

1 | Derivatives

1.1 | Common

function	derivative
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\frac{1}{\sin^2 x}$
$\sin x^{-1}$	$-\frac{1}{\sqrt{1-x^2}}$
$\cos x^{-1}$	$\frac{1}{\sqrt{1-x^2}}$
$\tan x^{-1}$	$\frac{1}{1+x^2}$
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

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

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 in 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

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