

Here are some problems to help you practice for the first exam. All problems should be done *without* calculators!

Problem 1. Compute the derivative of the following functions *using the definition*. (This means using limits.)

A. $f(x) = 3x^2 - 5x$

B. $f(t) = \frac{1}{5t}$

C. $g(x) = \sqrt{x-1}$

D. $k(x) = \frac{x+2}{x}$

Problem 2. Compute the derivative of the following functions. (You may use the shortcut rules.)

A. $f(x) = \frac{2x^3 - \sqrt{x}}{3x^5}$

B. $g(t) = 1 + t + t^2 + t^3$

C. $p(x) = \frac{1}{x^2} + \frac{1}{x}$

D. $q(t) = t^{-1/2} - t^{1/2}$

Problem 3. Consider the function

$$f(x) = -2t^3 + 12t^2 + 30t - 180$$

- Find all roots, critical points, and inflection points of f .
- Determine the regions where function is increasing, and the regions where the function is decreasing.
- Determine the regions where the function is concave up and regions where the function is concave down.
- What are the local minima and maxima of f ?
- Draw a sketch of the graph of f .

Problem 4.

- Find the first order approximation of the function $f(x) = \sqrt{x}$ centered at $x = 9$.
- Find the first order approximation of the function $f(x) = \frac{1}{x}$ centered at $x = -1$.