3(a) $f(x) = 8x^3 - 12x^2 - 2x + d$. Given that when $f(x)$ is divided by $(2x+1)$ the remainder is -2 find d.

$$f\left(-\tfrac{1}{2}\right) = 8\left(-\tfrac{1}{2}\right)^3 - 12\left(-\tfrac{1}{2}\right)^2 - 2\left(-\tfrac{1}{2}\right) + d = -2$$

$$\therefore \quad -3 + d = -2$$

$$\underline{\underline{d = 1}}$$

(b) $g(x) = 8x^3 - 12x^2 - 2x + 3$. Given that $x = -\frac{1}{2}$ is a solution of $g(x) = 0$, express $g(x)$ as a product of 3 linear factors.

$$\begin{array}{r|l}
 & 4x^2 - 8x + 3 \\
2x+1 & 8x^3 - 12x^2 - 2x + 3 \\
 & -\left(8x^3 + 4x^2 + 0x + 0\right) \\
 & \quad -16x^2 - 2x + 3 \\
 & \quad -\left(-16x^2 - 8x + 0\right) \\
 & \qquad 6x + 3 \\
 & \qquad -\left(6x + 3\right) \\
 & \qquad\quad 0
\end{array}$$

$g(x) = (2x+1)(4x^2 - 8x + 3)$

$4x^2 - 8x + 3 = (2x-3)(2x-1)$

$$\therefore \underline{\underline{g(x) = (2x+1)(2x-3)(2x-1)}}$$

Do not write outside the box

QUESTION PART REFERENCE

(c) h(x) is given by $\frac{4x^2-1}{g(x)}$. Simplify h(x), showing that it is a decreasing function $(x > 2)$

$$4x^2-1 = (2x+1)(2x-1)$$

$$\therefore \frac{\cancel{(2x+1)}\cancel{(2x-1)}}{\cancel{(2x+1)}(2x-3)\cancel{(2x-1)}} = \frac{1}{2x-3}$$

$$\therefore h(x) = (2x-3)^{-1}$$

$$h'(x) = -2(2x-3)^{-2}$$

$x > 2 \therefore h'(x) < 0 \therefore$ decreasing function