Question 6 **(7 marks)**

Consider the function $f(x) = \ln(x)$. The function $g(x) = f(x) + a$ is a vertical translation of f by a units.

(a) Express the function $g(x) = \ln(4x)$ in terms of a vertical translation of f (i.e. in the form $g(x) = f(x) + a$), stating the number of units that f is translated. (2 marks)

The function $h(x) = cf(x)$ is a vertical dilation of f by a scale factor of c.

(b) Express the function $h(x) = \ln(\sqrt{x})$ in terms of a vertical dilation of f, stating the scale factor. (2 marks)

The function $p(x) = f(bx)$ is a horizontal dilation of f by a scale factor of $\frac{1}{b}$.

(c) Express the function $p(x) = \ln(x) + 4$ in terms of a horizontal dilation of f, stating the scale factor. (3 marks)