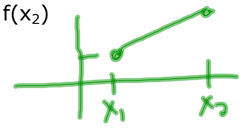
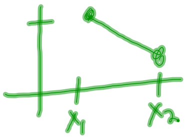
3.3 Increasing & Decreasing Functions & First Derivative Test

A function f is <u>increasing</u> on an interval if $x_1 < x_2$ implies that $f(x_1) < f(x_2)$



A function f is <u>decreasing</u> on an interval if $x_1 < x_2$ implies that $f(x_1) > f(x_2)$



<u>First Derivative Test for Inc./Dec.</u>

1. f '(x) > 0 on (a,b), then f(x) is increasing
2. f '(x) < 0 on (a,b), then f(x) is decreasing
3. f '(x) = 0 on (a,b), then f(x) is constant (horiz)

<u>Finding Intervals for Inc./Dec.</u>

1. Find all critical #'s c (where f '(x)=0 or undef.)
2. Set up intervals using all c values
3. Find f '(x) for one test value in each interval:
   - f '(x) > 0 Inc
   - f '(x) < 0 Dec

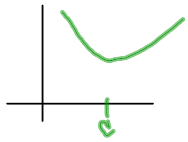
Nov 11-8:51 PM

<u>Strictly Monotonic</u> -- functions that are always increasing or always decreasing.

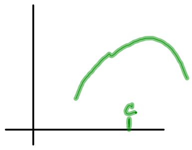
ex) $f(x) = x$, $g(x) = -x^3$

First Derivative Test

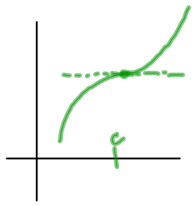
1. If f '(x) changes from negative to positive at c, then f(c) is a Relative Minimum



2. If f '(x) changes from positive to negative at c, then f(c) is a Relative Maximum



Neither min or max:



Nov 11-8:57 PM

Find all rel. extrema & Inc/Dec intervals

ex 1) $f(x) = x^3 - 3/2\, x^2$

$f' = 3x^2 - 3x = 0$

$3x(x-1) = 0$

$x = 0, 1$

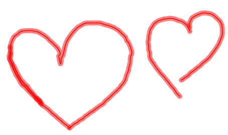
max @ $x=0$
min @ $x=1$

$(-\infty, 0)$	$f'(-1) = 6$	Inc
$(0, 1)$	$f'(1/2) = -3/4$	Dec
$(1, \infty)$	$f'(2) = 6$	Inc

2. $f(x) = (x^2 - 4)^{2/3}$

Nov 11-9:00 PM

p181 # 3-7, 13-17, 33, 35



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