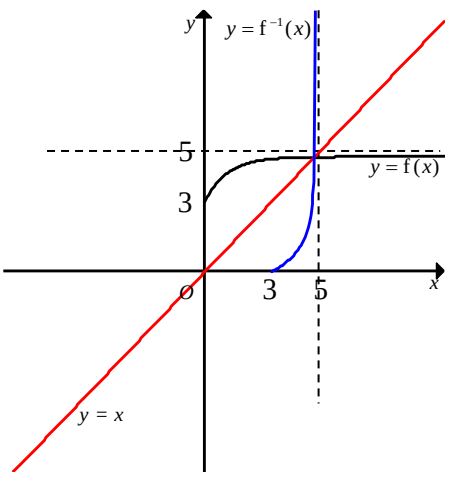
| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 7(b) | $\frac{dy}{dx} = -3(x-3)^{-4}$ oe, soi | **B1** | |
| | $\frac{d^2y}{dx^2} = -4\times -3(x-3)^{-5}$ oe, soi | **B1** | |
| | $\frac{(x-3)^2+3(x-3)-4}{(x-3)^5}$ or $\left[\frac{x-3+3}{(x-3)^4} - \frac{4}{(x-3)^5} = \right]\frac{x(x-3)-4}{(x-3)^5}$ | **M1** | **FT** $\frac{dy}{dx} = k(x-3)^{-4}$ and $\frac{d^2y}{dx^2} = m(x-3)^{-5}$ where $k$ and $m$ are constants |
| | Correct completion to given answer: $\frac{x^2-3x-4}{(x-3)^5} = \frac{(x+1)(x-4)}{(x-3)^5}$ | **A1** | |
| 8(a)(i) | $3 \leqslant x < 5$ | **B2** | **B1** for $x \geqslant 3$ or for $x < 5$ or for 3 and 5 in an incorrect inequality |
| 8(a)(ii) | $x = \sqrt{5x-4}$ and rearrangement to $x^2 - 5x + 4[=0]$ | **B1** | |
| | Factorises $x^2 - 5x + 4$ or solves *their* $x^2 - 5x + 4 = 0$ | **M1** | |
| | $x = 4$ only, nfww | **A1** | |
| 8(a)(iii) | Correct pair of graphs.   | **4** | **B1** for correct shape for f; may not be over correct domain but must have positive $y$-intercept and appear to tend to an asymptote in the 1st quadrant<br><br>**B1** for (0, 3) and f in 1st quadrant only; must have attempted correct shape<br><br>**B1** for asymptote at $y = 5$; must have attempted correct shape<br><br>**B1** for a correct reflection of *their* f in the line $y = x$<br><br>**Maximum of 3 marks if not fully correct** |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 8(b) | $f^{-1}(x) = -\ln\frac{5-x}{2}$ or $f^{-1}(x) = \ln\frac{2}{5-x}$ oe | **2** | **M1** for a complete attempt to find the inverse function with at most one sign or arithmetic error:<br>Putting $y = f(x)$ and changing subject to $x$ and swopping $x$ and $y$<br>or<br>swopping $x$ and $y$ and changing subject to $y$ |
| | Correct simplified form e.g. $\left[f^{-1}g(x) =\right] -\ln\frac{2-5x}{2(1-x)}$<br>or $\left[f^{-1}g(x) =\right]\ln\frac{2-2x}{2-5x}$ | **2** | **M1 FT** for a correct unsimplified form of the function; FT providing of equivalent difficulty |
| 9(a) | $6.5\left(\frac{3\pi}{8}\right)+5.2\left(\frac{3\pi}{8}\right)+2(6.5-5.2)$ | **M2** | **M1** for $6.5\left(\frac{3\pi}{8}\right)$<br>or $5.2\left(\frac{3\pi}{8}\right)$ |
| | 16.38 to 16.4 | **A1** | |
| 9(b) | [Angle $PRQ$ = ] $2\phi$ soi | **B1** | |
| | $y = 2a\cos\phi$ oe or $y = \frac{a\sin(\pi-2\phi)}{\sin\phi}$ oe<br>$y^2 = a^2 + a^2 - 2a^2\cos(\pi-2\phi)$ oe<br>or $y^2 = a^2 + a^2 + 2a^2\cos(2\phi)$ oe | **B1** | |
| | Complete and correct plan soi:<br>$\pi a^2 - \frac{1}{2}(2a\cos\phi)^2(2\phi)$ oe<br>or $\pi a^2 - \frac{1}{2}\left(\frac{a\sin(\pi-2\phi)}{\sin\phi}\right)^2(2\phi)$ oe<br>or $\pi a^2 - \frac{1}{2}(a^2 + a^2 - 2a^2\cos(\pi-2\phi))(2\phi)$ oe<br>or $\pi a^2 - \frac{1}{2}(a^2 + a^2 + 2a^2\cos(2\phi))(2\phi)$ | **M1** | **FT** *their* $2\phi$ and *their* expression for $y$ or $y^2$ in terms of $a$ and $\phi$ |
| | $a^2\left(\pi - 4\phi\cos^2\phi\right)$ or $\pi a^2 - \frac{a^2\phi\sin^2(\pi-2\phi)}{\sin^2\phi}$<br>or $\pi a^2 - 2\phi(a^2 - a^2\cos(\pi-2\phi))$<br>or $\pi a^2 - 2\phi(a^2 + a^2\cos 2\phi)$ oe | **A1** | |