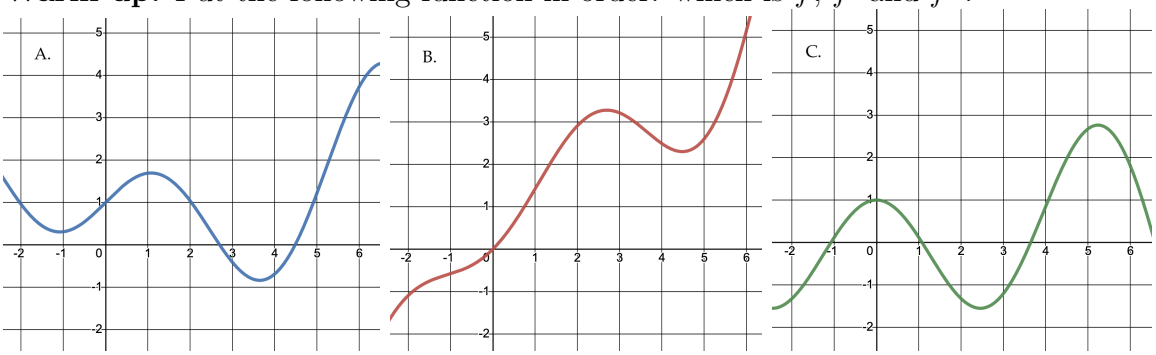
Name: _____

3.1 Derivatives of Polynomials

Warm-up: Put the following function in order: which is f, f' and f''?



1. Compute the following derivatives.

   (a) $k(x) = 5x^3 - 2x + 10$

   (b) $g(s) = \sqrt{s} - 2s^{\frac{2}{3}}$

   (c) $f(x) = \pi^2 - \frac{2}{x}$

   (d) $h(t) = t^3(2t - 5)$

2. Suppose $f(x) = x^{12}$.

   (a) Find $\dfrac{d^{10}f}{dx^{10}}$. (Hint: look for a pattern!)

   (b) Find $\dfrac{d^{14}f}{dx^{14}}$.

3. If M is the mass of the earth and G is a constant, the acceleration due to gravity, g, at a distance r from the center of the earth is given by

$$g = \frac{(GM)}{r^2}$$

(a) Find $\dfrac{dg}{dr}$.

(b) What is the practical interpretation (in terms of acceleration) of $\dfrac{dg}{dr}$? Why would you expect it to be negative?

(c) You are told that $M = 610^{24}$ and $G = 6.6710^{-20}$ where M is in kilograms and r in kilometers, and g in km per sec^2. What is the value of $\dfrac{dg}{dr}$ at the surface of the earth ($r = 6400$ km)? Include units.

(d) What does this tell you about whether or not it is reasonable to assume g is constant near the surface of the earth?

4. Find the equation of the line tangent to the graph of f at $(1, 1)$, where f is given by $f(x) = 2x^3 - 2x^2 + 1$. Check your work using Desmos.