1 | Derivatives

1.1 | Common

function	derivative
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\frac{1}{sin^2 x}$
$\sin x^-$	$\frac{1}{\sqrt{1-x}}$
$\cos x^-$	$\frac{-1}{\sqrt{1-x}}$
$\tan x^-$	$\frac{1}{1+x^2}$
a^x	$\ln(a)a^x$
$\log_a x$	$\frac{1}{\ln(a)x}$

1.2 | Rules

1.2.1 | Add/Subtract

$$\frac{d}{dx}f(x)+g(x)=\frac{d}{dx}f(x)+\frac{d}{dx}g(x)$$

1.2.2 | Multiply

$$\frac{d}{dx}\left(f(x)g(x)\right)=\left(\frac{d}{dx}f(x)\right)g(x)+f(x)\left(\frac{d}{dx}g(x)\right)$$

1.2.3 | Divide

$$\frac{d}{dx}\frac{f(x)}{g(x)}=\frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

1.2.4 | Chain Rule

$$\frac{d}{dx}f(g(x))=\left(\frac{d}{dx}f\right)(g(x))\left(\frac{d}{dx}g(x)\right)$$

1.2.5 | Power Rule (ONLY TAKE OUT CONST MULTIPLES)

$$\frac{d}{dx}x^n=nx^{n-1}$$

2 | **Approximation**

2.1 | **Linear Approximation at a Point**

$$y = f(a) + f'(a)(x - a)$$

(First order taylor series)

2.2 | **Differentials**

$$dy = f'(x)dx$$

Basically use the slope of the linear approximation to approximate the change (dy) in the function given a change an x (dx).

3 | **Implicit Differentiation**

REMEMBER that y is $f(x)$ which means it's a function of x! Use the chain rule!

Then solve for $f'(x)$ and if necessary, plug in the original definition of $f(x)$.

Use point slope form to find tangent lines.

4 | **Derivative of Inverse Functions**

$$f^{-\prime}(x) = \frac{1}{f'\left(f^{-}(x)\right)}$$