Name:______________________

Notesheet. Section 4.1: Applications of First Derivative

Math 1210

Definition 1. We say a function f is increasing on an interval (a, b) if

Challenge 2. Consider $f(x) = x^2$. Where is f increasing and where is it decreasing? What can you say about $f'(x)$ on each interval?

Theorem 3. Let f be a differentiable function on the interval (a, b).

(a) If $f'(x) > 0$ for each value x in an interval (a, b), then

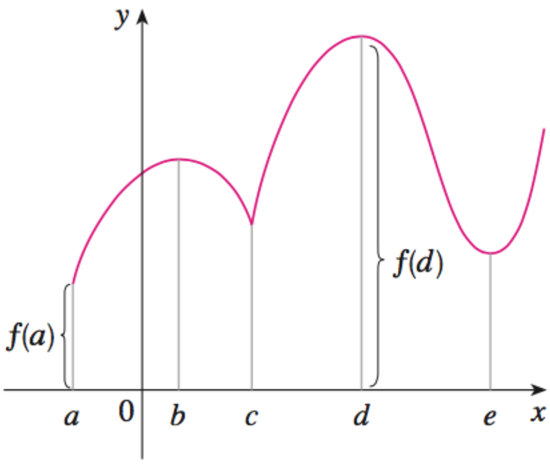
(b) If $f'(x) < 0$ for each value x in an interval (a, b), then

(c) If $f'(x) = 0$ for each value x in an interval (a, b), then

Challenge 4. Find where the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is increasing and where it is decreasing. Do the same with $g(x) = x^{\frac{2}{3}}$.

Definition 5. A function f has a relative maximum (also called a local maximum) at $x = c$ if

Challenge 6. Where are the relative extrema on the following graph? What can we say about the derivative of the function at those points?



Challenge 7. Find the relative extrema of $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$. Find the relative extrema of $g(x) = x^3$ and $h(x) = x + \frac{1}{x}$ as well.

Challenge 8. The Hubble Space Telescope was deployed on April 24, 1990, by the space shuttle Discovery. A model for the velocity of the shuttle during this mission, from liftoff at $t = 0$ until the solid rocket boosters were jettisoned at $t = 126$ s is given by

$$v(t) = 0.001t^3 - 0.09t^2 + 24t - 3 \text{ (in ft/s)}$$

Estimate the absolute maximum and minimum values of the *acceleration* of the shuttle between liftoff and the jettisoning of the boosters.