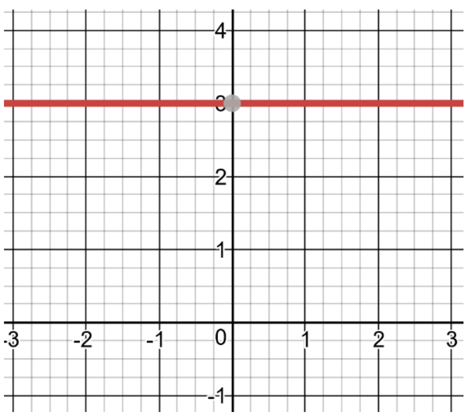
## GRAPH SKETCHING: Sketching the Graph of $f'(x)$

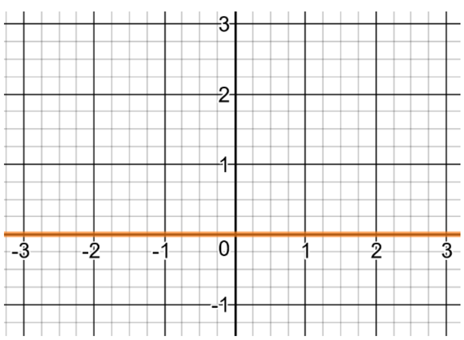
Most graphing up until this point was done graphing x and y values on a coordinate plain. The graph is a visual display of the relationship between the x-values and y-values. However, when sketching a graph of $f'(x)$ we are creating a model displaying the relationships between the x-values and the rate of change (slope) of the function at a particular value of x.

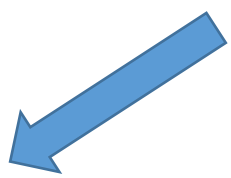



The graph to the left represents the function $f(x) = 3$. Notice the slope of the line is 0. So if I were to make a table representing the slope of the function at given values of x, my table would be as follows;

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $f'(x)$ | 0 | 0 | 0 | 0 | 0 |

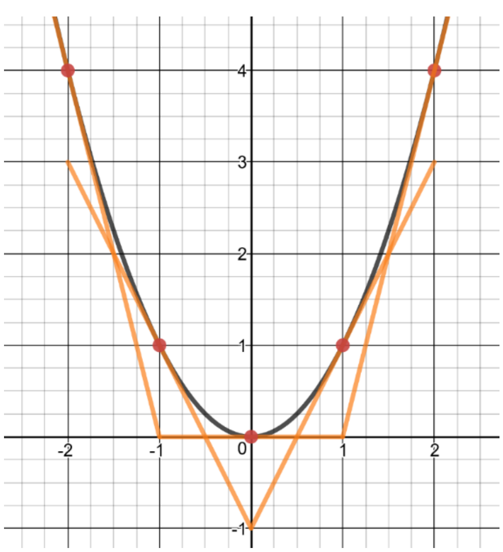
So if we plot the points in the table we get the graph below .



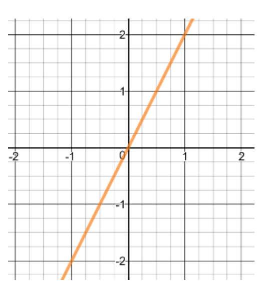
This is the graph of $\boldsymbol{f'(x)}$; this graph should make sense if you take $f(x) = 3$ *and derive we get* $f'(x) = 0$ *using the power rule*

This is a pretty simplistic example: consider the function $\boldsymbol{f(x) = x^2}$ if we derive using the power rule we get $f'(x) = 2x$.



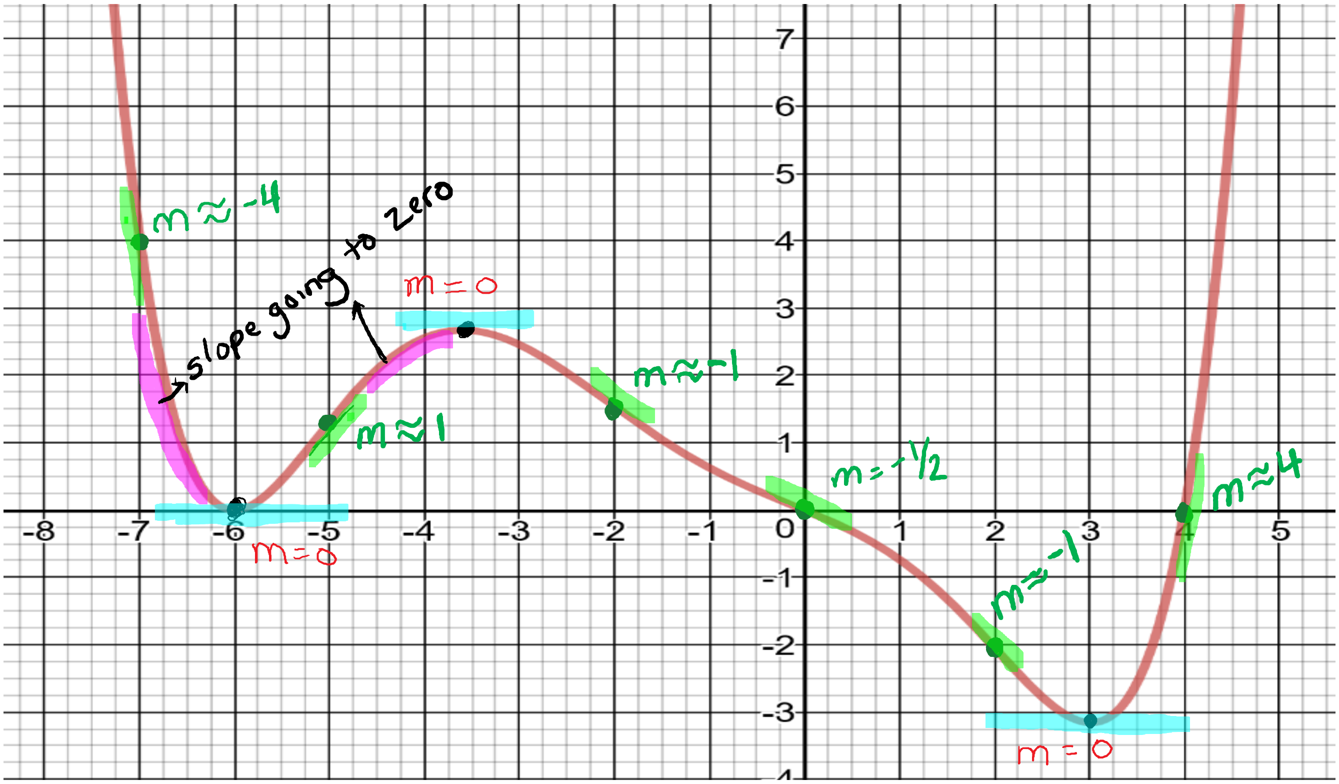

Each of the orange line is a tangent at a given red point. Notice that each tangent line as a different slope. If we make a table like above we get;

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $f'(x)$ | $-4$ | $-2$ | $0$ | $2$ | $4$ |




Notice the graph is just the equation $2x$. This still may be a little hard so let's look at a better example.

Consider the graph:

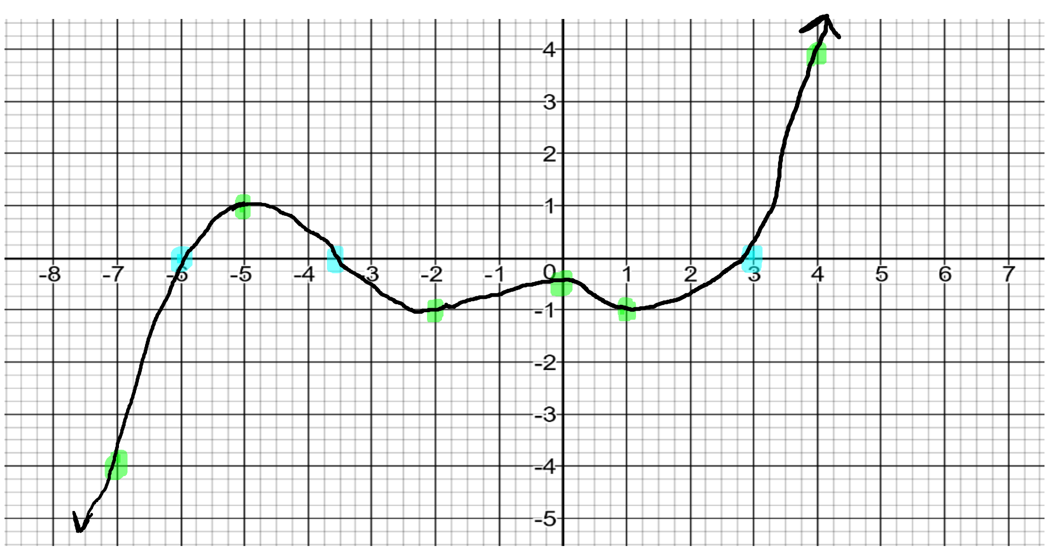



At $x = -6,\ x \approx -3.6, and\ x = 3$ are the local maximum and minimum this is where I have a horizontal tangent so the slope is 0 which means $f'(x) = 0$.

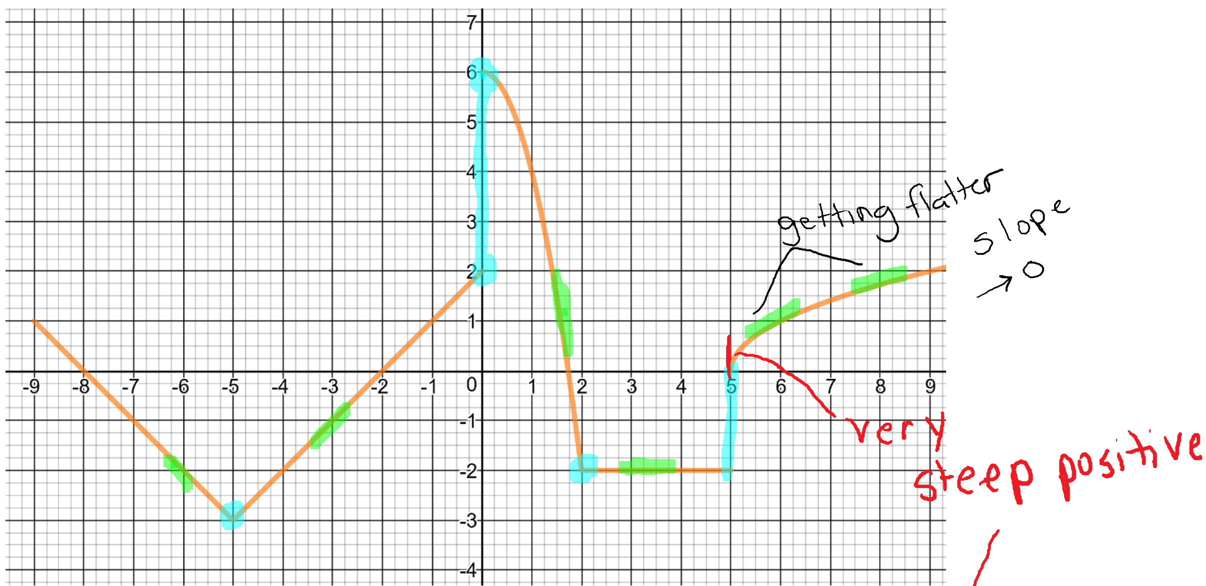
| $x$ | $-7$ | $-6$ | $-5$ | $-3.6$ | $-2$ | $0$ | $2$ | $3$ | $4$ |
|---|---|---|---|---|---|---|---|---|---|
| $f'(x)$ | $-4$ | $0$ | $1$ | $0$ | $-1$ | $-1/2$ | $-1$ | $0$ | $4$ |

Now we can draw little tangents to approximate the slope at the other values to finishing filling in the table.

Using the table plot the points on an $f'(x)$ *and* $x - value\ coordinate\ plane$. Then play connect the dots.

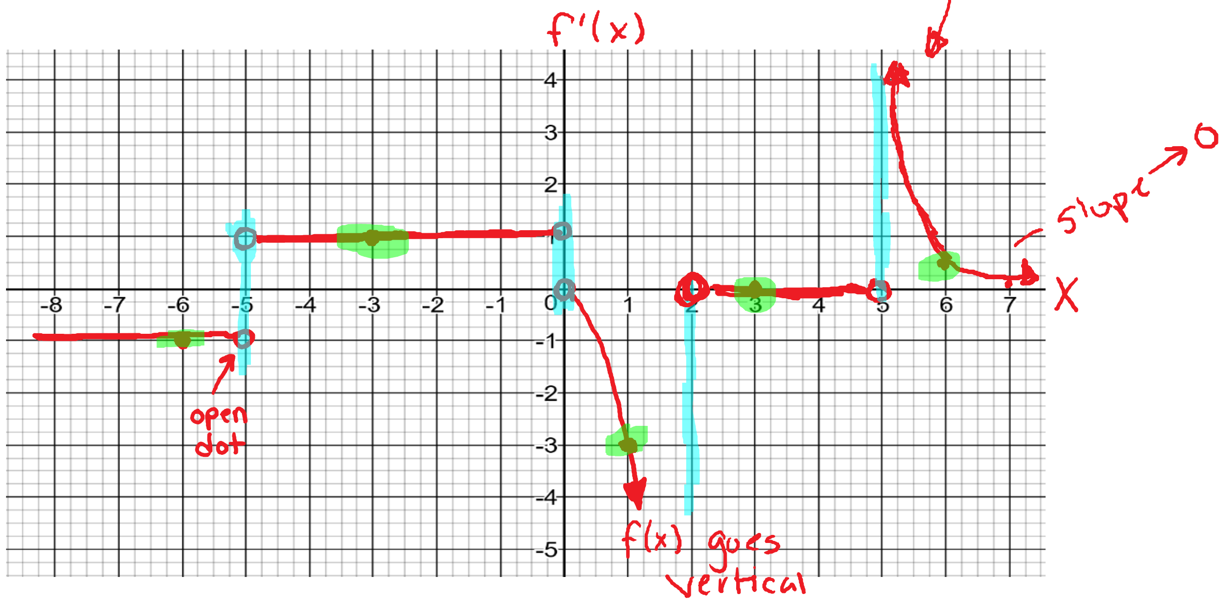


One thing that should be even attention is where the function is non-differentiable. This happens at corner points, shape points, or points of discontinuity. Consider the graph:




Let's create a table to help graph the slope function.

| $x$ | $-6$ | $-5$ | $-3$ | $0$ | $1$ | $2$ | $3$ | $5$ | $6$ | $8$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $f'(x)$ | $-1$ | Ø | $1$ | Ø | $-3$ | Ø | $0$ | Ø | ½ | $1/4$ |




PAY ATTENTION TO THE SLOPE—NO VERTICAL TANGENTS OR TWO DIFFERENT SLOPES ON THE LEFT OR RIGHT SIDE OF A POINT.

Create more points in the table if need more points. Keep the question is the slope really negative, small negative, small positive, or really positive in mind.