MATH 1210, SECTION 002
SUMMARY OF DERIVATIVE APPLICATION PROCEDURES
10/16/2017

Procedure for determining intervals of increase/decrease of "nice" functions.

(1) Compute f'. Then find the x values where $f'(x) = 0$ or f' is discontinuous. Plot these numbers on the number line.

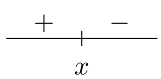
(2) In each open interval between the numbers plotted in part (1), pick a number c and plug it into f'.
   (a) If $f'(c) > 0$, then f is increasing on the corresponding open interval containing c. Write a plus sign above this interval.
   (b) If $f'(c) < 0$, then f is decreasing on the corresponding open interval containing c. Write a minus sign above this interval.

(3) Write down the intervals, in interval notation, on which f is increasing. If there is more than one interval write "and" between rather than $\cup$. Do the same thing for the intervals on which f is decreasing.

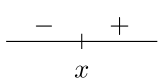
First Derivative Test: Procedure for determining relative max(s) and relative min(s) of "nice" functions.

(1) Determine the critical numbers of f. In other words, calculate $f'(x)$. Then, find the values x **IN THE DOMAIN OF** f for which $f'(x) = 0$ or $f'(x)$ DNE. Plot these numbers on the number line. Notice the difference in this step and step (1) of the previous procedure.

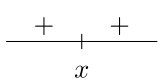
(2) In each open interval between the numbers plotted in part (1), pick a number c and plug it into f'. If $f'(c) > 0$, put a plus sign above the corresponding interval. If $f'(c) < 0$ put a minus sign above the corresponding interval. If x is a critical number and the sign chart zoomed in at x looks like:

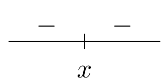
   (a) 

   Then f has a relative max of $f(x)$ at x.

   (b) 

   Then f has a relative min of $f(x)$ at x.

   (c) 

   or 

   Then f has a niether a relative max nor a relative min at x.

(3) Write down the relative max(s) and relative min(s).

Second Derivative Test: An alternate (less powerful) procedure for determining relative max(s) and min(s) of "nice" functions.

(1) Compute f' and f''. Find all x values where $f'(x) = 0$.

(2) For each value x from part (1), plug x into f''.
   (a) If $f''(x) < 0$, then f has a relative max of $f(x)$ at x.
   (b) If $f''(x) > 0$, then f has a relative min of $f(x)$ at x.
   (c) If $f''(x) = 0$ or $f''(x)$ DNE, then we cannot conclude anything. Therefore, this test is less powerful. It will not always tell us as much as the first derivative test.

(3) Write down the relative max(s) and relative min(s).

Procedure for determining intervals of concavity of "nice" functions.

(1) Compute f''. Then find the values of x where $f''(x) = 0$ or $f''(x)$ DNE. Plot these numbers on the number line.

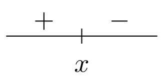
(2) In each open interval between the numbers plotted in part (1), pick a number c and plug it into f''.
  (a) If $f''(c) > 0$, then the graph of f is concave upward on the corresponding interval containing c. Write a plus sign above this interval.
  (b) If $f''(c) < 0$, then the graph of f is concave downward on the corresponding interval containing c. Write a minus sign above this interval.

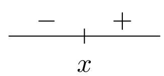
(3) Write down the intervals, in interval notation, on which f is concave upward. If there is more than one interval write "and" between rather than $\cup$. Do the same thing for intervals on which f is concave down.

Procedure for determining inflection points of "nice" functions.

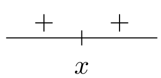
(1) Compute f''. Find the values x **IN THE DOMAIN OF** f for which $f''(x) = 0$ or $f''(x)$ DNE.

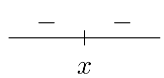
(2) In each open interval between the numbers plotted in part (1), pick a number c and plug it into f''. If $f''(c) > 0$, put a plus sign above the corresponding interval. If $f''(c) < 0$ put a minus sign above the corresponding interval. If x is a number from part (1), and the sign chart zoomed in at x looks like:

  (a) 

or 

  Then $(x, f(x))$ is an inflection point.

  (b) 

or 

  Then $(x, f(x))$ is not an inflection point.

(3) Write down the inflection point(s).