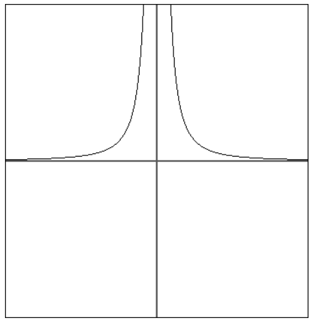
Increasing and Decreasing Functions and the First Derivative Test

A function is increasing on the interval if $x_1 < x_2$ and $f(x_1) < f(x_2)$.
A function is decreasing on the interval if $x_1 > x_2$ and $f(x_1) > f(x_2)$.

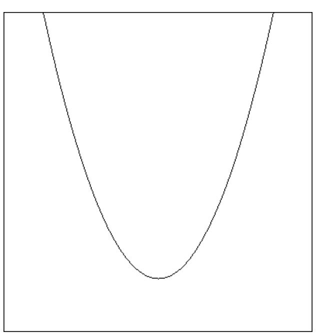


Theorem: Let f be continuous on $[a,b]$ and differentiable on (a,b):
If $f'(x) > 0$ for all x in the interval, then $f(x)$ is increasing on the interval.
If $f'(x) < 0$ for all x in the interval, then $f(x)$ is decreasing on the interval.

First Derivative Test
Let f be continuous on $[a,b]$ and let x_0 be a critical value in the interval.

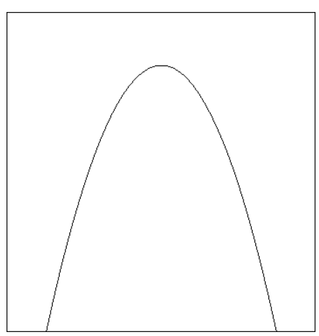
Relative Mininum

$-$ 0 $+$



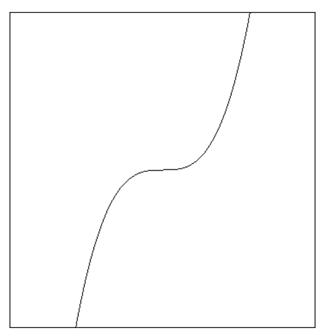
Relative Maximum

$+$ 0 $-$



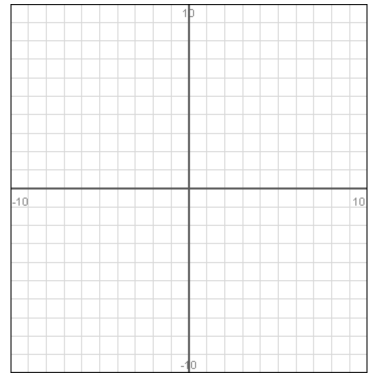
Terrace Point

$+$ 0 $+$
$-$ 0 $-$

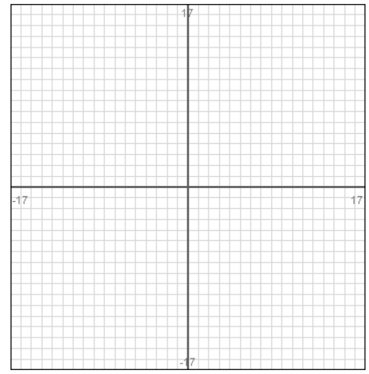


1. For each function, find the critical numbers of $f(x)$ and determine the intervals for which the function is increasing or decreasing using the first derivative test.

a) $f(x) = x^3 - 9x^2 + 24x - 20$



b) $f(x) = 12x^{\frac{2}{3}} - 4x$



c) $f(x) = 3x^4 - 4x^3$