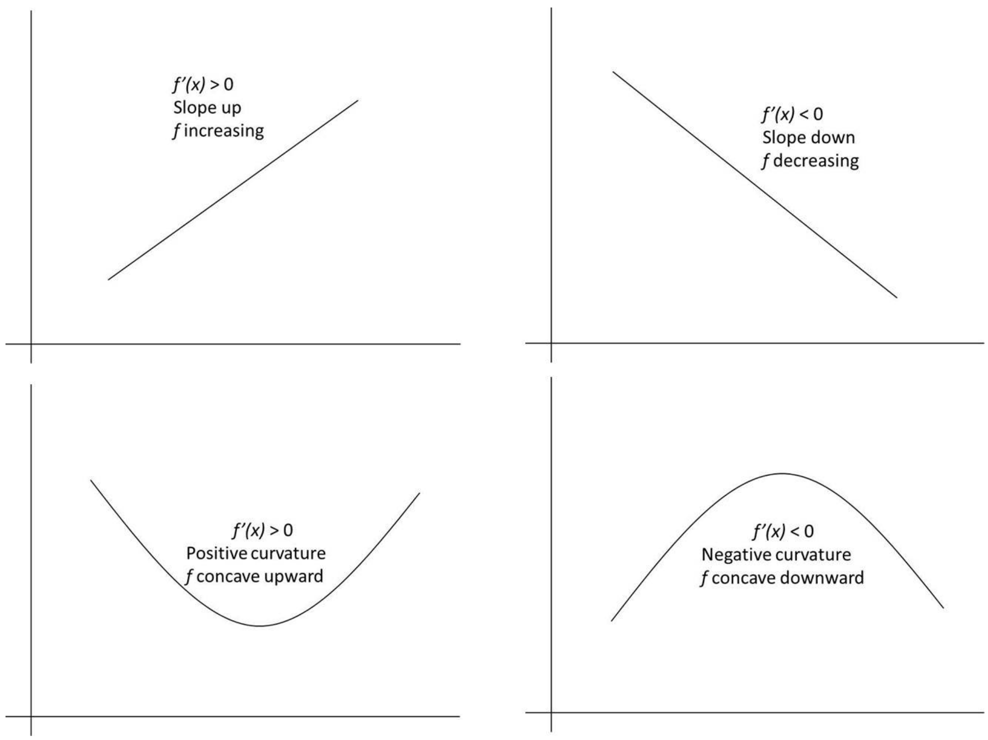
# *Derivatives and Graphing*

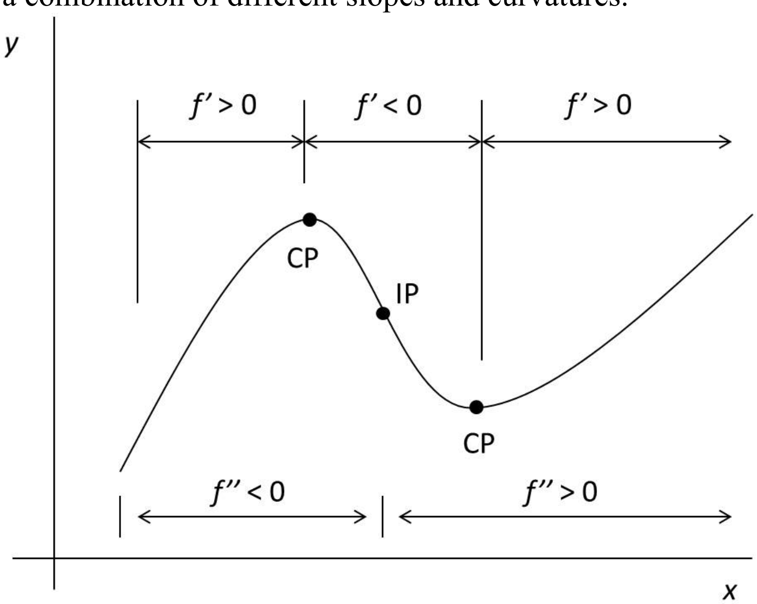
(2.2, 2.6, 4.3 and 4.5)

Prelab: Review the definitions of vertical asymptotes (p. 90) and horizontal asymptotes (p.128). Review Example 7 (p.298) and Example 1 (p. 317).

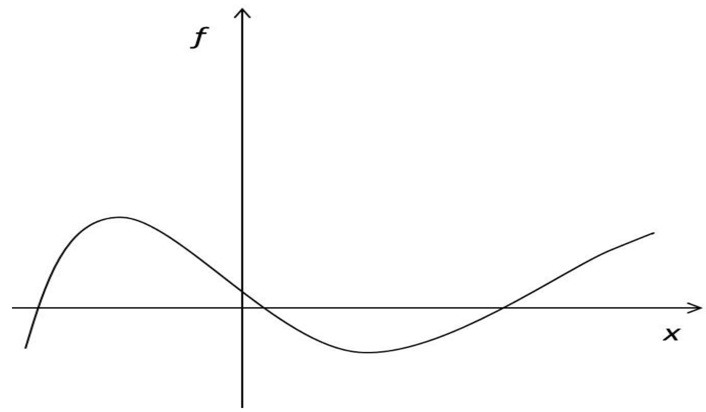
I. The first derivative tells us about slope and the second derivative tells us about concavity.




II. Many functions are a combination of different slopes and curvatures.

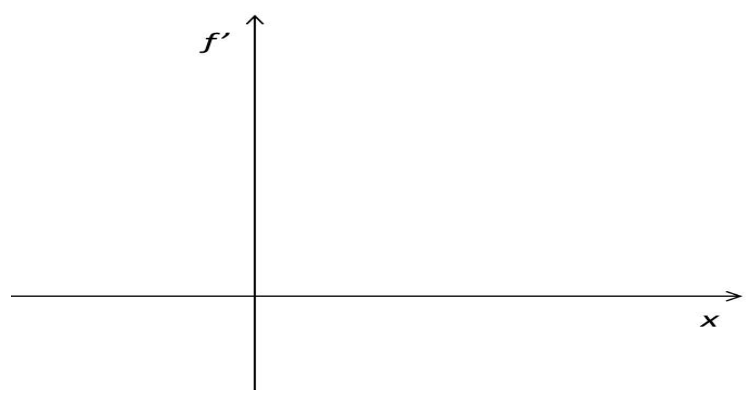


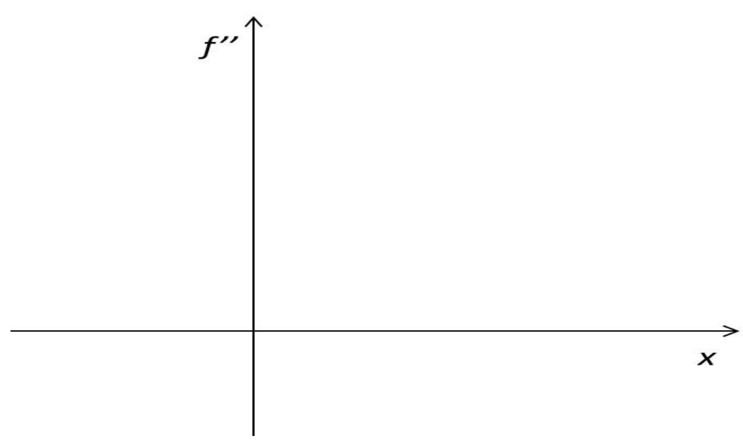
Recall that points on the graph where either $f'(x)=0$ or $f'(x)$ does not exist, are called "critical points" (CP). An inflection point (IP) on a graph is where $f''(x)$ changes sign.
Example 1: On the graph below, mark slope and curvature using the proper derivative inequality (as seen on the graph above). Label the critical and inflection points.



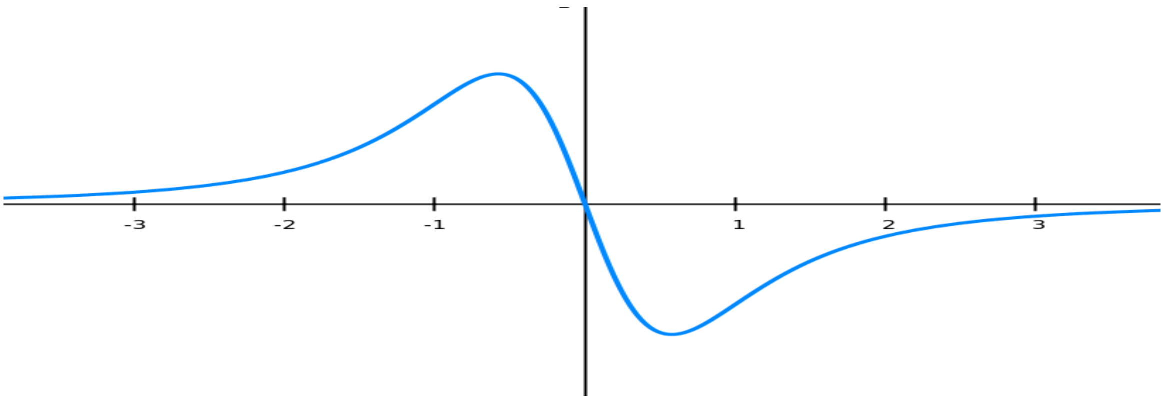

III. Derivative Functions: The previous example gave us a general qualitative description of a graph. As you know, the derivatives of a function are themselves functions, and have their own graphs.

Example 2: Use the information in Example 1 and the graph of the function to sketch graphs of the first and second derivatives.



Example 3: Here is the graph of the derivative $f'(x)$ of a continuous function $f(x)$.




(a) On what intervals is $f$ increasing? Decreasing?

(b) Where does $f$ have a local maximum? Minimum?

(c) On what intervals is $f$ concave upward? Concave downward?

(d) State where $f$ has (an) inflection point(s).

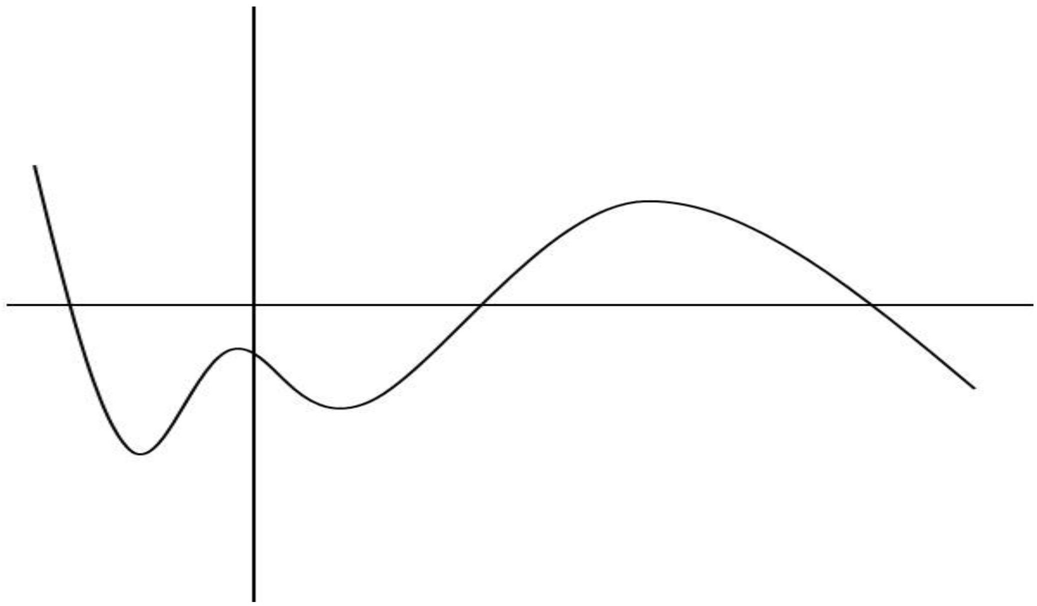
IV. We use the first and second derivatives to locate important graphical features of a function.

Example 4: Consider the function $f(x) = x - 3x^{2/3}$. Find (a) intervals of increase/decrease (b) location(s) of maximum(s)/minimum(s) (c) intervals of concavity and (d) location(s) of any IP(s).
* We use this information along with the location of roots and the existence of horizontal and vertical asymptotes to graph a function.

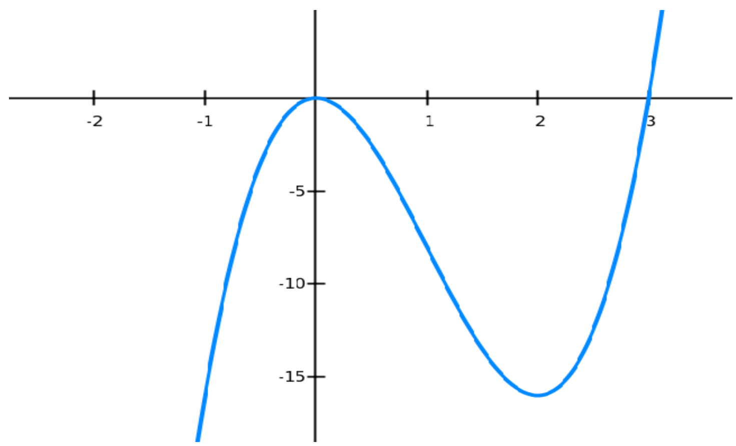
Math 111 F24 Lab 8 Exercises Name: ___________________________ Section: _____ Score: _____

Work each problem showing all supporting work ON THIS PAPER. You may use your textbook, lab and notes. Students may work cooperatively but each submits his/her own set of Lab Exercises. No calculators.

1. On the graph below, mark slope and curvature using the proper derivative inequalities (as seen on page 7-1 and Example 1). Label the critical and inflection points.



2. The graph of the **derivative** $f'(x)$ of a continuous function $f(x)$ is shown. Find the following or state "none".




(a) On what intervals is $f$ increasing? Decreasing?

(b) Locate the $x$-value(s) where $f$ has a local maximum? Minimum?

(c) On what intervals is $f$ concave upward? Concave downward?

(d) Locate the $x$-value(s) where $f$ has an inflection point.

3. For the function $f(x) = x - 4\sqrt{x}$, find the following if they exist *or state "none"*. (a) the zeroes (roots) (b) intervals of increase/decrease (c) location(s) ($x$, $y$) of local maximum(s)/minimum(s) (d) intervals of concavity and (e) location(s) ($x$, $y$) of any point(s) of inflection. You do not need to graph the function.