| Question Number | Scheme | Marks |
|---|---|---|
| **3(i)** | $\int \frac{12}{(2x-1)^2}\,\mathrm{d}x = \frac{-6}{(2x-1)}(+c)$ | M1 A1 |
| | | **(2)** |
| **(ii)(a)** | (a) $\frac{4x+3}{x+2} = 4 - \frac{5}{x+2}$ | M1, A1 |
| | | **(2)** |
| **(ii)(b)** | (b) $\int \frac{4x+3}{x+2}\,\mathrm{d}x = \int 4 - \frac{5}{x+2}\,\mathrm{d}x = 4x - 5\ln\lvert x+2\rvert\ (+c)$ | M1 A1ft |
| | Hence $\int_{-8}^{-5} \frac{4x+3}{x+2}\,\mathrm{d}x = (-20-5\ln 3)-(-32-5\ln 6)$ | dM1 |
| | $=12+5\ln 2$ | A1 |
| | | **(4)** |
| | | **(8 marks)** |

(i)

M1: Achieves $\frac{A}{(2x-1)}$ or equivalent e.g. $A(2x-1)^{-1}$

A1: Achieves $\frac{-6}{(2x-1)}$ or $-6(2x-1)^{-1}$. There is no requirement for the $+c$

(ii)(a)

M1: For using division or any other suitable method to find either $A$ or $B$

Using division look for $x+2\overline{)4x+3}$

Using an identity look for $4x + 3 = A(x + 2) + B$ followed by a value for either $A$ or $B$

It may be implied by either $A = 4$ or $B = -5$

A1: Correct value for $A$ and $B$ or a correct expression $4 - \frac{5}{x+2}$ or $4 + \frac{-5}{x+2}$

(ii)(b)

M1: Integrates $\frac{B}{x+2} \to \ldots \ln\lvert x+2\rvert$. Condone $\frac{B}{x+2} \to \ldots \ln(x+2)$ and condone $\frac{B}{x+2} \to \ldots \ln x+2$

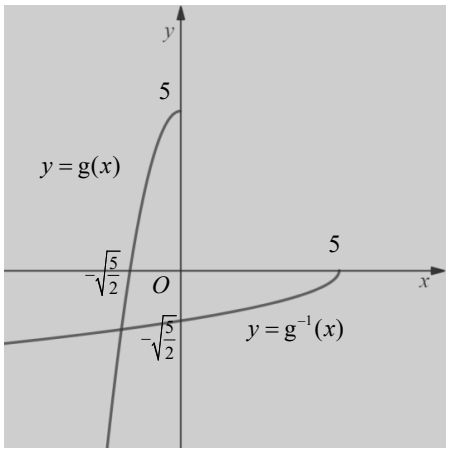
A1ft: Integrates $A + \frac{B}{x+2} \to Ax + B\ln\lvert x+2\rvert$. Condone $A + \frac{B}{x+2} \to Ax + B\ln(x+2)$

But do **not** condone missing brackets unless they are implied by subsequent work.

dM1: Substitutes $-5$ and $-8$ into their integrated function containing $\ln\lvert x+2\rvert$ or $\ln(x + 2)$

A1: $12+5\ln 2$ or equivalent exact answer such as $12+\ln 32$

**SC:** For candidates who proceed to $12+5\ln 2$ or equivalent exact answer via $(-20-5\ln(-3))-(-32-5\ln(-6))$ without sight of modulus signs withhold just the final A1

| Question Number | Scheme | | Marks |
|---|---|---|---|
| **4(a)** | $\text{fg}(x) = \dfrac{4\left(5-2x^2\right)+6}{5-2x^2-5}$ | | M1 |
| | $\text{fg}(x) = 3 \Rightarrow \dfrac{26-8x^2}{-2x^2} = 3 \Rightarrow x = -\sqrt{13}$ | | **d**M1 A1 A1 |
| | | | **(4)** |
| **(b)** | $y = \dfrac{4x+6}{x-5} \Rightarrow yx-5y = 4x+6 \Rightarrow yx-4x = 5y+6$ | | M1 |
| | $\Rightarrow x = \dfrac{5y+6}{y-4}$ | | A1 |
| | $\Rightarrow \text{f}^{-1}(x) = \dfrac{5x+6}{x-4} \qquad x \in \mathbb{R},\ x \neq 4$ | | A1 |
| | | | **(3)** |
| **(c)** |  | Shape and position for $y = \text{g}(x)$. A parabola starting on the $y$-axis that extends down in quadrant 2 to at least the $x$-axis. Condone slips of the pen e.g. if the curve heads back towards the $y$-axis in quadrant 3 slightly. | B1 |
| | | Shape and position for $y = \text{g}(x)$ as above that crosses the $x$-axis **and** $y = \text{g}^{-1}(x)$ a parabola starting on the $x$-axis with graphs crossing as shown in quadrant 3. Condone slips of the pen e.g. if $\text{g}^{-1}(x)$ heads back towards the $x$-axis in quadrant 3 slightly. | B1 |
| | | Correct intercepts. This mark is for the 4 correct intercepts as shown. Allow as values or coordinates and allow coordinates the wrong way round (e.g. (0, 5) for (5, 0)) as long as they are in the correct places. The negative intercepts must be exact as shown or equivalent. The graphs must cross the axes at these points and you can ignore any other intercepts. | B1 |
| | **Note that labels for g($x$) and $\text{g}^{-1}(x)$ are not required** | | |
| | | | **(3)** |
| | | | **(10 marks)** |

(a)

M1: For attempting $\text{fg}(x)$ in the correct order.

**d**M1: For proceeding to $x^2 = \ldots$ **Depends on the first mark**.

A1: For $x^2 = 13$ which may be implied by $x = \sqrt{13}$

A1: For $x = -\sqrt{13}$ only