Question	Answer	Marks	Partial Marks
1	$x^2 + 3x - 10 - 3x - 6$ * 0 oe	**M1**	Condone one sign or arithmetic error * can be = or any inequality sign
	Critical Values: 4 and –4	**A1**	
	$x > 4$ or $x < -4$	**A1**	Mark final answer
2	Eliminate one unknown $x(11-3x)+x^2=15$	**M1**	
	$2x^2-11x+15[=0]$	**A1**	
	Factorises or solves *their* 3-term quadratic	**M1**	
	$x=\frac{5}{2},\ y=\frac{7}{2}$ $x=3,\ y=2$	**A2**	**A1** for $x=\frac{5}{2}, x=3$ nfww or $y=\frac{7}{2}, y=2$ nfww
3(a)	$\frac{\mathrm{d}}{\mathrm{d}x}(\sin 3x)=3\cos 3x$ soi	**B1**	
	Applies the correct form of the quotient rule	**M1**	
	$\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{(x+1)(3\cos 3x)-(2+\sin 3x)[1]}{(x+1)^2}$	**A1**	**FT** *their* $\frac{\mathrm{d}}{\mathrm{d}x}(\sin 3x)$
	$\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{\left(\frac{\pi}{6}+1\right)\left(3\cos\frac{3\pi}{6}\right)-\left(2+\sin\frac{3\pi}{6}\right)[1]}{\left(\frac{\pi}{6}+1\right)^2}$	**M1**	
	$\left[\frac{\mathrm{d}y}{\mathrm{d}x}=\right]\ \frac{-3}{\left(\frac{\pi}{6}+1\right)^2}$	**A1**	not from wrong working

Question	Answer	Marks	Partial Marks
3(b)	[When $x = 0$] $y = 2$	**B1**	
	[When $x = 0$] $\frac{dy}{dx} = 1$	**B1**	**FT** *their* $\frac{dy}{dx}$
	$[m_{\perp} =] = -1$	**M1**	**FT** $\frac{-1}{their 1}$
	$y - 2 = -x$ oe	**A1**	**FT** *their* $m_{\perp}$
4	$\left(\sqrt{5}-2\right)a + \left(\sqrt{5}+2\right)b = 1$ oe, soi	**M1**	
	$2b - 2a = 1$	**A1**	
	$a + b = 0$ or $a\sqrt{5} + b\sqrt{5} = 0$	**A1**	
	Solves *their* linear simultaneous equations in a and b as far as $a = \ldots$ or $b = \ldots$	**M1**	**dep** on previous **M1**
	$a = -\frac{1}{4}, b = \frac{1}{4}$	**A1**	
5(a)	$\frac{dy}{dx} = 6\tan x \sec^2 x$	**B2**	**B1** for $\frac{d}{dx}(\tan^2 x) = 2(\tan x)^1 \sec^2 x$
5(b)	$6\tan x \sec^2 x - 3\sec x \operatorname{cosec} x = 0$ $3\sec x(2\tan x \sec x - \operatorname{cosec} x) = 0$ oe	**B1**	NB division by sec$x$ is **B0**
	$2\tan^2 x = 1$ oe	**B1**	
	$\tan x = [\pm]\sqrt{\frac{1}{2}}$ or [±] 0.707[1…]	**M1**	**FT** $\tan^2 x = k$ where $k > 0$
	35.3 or 35.2643… rot to 2 or more dp 215.3 or 215.2643… rot to 2 or more dp 144.7 or 144.7356… rot to 2 or more dp 324.7 or 324.7356… rot to 2 or more dp	**A2**	no extras in range **A1** for any two correct answers

Question	Answer	Marks	Partial Marks
6	$(m+1)x^2+(8-m)x+3=0$ oe, soi	**B1**	
	$(8-m)^2-4(m+1)(3)$	**M1**	
	$m^2-28m+52$ [*0] oe	**M1**	dep on previous **M1**; condone one sign error where * is = or any inequality sign
	Factorises or solves *their* 3-term quadratic expression or equation for CVs	**M1**	dep on use of b^2-4ac
	Finds correct CVs: 2, 26	**A1**	
	$2<m<26$	**A1**	Mark final answer
7(a)	$\log 5^{x-2}=\log 3+\log 2^{2x+3}$ soi	**M1**	
	$(x-2)\log 5=\log 3+(2x+3)\log 2$ oe	**M1**	dep on previous **M1**; Condone one sign or bracketing error
	$x=\dfrac{\log 3+3\log 2+2\log 5}{\log 5-2\log 2}$ soi	**A1**	
	$x=28.7$	**A1**	
7(b)	$\log_3\left(\dfrac{y^2+11}{9}\right)=\log_3(y-1)$ or $\log_3\left(\dfrac{y^2+11}{y-1}\right)=2$ oe	**B1**	
	$\dfrac{y^2+11}{9}=y-1$ or $\dfrac{y^2+11}{y-1}=9$ oe	**M1**	
	$y^2-9y+20=0$	**A1**	
	Solves *their* 3-term quadratic	**M1**	**dep** on previous **M1**
	$y=4,\ y=5$	**A1**	
8(a)	252	**B1**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td rowspan="6">8(b)</td><td>[2 men and 3 others =] 120
[3 men and 2 others =] 60
[4 men and 1 other =] 6</td><td>M2</td><td>M1 for any two correct</td></tr>
<tr><td>186</td><td>A1</td><td></td></tr>
<tr><td>Alternative method</td><td></td><td></td></tr>
<tr><td>[0 men =] 6
[1 man and 4 others =] 60</td><td>(M1)</td><td></td></tr>
<tr><td>(their 252) – (6 + 60)</td><td>(M1)</td><td></td></tr>
<tr><td>186</td><td>(A1)</td><td></td></tr>
<tr><td rowspan="6">8(c)</td><td><table><tr><td>M</td><td>W</td><td>C</td><td></td></tr><tr><td>1</td><td>3</td><td>1</td><td>32</td></tr><tr><td>1</td><td>2</td><td>2</td><td>24</td></tr><tr><td>2</td><td>2</td><td>1</td><td>72</td></tr><tr><td>2</td><td>1</td><td>2</td><td>24</td></tr><tr><td>3</td><td>1</td><td>1</td><td>32</td></tr></table></td><td>M2</td><td>for at least four out of five correct values soi
or M1 for any two or three correct values soi</td></tr>
<tr><td>184</td><td>A1</td><td></td></tr>
<tr><td>Alternative method</td><td></td><td></td></tr>
<tr><td>[0 men =] 6
[0 women] 6
[0 children] 56</td><td>(M1)</td><td></td></tr>
<tr><td>(their 252) – (6 + 6 + 56)</td><td>(M1)</td><td></td></tr>
<tr><td>184</td><td>(A1)</td><td></td></tr>
<tr><td>9(a)</td><td>$[\text{fg}(x) =] \frac{x^2+4}{x^2}$ oe, final answer</td><td>2</td><td>B1 for an attempt at the correct order of composition with at most one error</td></tr>
<tr><td rowspan="2">9(b)</td><td>Complete, correct method to find the inverse</td><td>M1</td><td></td></tr>
<tr><td>$[\text{g}^{-1}(x) =] \sqrt{x-1}$ final answer</td><td>A1</td><td></td></tr>
</table>

Question	Answer	Marks	Partial Marks
9(c)	$x^3 - x^2 - 4 = 0$	**M1**	condone one sign or arithmetic error
	Shows $x - 2$ is a factor or shows that $x = 2$ is a solution	**M1**	
	Uses $x - 2$ is a factor to find $x^2 + x + 2$	**B2**	**B1** for a quadratic factor with 2 terms correct
	Indicates that $x^2 + x + 2$ has no real roots and states $x = 2$ as the only solution	**A1**	dep on all previous marks awarded
10(a)	$\frac{dy}{dx} = -5x^{-2} + 2x - 1$ oe	**M2**	**M1** for any two correct terms
	[When $x = 1$] $\frac{dy}{dx} = -4$ and $y = 5$	**A1**	
	$y - 5 = -4(x - 1)$ oe	**M1**	**FT** *their* $\left.\frac{dy}{dx}\right\|_{x=1}$ and y; dep on at least **M1**
	$y = -4x + 9$	**A1**	**FT**
10(b)	$F(x) = 5\ln x + \frac{x^3}{3} - \frac{x^2}{2}$ $(+c)$	**B2**	**B1** for $5\ln x$ and one other term correct
	$F(3) - F(1)$	**M1**	dep on at least **B1** for integration
	$5\ln 3 + \frac{14}{3}$	**A1**	

Question	Answer	Marks	Partial Marks
11(a)	$l=\frac{4}{r}$	**B1**	
	$h^2 = l^2 - r^2$ or $l^2 = r^2 + h^2$	**M1**	
	$h^2=\left(\frac{4}{r}\right)^2 - r^2$ or $\left(\frac{4}{r}\right)^2 = r^2 + h^2$ or $l^2 = \frac{16}{r^2}$ **and** $h^2 = l^2 - r^2$	**M1**	**FT** *their l* ; dep on previous **M1**
	Correct, convincing completion to $h^2 = \frac{16}{r^2} - r^2$	**A1**	
	Alternative method		
	$l=\sqrt{r^2+h^2}$	**(B1)**	
	$\pi r\sqrt{r^2+h^2} = 4\pi$	**(M1)**	
	$\left(\sqrt{r^2+h^2}\right)^2=\left(\frac{4}{r}\right)^2$	**(M1)**	
	Correct, convincing completion to $h^2 = \frac{16}{r^2} - r^2$	**(A1)**	
11(b)	$\frac{\pi}{3} r^2 \sqrt{\frac{16}{r^2} - r^2}$	**M1**	
	$\frac{\pi}{3}\sqrt{r^4\left(\frac{16}{r^2} - r^2\right)}$ and correct completion to $\frac{\pi}{3}\sqrt{16r^2 - r^6}$	**A1**	

Question	Answer	Marks	Partial Marks
11(c)	$\frac{\mathrm{d}V}{\mathrm{d}r} = \frac{\pi}{3}\left(\frac{1}{2}\left(16r^2 - r^6\right)^{-\frac{1}{2}}\right)\left(32r - 6r^5\right)$ oe	**B3**	**B2** for $k\left(16r^2 - r^6\right)^{-\frac{1}{2}}\left(32r - 6r^5\right)$ where k is a constant and $k \neq 0$ or **B1** for $k\left(16r^2 - r^6\right)^{-\frac{1}{2}} \times \left(\mathrm{f}(r)\right)$ where $\mathrm{f}(r) \neq 32r - 6r^5$
	Equates *their* $\frac{\mathrm{d}V}{\mathrm{d}r}$ to 0 and solves as far as $r^4 = \ldots$	**M1**	**FT** *their* f(r) = $ar + br^5$ for a, $b \neq 0$
	$r = 1.52$ or 1.519[67…] rot to 4 or more sf or $\frac{2}{\sqrt[4]{3}}$ oe	**A1**	