

# AP Calculus

## A Notebook

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## 1 Unit 2: Differentiation: Definition and Basic Derivative Rules

This unit will make up 10-12% (AB) or 4-7% (BC) of the AP exam score, and is usually covered in ~13-14 (AB) or ~9-10 (BC) class periods

- 1.1 Defining Average and Instantaneous Rates of Change at a Point
- 1.2 Defining the Derivative of a Function and Using Derivative Notation
- 1.3 Estimating Derivatives of a Function at a Point
- 1.4 Connecting Differentiability and Continuity: Determining When Derivatives Do and Do Not Exist
- 1.5 Applying the Power Rule

### The Power Rule

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

- 1.6 Derivative Rules: Constant, Sum, Difference, and Constant Multiple

### Constant Rule

$$\frac{d}{dx}[kx] = k \frac{d}{dx}[x]$$

**1.7 Derivatives of  $\cos x$ ,  $\sin x$ ,  $e^x$ , and  $\ln x$**

**1.8 The Product Rule**

**1.9 The Quotient Rule**

**1.10 Finding the Derivatives of Tangent, Cotangent, Secant, and/or Cosecant Functions**

Coefficient Rule

$$\frac{d}{dx}[kf(x)] = k \frac{d}{dx}[f(x)]$$

Sum/Difference Rule

$$\frac{d}{dx}[f(x) \pm g(x)] = \frac{df}{dx} \pm \frac{dg}{dx}$$

Chain Rule

$$\frac{df}{dx} = \frac{df}{du} \frac{du}{dx}$$

or

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

Product Rule

$$\frac{d}{dx}[f(x)g(x)] = \frac{df}{dx}g(x) + \frac{dg}{dx}f(x)$$

### Quotient Rule

$$\frac{d}{dx} \left[ \frac{f(x)}{g(x)} \right] = \frac{g(x) \frac{df}{dx} - f(x) \frac{dg}{dx}}{g(x)^2}$$

### Derivative of transcendental functions

$$\frac{d}{dx} [\ln(x)] = \frac{1}{x}$$

$$\frac{d}{dx} [a^x] = a^x \ln(x)$$

$$\frac{d}{dx} [e^x] = e^x$$

$$\frac{d}{dx} [\sin(x)] = \cos(x)$$

$$\frac{d}{dx} [\cos(x)] = -\sin(x)$$

$$\frac{d}{dx} [\log_a(x)] = \frac{1}{\ln(x)a}$$

REMEMBER CHAIN RULE

## 1.11 Overview

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