

6665 Core C3

Mark Scheme (Post standardisation)

Question Number	Scheme	Marks
1 (a)	Dividing by $\cos^2 \theta$: $\frac{\sin^2 \theta}{\cos^2 \theta} + \frac{\cos^2 \theta}{\cos^2 \theta} \equiv \frac{1}{\cos^2 \theta}$ Completion : $1 + \tan^2 \theta \equiv \sec^2 \theta$ (no errors seen)	M1 A1 (2)
(b)	Use of $1 + \tan^2 \theta = \sec^2 \theta$: $2(\sec^2 \theta - 1) + \sec \theta = 1$ [$2\sec^2 \theta + \sec \theta - 3 = 0$] Factorising or solving: $(2\sec \theta + 3)(\sec \theta - 1) = 0$ [$\sec \theta = -\frac{3}{2}$ or $\sec \theta = 1$] $\theta = 0$ $\cos \theta = -\frac{2}{3}$; $\theta_1 = 131.8^\circ$ $\theta_2 = 228.2^\circ$ [A1ft for $\theta_2 = 360^\circ - \theta_1$]	M1 M1 B1 M1 A1 A1√ (6) [8]

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2	<p>(a) (i) $6 \sin x \cos x + 2 \sec 2x \tan 2x$</p> <p>or $3 \sin 2x + 2 \sec 2x \tan 2x$ [M1 for $6 \sin x$]</p> <p>(ii) $3(x + \ln 2x)^2(1 + \frac{1}{x})$ [B1 for $3(x + \ln 2x)^2$]</p> <p>(b) Differentiating numerator to obtain $10x - 10$</p> <p>Differentiating denominator to obtain $2(x-1)$</p> <p>Using quotient rule formula correctly:</p> <p>To obtain $\frac{dy}{dx} = \frac{(x-1)^2(10x-10) - (5x^2-10x+9)2(x-1)}{(x-1)^4}$</p> <p>Simplifying to form $\frac{2(x-1)[5(x-1)^2 - (5x^2-10x+9)]}{(x-1)^4}$</p> <p>$= -\frac{8}{(x-1)^3} \quad * \quad (\text{c.s.o.})$</p>	<p>M1A1A1 (3)</p> <p>B1M1A1 (3)</p>
3	<p>(a) $\frac{5x+1}{(x+2)(x-1)} - \frac{3}{x+2}$ $= \frac{5x+1-3(x-1)}{(x+2)(x-1)}$ M1 for combining fractions even if the denominator is not lowest common</p> <p>$= \frac{2x+4}{(x+2)(x-1)} = \frac{2(x+2)}{(x+2)(x-1)} = \frac{2}{x-1} \quad *$ M1 must have linear numerator</p> <p>(b) $y = \frac{2}{x-1} \Rightarrow xy - y = 2 \Rightarrow xy = 2 + y$</p> <p>$f^{-1}(x) = \frac{2+x}{x} \quad \text{o.e.}$</p> <p>$fg(x) = \frac{2}{x^2+4} \quad (\text{attempt}) \quad [\frac{2}{"g"-1}]$</p> <p>Setting $\frac{2}{x^2+4} = \frac{1}{4}$ and finding $x^2 = \dots; \quad x = \pm 2$</p>	<p>B1</p> <p>M1</p> <p>M1 A1 cso (4)</p> <p>M1A1</p> <p>A1 (3)</p> <p>M1</p> <p>M1; A1 (3)</p> <p>[10]</p>

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4	<p>(a) $f'(x) = 3e^x - \frac{1}{2x}$</p> <p>$3e^x - \frac{1}{2x} = 0$</p> <p>$\Rightarrow 6\alpha e^\alpha = 1 \quad \Rightarrow \alpha = \frac{1}{6} e^{-\alpha} \quad (*)$</p> <p>(c) $x_1 = 0.0613..., x_2 = 0.1568..., x_3 = 0.1425..., x_4 = 0.1445....$</p> <p>[M1 at least x_1 correct, A1 all correct to 4 d.p.]</p> <p>(d) Using $f'(x) = 3e^x - \frac{1}{2x}$ with suitable interval</p> <p>e.g. $f'(0.14425) = -0.0007$</p> <p>$f'(0.14435) = +0.002(1)$</p> <p>Accuracy (change of sign and correct values)</p>	<p>M1A1A1 (3)</p> <p>M1</p> <p>A1 cso (2)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>A1 (2)</p> <p>[9]</p>

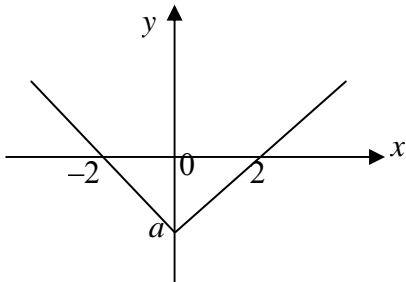
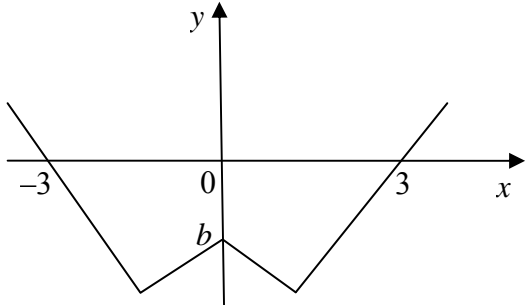
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5	<p>(a) $\cos 2A = \cos^2 A - \sin^2 A$ (+ use of $\cos^2 A + \sin^2 A \equiv 1$)</p> <p>$= (1 - \sin^2 A); -\sin^2 A = 1 - 2\sin^2 A$ (*)</p> <p>(b) $2\sin 2\theta - 3\cos 2\theta - 3\sin \theta + 3 \equiv 4\sin \theta \cos \theta; -3(1 - 2\sin^2 \theta) - 3\sin \theta + 3$</p> <p>$\equiv 4\sin \theta \cos \theta + 6\sin^2 \theta - 3\sin \theta$</p> <p>$\equiv \sin \theta(4\cos \theta + 6\sin \theta - 3)$ (*)</p> <p>(c) $4\cos \theta + 6\sin \theta \equiv R\sin \theta \cos \alpha + R\cos \theta \sin \alpha$</p> <p>Complete method for R (may be implied by correct answer)</p> <p>$[R^2 = 4^2 + 6^2, R\sin \alpha = 4, R\cos \alpha = 6]$</p> <p>$R = \sqrt{52}$ or 7.21</p> <p>Complete method for α; $\alpha = 0.588$ (allow 33.7°)</p> <p>(d) $\sin \theta (4\cos \theta + 6\sin \theta - 3) = 0$</p> <p>$\theta = 0$</p> <p>$\sin(\theta + 0.588) = \frac{3}{\sqrt{52}} = 0.4160..$ (24.6°)</p> <p>$\theta + 0.588 = (0.4291), 2.7125$ [or $\theta + 33.7^\circ = (24.6^\circ), 155.4^\circ$]</p> <p>$\theta = 2.12$ cao</p>	<p>M1</p> <p>A1 (2)</p> <p>B1; M1</p> <p>M1</p> <p>A1 (4)</p> <p>M1</p> <p>A1</p> <p>M1 A1 (4)</p> <p>M1</p> <p>B1</p> <p>M1</p> <p>dM1</p> <p>A1 (5)</p> <p>[15]</p>

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6. (a)	<p>Translation \leftarrow by 1</p>  <p>Intercepts correct</p>	M1 A1 (2)
(b)	 <p>$x \geq 0$, correct “shape” [provided not just original]</p> <p>Reflection in y-axis</p> <p>Intercepts correct</p>	B1 B1√ B1 (3)
(c)	$a = -2, \quad b = -1$	B1 B1 (2)
(d)	<p>Intersection of $y = 5x$ with $y = -x - 1$</p> <p>Solving to give $x = -\frac{1}{6}$</p> <p>[Notes: (i) If both values found for $5x = -x - 1$ and $5x = x - 3$, or solved algebraically, can score 3 out of 4 for $x = -\frac{1}{6}$ and $x = -\frac{3}{4}$; required to eliminate $x = -\frac{3}{4}$ for final mark. (ii) Squaring approach: M1 correct method, $24x^2 + 22x + 3 = 0$ (correct 3 term quadratic, any form) A1 Solving M1, Final correct answer A1.]</p>	M1A1 M1A1 (4) [11]

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7	<p>(a) Setting $p = 300$ at $t = 0 \Rightarrow 300 = \frac{2800a}{1 + a}$ $(300 = 2500a); \quad a = 0.12 \text{ (c.s.o) } *$</p> <p>(b) $1850 = \frac{2800(0.12)e^{0.2t}}{1 + 0.12e^{0.2t}} ; \quad e^{0.2t} = 16.2...$ Correctly taking logs to $0.2 t = \ln k$ $t = 14 \quad (13.9..)$</p> <p>(c) Correct derivation: (Showing division of num. and den. by $e^{0.2t}$; using a)</p> <p>(d) Using $t \rightarrow \infty, e^{-0.2t} \rightarrow 0,$ $p \rightarrow \frac{336}{0.12} = 2800$</p>	<p>M1 dM1A1 (3)</p> <p>M1A1 M1 A1 (4)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p>[10]</p>