MAT137

- 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.

Computations

Compute the derivative of the following functions:

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

Higher order derivatives

Let $g(x) = \dfrac{1}{x^3}$.

Calculate the first few derivatives.
Make a conjecture for a formula for the n-th derivative $g^{(n)}(x)$.
Prove it.

Presidential derivatives

Richard Nixon, during the 1972 US Presidential campaing, (paraphrased):

> *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?

True or False

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.

Vertical things

Construct a function that has both

- a vertical tangent line at $x = 1$, and
- a vertical asymptote at $x = -1$.

From the derivative to the function

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