

# AP Calculus Cheat Sheet

v1.6 (Condensed)

## 1 Derivatives

### 1.1 Using limits to calculate derivatives

$$\frac{d}{dx}f(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \quad (1)$$

### 1.2 Utilities

Power rule:

$$\frac{d}{dx}x^n = nx^{n-1} \quad (2)$$

Chain rule:

$$\frac{d}{dx}(f(x) \circ g(x)) = f'(g(x)) * g'(x) \quad (3)$$

Derivatives of inverses

$$\frac{d}{dx}f^{-1}(x) = \frac{1}{f'(f^{-1}(x))} \quad (4)$$

Derivatives of logbase

$$\frac{d}{dx}\log_b x = \frac{1}{x} * \frac{1}{\ln b} \quad (5)$$

Derivative of a multiplier

$$\frac{d}{dx}cx = c \quad (6)$$

Derivative of natural log

$$\frac{d}{dx}\ln x = \frac{1}{x} \quad (7)$$

Derivative of multiplication

$$\frac{d}{dx}fg = f'g + fg' \quad (8)$$

Quotient Rule

$$\frac{d}{dx} \left( \frac{f}{g} \right) = \frac{f'g - fg'}{g^2} \quad (9)$$

Tangent line equation

$$y - y_1 = m(x - x_1) \quad (10)$$

Definition of euler's number

$$e = \lim_{b \rightarrow \infty} \left( 1 + \frac{1}{b} \right)^b \quad (11)$$

Derivative of constant

$$\frac{d}{dx}c = 0 \quad (12)$$

Derivative of addition

$$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x) \quad (13)$$

Derivative of function multiplied by a constant

$$\frac{d}{dx}c * f(x) = c * f'(x) \quad (14)$$

Derivative of  $a^x$

$$\frac{d}{dx}a^x = a^x * \ln a \quad (15)$$

## 2 Identities

Trig Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad (16)$$

Derivative of cosine

$$\frac{d}{dx} \cos x = -\sin x \quad (17)$$

Derivative of sine

$$\frac{d}{dx} \sin x = \cos x \quad (18)$$

Derivative of tangent

$$\frac{d}{dx} \tan x = \sec^2 x \quad (19)$$

Derivative of cotangent

$$\frac{d}{dx} \cot x = -\csc^2 x \quad (20)$$

Derivative of secant

$$\frac{d}{dx} \sec x = \sec x \tan x \quad (21)$$

Derivative of cosecant

$$\frac{d}{dx} \csc x = -\csc x \cot x \quad (22)$$

Derivative of inverse sine

$$\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}} \quad (23)$$

Derivative of inverse tangent

$$\frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2} \quad (24)$$

Pythagorean theorem with sin/cos

$$\sin^2(x) + \cos^2(x) = 1 \quad (25)$$

Rules of logarithms

$$\log_b(b^x) = x b^{(\log_b x)} = x \log_b a^n = n \cdot \log_b a \quad (26)$$

Rules of exponents

$$\begin{aligned} \left(\frac{a}{b}\right)^n &= \frac{a^n}{b^n} \\ (x^a)^b &= x^{ab} \\ x^a \cdot x^b &= x^{a+b} \\ x^{-n} &= \frac{1}{x^n} \\ \frac{a}{x} \cdot \frac{b}{x} \cdot \frac{c}{x} \cdot \dots &= (a \cdot b \cdot c \cdot \dots)^{1/x} \end{aligned} \quad (27)$$