Objectives:

- Take derivatives of polynomials using the power rule, the constant multiple rule, and the sum/difference rule.

Derivative of a constant:

$$\frac{d}{dx}(c) =$$

Proof:

Derivative of $f(x) = x$:

$$\frac{d}{dx}(x) =$$

Proof:

Derivative of $f(x) = x^2$:

$$\frac{d}{dx}(x^2) =$$

Proof:

Derivative of $f(x) = x^3$:

$$\frac{d}{dx}(x^3) =$$

Proof:

Power Rule:

For any nonzero number n, $\frac{d}{dx}(x^n) =$

Proof: (for positive integers n)

Constant Multiple Rule:

$$\frac{d}{dx}(cf(x)) =$$

Proof:

Sum/Difference Rule:

$$\frac{d}{dx}\big(f(x)+g(x)\big) = \quad \text{and} \quad \frac{d}{dx}\big(f(x)-g(x)\big) =$$

Proof: (of the sum rule)

Some practice with our new rules!

1. Find the derivatives of the following functions using our new rules:

   (a) $f(x) = 3x^5$

   (b) $f(x) = \dfrac{4}{\sqrt[3]{x}} + 3x$

   (c) $f(x) = \dfrac{x^3 + \sqrt{x}}{x}$

   (d) $f(t) = \sqrt[5]{t} + \dfrac{3}{t^2} + \dfrac{1}{4t}$

   (e) $g(s) = 4s^{10} + 3s^4 + 7$

   (f) $h(x) = \left(\sqrt[3]{x} + \dfrac{4}{\sqrt[3]{x}}\right)^2$

2. Find an equation of the tangent line to $f(x) = 3x^4 + x^2 + 1$ at $x = 1$.