Absolute Max and Min

A lot can be determined by obtaining **derivatives**. One thing is the highest and lowest point of your function.

Steps:

1. Find **derivative** to obtain **critical points:** these points are possible **maxs** or **mins** and all have **slopes** of **zero** (**tangent slope**).
2. Set **derivative** equal to **zero** to get the **critical points**.
3. Plug **critical points** into **original equation**.
   Highest y-value → absolute max
   Lowest y-value → absolute min

Example:

$$y = 3x^2 - 12x \qquad [0,3]$$

(1) Find the derivative of y.

$$\frac{dy}{dx} = 6x - 12$$

(2) Set derivative equal to zero and solve.

$$0 = 6x - 12$$

$$12 = 6x$$

$$2 = x$$

$$y = 3(2)^2 - 12(2)$$
$$= 12 - 24$$
$$= -12$$

(2,–12) is an absolute min because -12 is the lowest y - value

$$y = 3(0)^2 - 12(0)$$
$$= 0 - 0$$
$$= 0$$

(0,0) is the absolute max because 0 is the highest y - value

$$y = 3(3)^2 - 12(3)$$
$$= 27 - 36$$
$$= -9$$

(3,–9)

<u>Other Sources of **Critical Points**:</u>

1. Always remember to test **end points** (if specified).

Example:

y = f(x) **[0,4]** $\rightarrow$ **x = 0** and **x =4** are added to **critical points** from **1st derivative**.

2. If a function is **defined** at a certain point but becomes **undefined** when you find the **derivative**, then it becomes a **critical point**.

Example:

$$y = \sqrt{4 - x}$$

$$= (4 - x)^{1/2}$$

$$\frac{dy}{dx} = \frac{1}{2}(4 - x)^{-1/2}(-1)$$

$$0 = \frac{-1}{2(4 - x)^{1/2}}$$

Since x = 4 makes the derivative undefined,
it becomes a crtical point.