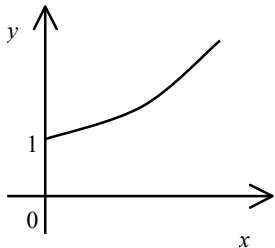
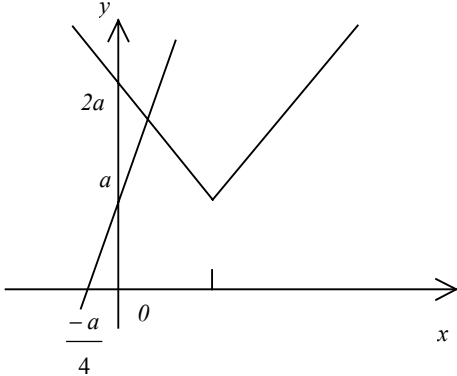


Question Number	Scheme	Marks
1.	<p>(a) $\frac{2}{x-3} + \frac{13}{(x-3)(x+7)}$ $= \frac{2(x+7)+13}{(x-3)(x+7)} = \frac{2x+27}{(x-3)(x+7)}$</p> <p>(b) $2x+27 = x^2 + 4x - 21$ $x^2 + 2x - 48 = (x+8)(x-6) = 0$ $x = -8, 6$</p>	<p>M1</p> <p>M1 A1 <u>3</u></p> <p>M1</p> <p>M1 A1 <u>3</u> <u>6</u></p>
2.	<p>(a) </p> <p>(b) $£800 \times 1.04^{10} \approx £1184$</p> <p>(c) $1.04^x = 2$ $x = \frac{\ln 2}{\ln 1.04} \approx 18 \text{ (years)}$</p>	<p>Shape B1</p> <p>domain, intercept B1 <u>2</u></p> <p>cao M1 A1 <u>2</u></p> <p>M1</p> <p>M1 A1 <u>3</u> <u>7</u></p>

Question Number	Scheme	Marks
3.	<p>(a) $1 + nax, + \frac{n(n-1)}{2}(ax)^2 + \frac{n(n-1)(n-2)}{6}(ax)^3 + \dots$ accept 2!, 3!</p> <p>(b) $na = 8, \frac{n(n-1)}{2}a^2 = 30$ both</p> <p>$\frac{n(n-1)}{2} \cdot \frac{64}{n^2} = 30, \frac{\frac{8}{a}(\frac{8}{a}-1)a^2}{2} = 30$ either</p> <p>$n = 16, a = \frac{1}{2}$</p> <p>(c) $\frac{16.15.14}{6} \cdot \left(\frac{1}{2}\right)^3 = 70$</p>	<p>B1, B1 <u>2</u></p> <p>M1</p> <p>M1</p> <p>A1, A1 <u>4</u></p> <p>M1 A1 <u>2 8</u></p>
4.	<p>(a) $\frac{8}{x} - x^2 = 0 \Rightarrow x^3 = 8 \Rightarrow x = 2$</p> <p>(b) $\left(\frac{8}{x} - x^2\right) = x^4 - 16x + \frac{64}{x^2}$ M1 3(or 4) terms</p> <p>$\int(x^4 - 16x + 64x^{-2})dx = \frac{x^5}{5} - 8x^2 - \frac{64}{x}$</p> <p>$\left[\frac{x^5}{5} - 8x^2 - \frac{64}{x}\right]_1^2 = \left(\frac{32}{5} - 32 - 32\right) - \left(\frac{1}{5} - 8\right) - 64$</p> <p>Volume is $\frac{71}{5}\pi$ (units³)</p>	<p>M1 A1 <u>2</u></p> <p>M1 A1</p> <p>M1 A1</p> <p>M1 A1 ft</p> <p>A1 <u>7 9</u></p>

Question Number	Scheme	Marks
5.	<p>(a)</p> $\frac{1 - \tan^2 \theta}{1 + \tan^2 \theta} = \frac{1 - \frac{\sin^2 \theta}{\cos^2 \theta}}{1 + \frac{\sin^2 \theta}{\cos^2 \theta}} \left(\text{or } \frac{1 - \frac{\sin^2 \theta}{\cos^2 \theta}}{\sec^2 \theta} \text{ or equivalent} \right)$ $\frac{\cos^2 \theta - \sin^2 \theta}{\cos^2 \theta + \sin^2 \theta} = \frac{\cos 2\theta}{1} = \cos 2\theta \quad * \quad \text{cso}$	$\frac{\text{M1}}{\text{M1}}$ M1 A1 <u>4</u>
	<p>(b)</p> $\theta = \frac{\pi}{8}, \quad \cos 2\theta = \frac{1}{\sqrt{2}}$ $\frac{1 - t^2}{1 + t^2} = \frac{1}{\sqrt{2}}$ $t^2 = \frac{\sqrt{2} - 1}{\sqrt{2} + 1}$ $= \frac{\sqrt{2} - 1}{\sqrt{2} + 1} \cdot \frac{\sqrt{2} - 1}{\sqrt{2} - 1} = 3 - 2\sqrt{2} \quad *$ <p><i>Alternative to 5(b)</i></p> $\frac{2t}{1 - t^2} = \tan 2\theta = 1$ $t^2 + 2t - 1 = 0$ $t = \sqrt{2} - 1$ $t^2 = (\sqrt{2} - 1)^2 = 3 - 2\sqrt{2} \quad *$	M1 M1 M1 M1 A1 <u>5</u> <u>9</u> <u>9</u> M1 M1 M1 M1 A1 <u>5</u>

Question Number	Scheme	Marks
6.	<p>(a)</p> $x \quad 0 \quad \frac{\pi}{6} \quad \frac{\pi}{3} \quad \frac{\pi}{2}$ $y \quad 1 \quad 1.46 \quad 1.42 \quad 0$ <p style="text-align: right;">1, 0</p> <p style="text-align: right;">1.46, 1.42</p>	<p>B1</p> <p>B1, B1 <u>3</u></p>
	<p><i>NB. Not giving 2 d.p. loses a maximum of one mark</i></p>	
	<p>(b)</p> $I \approx \frac{1}{2} \left(\frac{\pi}{6} \right) \dots$ $\approx \dots (1 + 2(1.46 + 1.42) + 0)$ ≈ 1.8 <p style="text-align: right;">fit their <i>ys</i></p> <p style="text-align: right;">accept 1.77</p>	<p>B1</p> <p>M1 A1 ft</p> <p>A1 <u>4</u></p>
<p>(c) underestimates diagram or explanation</p> <p><i>NB. Exact answer is $\frac{1}{2} \left(e^{\frac{\pi}{2}} - 1 \right) \approx 1.905 \dots$</i></p>	<p>B1</p> <p>B1 <u>2</u> <u>2</u></p>	

Question Number	Scheme	Marks
7.	<p>(a)</p> <p>V shape right way up vertex in first quadrant g</p> <p>-1 eeo; $2a, a, -\frac{a}{4}$</p>  <p>(b)</p> $4x + a = (a - x) + a$ $5x = a, \quad x = \frac{a}{5}$ $y = \frac{9a}{5}$ <p>(c) $fg(x) = 4x + a - a + a = 4x + a$</p> <p>(d) $4x + a = 3a \Rightarrow 4x = 2a$</p> $x = \frac{a}{2}, -\frac{a}{2}$	<p>B1 B1 B1</p> <p>B2 (1, 0) <u>5</u></p> <p>M1 M1</p> <p>both correct A1 <u>3</u></p> <p>M1 A1 <u>2</u></p> <p>M1 A1</p> <p>A1, A1 <u>3 13</u></p>

Question Number	Scheme	Marks
8.	<p>(a) $f'(x) = \frac{3}{x} - \frac{1}{x^2}$</p>	M1 A1
	<p>$\frac{3}{x} - \frac{1}{x^2} = 0 \Rightarrow 3x^2 - x = 0 \Rightarrow x = \frac{1}{3}$</p>	M1 A1 <u>4</u>
	<p>(b) $y = 3 \ln\left(\frac{1}{3}\right) + \frac{1}{\left(\frac{1}{3}\right)} = 3 - 3 \ln 3 \quad (k = 3)$</p>	M1 A1 <u>2</u>
	<p>(c) $x = 1 \Rightarrow y = 1$</p>	B1
	<p>$f'(1) = 2 \Rightarrow m' = -\frac{1}{2}$</p>	M1
	<p>$y - 1 = -\frac{1}{2}(x - 1) \quad \left(y = -\frac{x}{2} + \frac{3}{2} \right)$</p>	M1 A1 <u>4</u>
	<p>(d) i $-\frac{x}{2} + \frac{3}{2} = 3 \ln x + \frac{1}{x}$</p>	M1
	<p>leading to $6 \ln x + x + \frac{2}{x} - 3 = 0$ *</p>	cso A1
	<p>ii $g(0.13) = 0.273 \dots$ $g(0.14) = -0.370 \dots$</p>	Both, accept one d.p. M1
	<p>Sign change (and continuity) \Rightarrow root $\in (0.13, 0.14)$</p>	A1 <u>4</u> 14