First Order Derivative

Definition:

* The ***first derivative*** tells us about the direction the function is going. That is, it tells us if the function is increasing or decreasing.
* The first derivative can also be interpreted as the slope of the tangent line.















Definition:

* A ***critical number*** of a function is a number in the domain of *f* such that either *f’*(c)=0 or *f’*(c) does not exist.

Examples:

Find the Derivative for the following examples.

1. $f\left(x\right)=x^{4}-3x^{2}+2x-8$ 2. $f\left(x\right)= 6x^{3}+9x^{2}-360x$

3. Find the critical number(s) for $f\left(x\right)=x^{2}-6x$.

Steps for Determining where *f* is increasing or decreasing:

1. Find all critical number(s).
2. Plot critical number(s) on a number line.
3. Choose values to test regions on the number line around the critical number(s). Plug test values into *f’* and record the sign.
4. If the sign is positive, then f is increasing and if the sign is negative, then f is decreasing.

Example:

Find where the function, $f\left(x\right)=x^{2}-6x$ is increasing and decreasing.

Step 1: Critical number(s)

Step 2 and 3: Number line/Test Values

Step 4: Increasing and decreasing intervals

AN EASIER WAY…

1. Go to Desmos.com



1. Click on “Start Graphing”
2. On the left hand side, begin typing in the function:

$f\_{1}(x)=x^{2}-6x$. (To acquire the exponent, hit “shift, 6”. Make sure to move the cursor to the right so no other numbers are in the exponent.)



4. Under $f\_{1}(x)$, enter the derivative of $f\_{1}(x)=x^{2}-6x$ and label it as $f\_{2}(x)$.

* You can see where $f\_{2}(x)$ crosses the x-axis at (3,0). This is the critical point that we found earlier.

Let’s try some more:

1. $f\_{2}\left(x\right)=4x^{3}- 16x$
2. $f\_{2}\left(x\right)= x^{3}+6x^{2}+4 $