Math Workshop: Difference Quotients

For the following exercises, use the difference quotient to find

\[ \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \]

**Note that you might also see the following notation in Calculus:**

\[ \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x} \]

where \( \Delta x \) is just like \( h \).

It is good practice to **BE NEAT** about your work when working on difference quotients. Do the work step by step.

a) Find \( f(x + h) \) by substituting \( (x + h) \) into the function for \( x \)

b) Simplify the expression \( f(x + h) - f(x) \)

c) Take what you found in (b) and divide it by \( h \) (This gives you \( \frac{f(x+h)-f(x)}{h} \)). Then simplify it.

d) Take the limit of your expression in (c) as \( h \to 0 \), which means you essentially substitute in 0 for \( h \).

1. \( f(x) = 4x^2 - 7x + 1 \)

2. \( f(x) = 3x^2 - x \)
3. \( f(x) = \frac{5x}{x+4} \)

4. \( f(x) = \frac{3}{4-2x} \)

5. \( f(x) = \frac{1}{\sqrt{x}-1} \)

6. \( f(x) = \sqrt{3x + 7} \)