MATH 171 CALCULUS I
DR. MCLOUGHLIN'S
HANDY DANDY GUIDE TO GRAPHING USING CALCULUS PART I

Consider $f(\mathrm{x})$ to be a function in simplified form

Finding where f(x) is above or below the x - axis.

Prerequisite: High School Algebra/ Pre-calculus THIS IS ONLY A REVIEW.

set the numerator of $f(\mathrm{x}) = 0$ yielding first coordinates of x - intercepts
set the denominator of $f(\mathrm{x}) = 0$ yielding vertical asymptotes.

call these values *cut values.*

Do a Positive - negative Analysis of $f(\mathrm{x})$ with the cut values

if $f(x) > 0$, the the graph is above the x -axis for all values between the cut values
if $f(x) < 0$, the the graph is below the x -axis for all values between the cut values

plug the cut values back into $f(\mathrm{x})$. If it exists, it is the second coordinate of the x - intercept,
if it does not exist, then that cut value should have been the x - value of a vertical asymptote (or if you did not simplify the function, it could be a hole in the graph).

Finding where $f(\mathrm{x})$ is increasing or decreasing.

First find $f'(\mathrm{x})$ and 'usefulfy' it.

set the numerator of $f'(\mathrm{x}) = 0$
set the denominator of of $f'(\mathrm{x}) = 0$

call these values *critical values.*

Do a Positive - negative Analysis of of $f'(\mathrm{x})$ with the critical values across the domain of *f.*

if $f'(\mathrm{x}) > 0$, the the graph is increasing for all values between the critical values
if $f'(\mathrm{x}) < 0$, the the graph is decreasing for all values between the critical values

plug the critical value(s) back into $f(\mathrm{x})$. If it exists, it is the second coordinate of a critical point, if it does not exist, then that critical value should have been the x - value of a vertical asymptote (or if you did not simplify the function, it could be a hole in the graph).

Any critical point where the function changed from increasing to decreasing is a **relative maxima.**
Any critical point where the function changed from decreasing to increasing is a **relative minima.**

Finding where $f(x)$ *is concave up or down.*

First find $f''(x)$!

set the numerator of $f''(x) = 0$
set the denominator of $f''(x) = 0$.

call these values *candidates for points of inflection (CPIs)*.

Do a Positive - negative Analysis of $f''(x)$ with the CPIs

if $f''(x) > 0$, the the graph is concave up for all values between the CPIs
if $f''(x) < 0$, the the graph is concave down for all values between the CPIs

plug the CPI(s) back into $f(x)$. If it exists, it is the second coordinate of a point,
if it does not exist, then that CPI value should have been the x - value of a vertical asymptote (or if you did not simplify the function, it could be a hole in the graph).

Any point that came from a CPI where the function changes concavity is **a point of inflection**.