The first test is on Friday, 4:10-6pm.

Today: Differentiation rules.

Homework before Thursday’s class: watch videos 3.6, 3.7, 3.9.
Compute the derivative of the following functions:

1. \( f(x) = x^{100} + 3x^{30} - 2x^{15} \)
2. \( f(x) = \sqrt[3]{x} + 6 \)
3. \( f(x) = \frac{4}{x^4} \)
4. \( f(x) = \sqrt{x} (1 + 2x) \)
5. \( f(x) = \frac{x^6 + 1}{x^3} \)
6. \( f(x) = \frac{x^2 - 2}{x^2 + 2} \)
Let \( g(x) = \frac{1}{x^3} \).

Calculate the first few derivatives.
Make a conjecture for a formula for the \( n \)-th derivative \( g^{(n)}(x) \).
Prove it.
Richard Nixon, during the 1972 US Presidential campaign, (paraphrased):

\textit{Inflation is increasing, but the rate of increase of inflation is decreasing.}

Let

- $C =$ cost of life
- $t =$ time

What did Nixon say in terms of calculus?
Let $a \in \mathbb{R}$.
Let $f$ be a function with domain $\mathbb{R}$.
Assume $f$ is differentiable everywhere.
What can we conclude?

1. $f(a)$ is defined.
2. $\lim_{x \to a} f(x)$ exists.
3. $f$ is continuous at $a$.
4. $f'(a)$ exists.
5. $\lim_{x \to a} f'(x)$ exists.
6. $f'$ is continuous at $a$. 
Construct a function that has both

- a vertical tangent line at $x = 1$, and
- a vertical asymptote at $x = -1$. 
1. Sketch the graph of a continuous function whose derivative has the graph below

2. Sketch the graph of a non-continuous function whose derivative has the graph below