**Section 3.3** (Increasing and Decreasing Functions and the First Derivative Test)

Recall that a function is increasing if as x increases (left-to-right) if f(x) or y is increasing (down-to-up). Sketch 2 increasing functions on the left axes and 2 decreasing functions on the right axes (sketch a constant function on the board).

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If you examine the derivatives of these functions, you will see that…

* if f `(x) > 0 for all x in (a,b) then f is increasing on [a,b]
* if f `(x) < 0 for all x in (a,b) then f is decreasing on [a,b]
* if f `(x) = 0 for all x in (a,b) then f is constant on [a,b]

Example: Find the open intervals on which f(x) = x2 – 4x + 3 is increasing or decreasing

 (note: find critical points where f `(x) = 0 or does not exist – why?)

Example: Answer the following (sketch as needed)

What happens if the sign of f `(x) does not change on from the left to the right of a critical point?

What happens if the sign of f `(x) chanes from positive to negative from the left to the right of a critical point?

What happens if the sign of f `(x) chanes from negative to positive from the left to the right of a critical point?

Guidelines for finding increasing decreasing intervals (and relative maxima, minima):

1. Locate critical numbers of f in (a,b)
2. Determine the sign of f `(x) at one test value in each interval
3. Use that information to determine whether a function is increasing / decreasing / constant (and extrema)

Example: Find the relative extrema of f(x) = x3 – 3x2 + 1 (define concave up and down / inflection points)

Example: Review example 5 in the book and find the relative extrema of f(x) = $\sqrt{4x-x^{2}}$ (consider the domain of f)