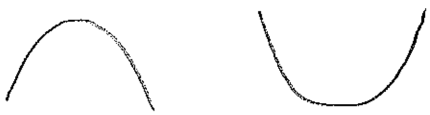
Recap 2.3 The Derivative Function – function whose dependent values are the slopes of the tangent lines of $f(x)$

Sketching $f'(x)$ given or what does $f(x)$ tell you about $f'(x)$?

1. $f(x)$ has a horizontal tangent line at $x = a \Rightarrow$ slope is zero $\Rightarrow f'(x)$ meets x-axis at $x = a$.

   If $f(x)$ looks like below $\Rightarrow$ crosses   If $f(x)$ looks like $\Rightarrow$ touches

2. $f(x)$ increasing $\Rightarrow$ slopes are positive $\Rightarrow f'(x)$ positive $\Rightarrow f'(x) > 0 \Rightarrow f'(x)$ lies above the x-axis.

3. $f(x)$ decreasing $\Rightarrow$ slopes are negative $\Rightarrow f'(x)$ negative $\Rightarrow f'(x) < 0 \Rightarrow f'(x)$ lies below the x-axis.

4. Domain $f'(x) \leq$ domain $f(x)$

5. $f(x)$ polynomial of degree N, $f'(x)$ is a polynomial of degree N - 1.

6. $f(x)$ has a sharp turn at $x = a$, $f'(x)$ is undefined.

   A. $y = |x|$, $f'(x)$ has a hole at $x = 0$

   B. $y = x^{2/3}$, $f'(x)$ has a vertical asymptote at $x = 0$

7. $f(x)$ has an inflection point at $x = a$.

   A. if the tangent line is vertical at $x = a$, $f'(a)$ undefined (vertical asymp)

   B. if the tangent line is nonvertical (diagonal or horizontal), $f'(x)$ has a local max/min at $x = a$.

8. $f(x)$ concave up  $\Rightarrow$ slopes are getting larger $\Rightarrow f'(x)$ is increasing.

9. $f(x)$ concave down  $\Rightarrow$ slopes are getting smaller $\Rightarrow f'(x)$ is decreasing.

10. Power Rule $f(x) = x^4 \quad f'(x) = nx^{n-1}$