84 OR 6.16 A1 awrt 3.84 AND 6.16 A1 (5) [9]

Question Number	Scheme	Marks
2. (a)	$\cos^2 \theta + \sin^2 \theta = 1 \quad (\div \cos^2 \theta)$ $\frac{\cos^2 \theta}{\cos^2 \theta} + \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1}{\cos^2 \theta}$ $1 + \tan^2 \theta = \sec^2 \theta$ $\tan^2 \theta = \sec^2 \theta - 1 \quad (\text{as required})$	M1 A1 cso (2)
(b)	$2 \tan^2 \theta + 4 \sec \theta + \sec^2 \theta = 2, \quad (\text{eqn } *) \quad 0 \leq \theta < 360^\circ$ $2(\sec^2 \theta - 1) + 4 \sec \theta + \sec^2 \theta = 2$ $2 \sec^2 \theta - 2 + 4 \sec \theta + \sec^2 \theta = 2$ $3 \sec^2 \theta + 4 \sec \theta - 4 = 0$ $(\sec \theta + 2)(3 \sec \theta - 2) = 0$ $\sec \theta = -2 \quad \text{or} \quad \sec \theta = \frac{2}{3}$ $\frac{1}{\cos \theta} = -2 \quad \text{or} \quad \frac{1}{\cos \theta} = \frac{2}{3}$ $\underline{\cos \theta = -\frac{1}{2}}; \quad \text{or} \quad \underline{\cos \theta = \frac{3}{2}}$ $\alpha = 120^\circ \quad \text{or} \quad \alpha = \text{no solutions}$ $\theta_1 = \underline{120^\circ}$ $\theta_2 = 240^\circ$	M1 M1 M1 A1; <u>A1</u> B1 ft (6) [8]

Question Number	Scheme	Marks
3. (a)	$5 \cos x - 3 \sin x = R \cos(x + \alpha), \quad R > 0, \quad 0 < x < \frac{\pi}{2}$ $5 \cos x - 3 \sin x = R \cos x \cos \alpha - R \sin x \sin \alpha$ <p>Equate $\cos x$: $5 = R \cos \alpha$ Equate $\sin x$: $3 = R \sin \alpha$</p> $R = \sqrt{5^2 + 3^2}; = \sqrt{34} \quad \{= 5.83095..\}$ $\tan \alpha = \frac{3}{5} \Rightarrow \alpha = 0.5404195003...^\circ$ <p>Hence, $5 \cos x - 3 \sin x = \sqrt{34} \cos(x + 0.5404)$</p>	M1; A1 M1 A1 (4)
(b)	$5 \cos x - 3 \sin x = 4$ $\sqrt{34} \cos(x + 0.5404) = 4$ $\cos(x + 0.5404) = \frac{4}{\sqrt{34}} \quad \{= 0.68599...\}$ $(x + 0.5404) = 0.814826916...^\circ$ $x = 0.2744...^\circ$ $(x + 0.5404) = 2\pi - 0.814826916...^\circ \quad \{= 5.468358...^\circ\}$ $x = 4.9279...^\circ$ <p>Hence, $x = \{0.27, 4.93\}$</p>	M1 M1 A1 M1 A1 (5) [9]

Question Number	Scheme	Marks
<p>4. (a)</p> <p>(b)</p>	$\frac{2x+2}{x^2-2x-3} - \frac{x+1}{x-3} = \frac{2x+2}{(x-3)(x+1)} - \frac{x+1}{x-3}$ $= \frac{2x+2-(x+1)(x+1)}{(x-3)(x+1)}$ $= \frac{(x+1)(1-x)}{(x-3)(x+1)}$ $= \frac{1-x}{x-3}$ <p style="text-align: right;">Accept $-\frac{x-1}{x-3}, \frac{x-1}{3-x}$</p> $\frac{d}{dx}\left(\frac{1-x}{x-3}\right) = \frac{(x-3)(-1) - (1-x)1}{(x-3)^2}$ $= \frac{-x+3-1+x}{(x-3)^2} = \frac{2}{(x-3)^2} \quad *$ <p style="text-align: right;">cs0</p>	<p>M1 A1</p> <p>M1</p> <p>A1 (4)</p> <p>M1 A1</p> <p>A1 (3)</p> <p style="text-align: right;">[7]</p>
<p>5. (a)</p> <p>(b)</p> <p>(c)</p>	<p>$p = 7.5$</p> <p>$2.5 = 7.5e^{-4k}$</p> <p>$e^{-4k} = \frac{1}{3}$</p> <p>$-4k = \ln\left(\frac{1}{3}\right)$</p> <p>$-4k = -\ln(3)$</p> <p>$k = \frac{1}{4}\ln(3)$</p> <p>$\frac{dm}{dt} = -kpe^{-kt}$</p> <p>$-\frac{1}{4}\ln 3 \times 7.5e^{-\frac{1}{4}(\ln 3)t} = -0.6\ln 3$</p> <p>$e^{-\frac{1}{4}(\ln 3)t} = \frac{2.4}{7.5} = (0.32)$</p> <p>$-\frac{1}{4}(\ln 3)t = \ln(0.32)$</p> <p>$t = 4.1486$</p> <p style="text-align: right;">ft on their p and k</p>	<p>B1</p> <p>(1)</p> <p>M1</p> <p>M1</p> <p>dM1</p> <p>A1</p> <p>(4)</p> <p>M1A1ft</p> <p>M1A1</p> <p>dM1</p> <p>A1</p> <p>(6)</p> <p style="text-align: right;">[11]</p>

Question Number	Scheme	Marks
6. (a)	$\frac{1}{\sin 2\theta} - \frac{\cos 2\theta}{\sin 2\theta} = \frac{1 - \cos 2\theta}{\sin 2\theta}$ $= \frac{2\sin^2 \theta}{2\sin \theta \cos \theta}$ $= \frac{\sin \theta}{\cos \theta} = \tan \theta$	M1 M1A1 cso A1* (4)
(b)(i)	$\tan 15^\circ = \frac{1}{\sin 30^\circ} - \frac{\cos 30^\circ}{\sin 30^\circ}$ $\tan 15^\circ = \frac{1}{\frac{1}{2}} - \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = 2 - \sqrt{3}$	M1 cso dM1 A1 (3)
(b)(ii)	$\tan 2x = 1$ $2x = 45^\circ$ $2x = 45^\circ + 180^\circ$ $x = 22.5^\circ, 112.5^\circ, 202.5^\circ, 292.5^\circ$	M1 A1 M1 A1(any two) A1 (5) [12]

Question Number	Scheme	Marks
7.	<p>(a) $\frac{2}{x+2} + \frac{4}{x^2+5} - \frac{18}{(x+2)(x^2+5)} = \frac{2(x^2+5)+4(x+2)-18}{(x+2)(x^2+5)}$</p> $= \frac{2x(x+2)}{(x+2)(x^2+5)}$ $= \frac{2x}{(x^2+5)}$ <p>(b) $h'(x) = \frac{(x^2+5) \times 2 - 2x \times 2x}{(x^2+5)^2}$</p> $h'(x) = \frac{10-2x^2}{(x^2+5)^2}$ <p>(c) Maximum occurs when $h'(x) = 0 \Rightarrow 10 - 2x^2 = 0 \Rightarrow x = \dots$ $\Rightarrow x = \sqrt{5}$</p> <p>When $x = \sqrt{5} \Rightarrow h(x) = \frac{\sqrt{5}}{5}$</p> <p>Range of $h(x)$ is $0 \leq h(x) \leq \frac{\sqrt{5}}{5}$</p>	<p>M1A1</p> <p>M1</p> <p>A1*</p> <p>(4)</p> <p>M1A1</p> <p>cso A1</p> <p>(3)</p> <p>M1</p> <p>A1</p> <p>M1,A1</p> <p>A1ft</p> <p>(5)</p> <p>[12]</p>
8. (a)	$D = 10, t = 5, \quad x = 10e^{-\frac{1}{8} \times 5}$ $= 5.353$ <p style="text-align: right;">awrt</p>	<p>M1</p> <p>A1 (2)</p>
(b)	$D = 10 + 10e^{-\frac{5}{8}}, t = 1, \quad x = 15.3526\dots \times e^{-\frac{1}{8}}$ $x = 13.549 \quad (*)$	<p>M1</p> <p>A1 cso</p> <p>(2)</p>
(c)	$15.3526\dots e^{-\frac{1}{8}T} = 3$ $e^{-\frac{1}{8}T} = \frac{3}{15.3526\dots} = 0.1954\dots$ $-\frac{1}{8}T = \ln 0.1954\dots$ $T = 13.06\dots$ or 13.1 or 13	<p>M1</p> <p>M1</p> <p>A1 (3)</p> <p>[7]</p>

Statistics for C3 Practice Paper Silver Level S4

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade:							
				ALL	A*	A	B	C	D	E	U
1	9		72	6.51	8.50	7.82	6.83	5.72	4.70	3.35	1.86
2	8		80	6.36		7.70	7.03	6.12	4.73	3.16	1.45
3	9		75	6.78		8.31	7.22	6.31	4.71	3.22	1.89
4	7		76	5.32		6.74	6.03	5.06	4.51	3.57	2.57
5	11		64	7.08	10.51	9.01	7.42	5.93	4.46	3.08	1.64
6	12		63	7.51	11.64	10.21	8.04	5.82	3.84	2.21	1.04
7	12		68	8.11	11.51	10.12	8.52	7.26	6.31	5.36	3.87
8	7		62	4.33		5.17	4.35	3.91	3.61	3.33	2.39
	75		69	52.00		65.08	55.44	46.13	36.87	27.28	16.71