MTH30 Homework Section 1.3

#70 $f(x) = -3x^2 + x - 1$

$$f(x+h) = -3(x+h)^2 + (x+h) - 1 =$$
$$= -3(x^2 + 2xh + h^2) + (x+h) - 1 =$$
$$= -3x^2 - 6xh - 3h^2 + x + h - 1$$

Then $$\frac{f(x+h) - f(x)}{h} = \frac{-3x^2 - 6xh - 3h^2 + x + h - 1 - (-3x^2 + x - 1)}{h} =$$

$$= \frac{\cancel{-3x^2} - 6xh - 3h^2 + \cancel{x} + h \cancel{-1} + \cancel{3x^2} - \cancel{x} + \cancel{1}}{h} =$$

$$= \frac{-6xh - 3h^2 + h}{h} = -6x - 3h + 1, \quad h \neq 0$$

#74 $f(x) = \frac{1}{2x}$

$f(x+h) = \frac{1}{2(x+h)}$, then

$$\frac{f(x+h) - f(x)}{h} = \frac{\frac{1}{2(x+h)}\cdot x - \frac{1}{2x}\cdot(x+h)}{h} = \frac{\frac{x}{2x(x+h)} - \frac{x+h}{2x(x+h)}}{h}$$

LCD $= 2x(x+h)$

$$= \frac{\frac{x - (x+h)}{2x(x+h)}}{h} = \frac{\frac{-h}{2x(x+h)}}{\frac{h}{1}} = -\frac{\cancel{h}}{2x(x+h)} \cdot \frac{1}{\cancel{h}} = -\frac{1}{2x(x+h)}$$

$h \neq 0$