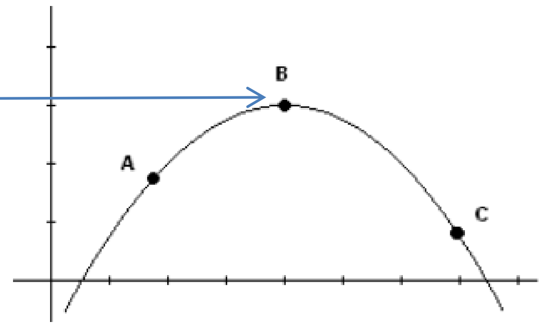
<u>Extrema and First Derivative Test</u>

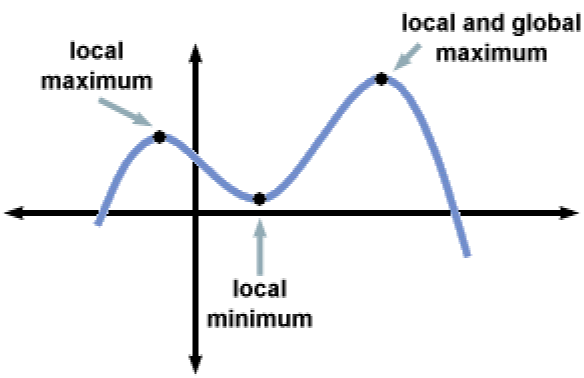
The point "B" is a maximum point. To the left of B



[There would also be a "minimum" point if the graph was a concave upwards graph]

Every local minimum and local maximum point occurs at a **critical point**

Consider a function with the following graph:



We see that there are local minimum and maximum points, but also we have a "global" maximum, which is the highest point in the graph. A global minimum would therefore be the lowest point in the graph. (Note that "global" can also be denoted as "absolute").

In applications, we don't really care much about the "local" max and mins; we care more about the "absolute" maxes and mins.

So how do you tell where the absolute Maxs/Mins are?

There are 3 different methods to do this.

1. <u>Extreme Value Theorem</u>

(If f(x) is a continuous function on a closed interval [a,b], then f(x) has both an absolute max and min.)

Find the absolute max's and mins for the function $f(x) = 2x^3 - 3x^2 - 36x + 2$ on the interval [0,5]

Step 1:

- Find all the critical points; if they are not in the range that the interval states, then they are useless hence they are not needed.
    - So $f'(x) = 6(x-3)(x+2)$; the critical points are at $x = 3$ and $x = -2$
        - -2 is not in the interval of [0,5], so it is not needed.

Step 2:

- List all the relevant points
  - The relevant points needed will be the **critical points** (that lie within the interval) and the **end points** of the interval (in this case, the end points of the interval are 0 and 5)
  - You plug each of these values into the **original function** and see what you get.

x	f(x)
0	2
3	-79
5	-3

The "3" is one of the critical points; the 0 and 5 are the end points of the interval

This is basically it, once you have the values you simply take the **biggest value as the absolute maximum** and the **smallest value as the absolute minimum.**

Therefore, the absolute maximum is "2" and the absolute minimum is "-79".