

# Antiderivatives & Indefinite Integration (4.1)



By the end of this lesson, I will be able to answer the following questions...

1. What is an antiderivative?
2. How do I calculate an antiderivative?

# Vocabulary

## Def. of an Antiderivative:

A function  $F$  is an antiderivative of  $f$  on an interval  $I$  if  $F'(x) = f(x)$  for all  $x$  in  $I$ .

\*Since the derivative of any constant  $C$  is zero, it is impossible to find a single function  $f$  for which  $F$  is the antiderivative.

# Prerequisite Skills with Practice

## Understanding the Notation

Given a differential equation,  $\frac{dy}{dx} = f(x)$  or  $dy = f(x)dx$ , finding all of the solutions of this equation is called antidifferentiation, or indefinite integration. The solution is

$$y = \int f(x) dx = F(x) + C$$

integral sign      integrand      variable of integration      Constant of integration

## Basic Integration Rules

\*Integration & differentiation are inverses, thus

$$\int F'(x)dx = F(x) + C$$

AND

$$\frac{d}{dx} \left[ \int f(x)dx \right] = f(x)$$

\*In addition, all the basic integration rules are mainly just the differentiation rules you've already learned, but in reverse.

Also, you can't integrate products and quotients piece by piece, just like with differentiation.



Find the  
indefinite integral

$$\int \left( -\frac{3}{x^2} \right) dx$$

$$\int \left( \frac{5}{x^4} - \frac{2}{x^2} + 4x^2 \right) dx$$

$$\int (y^5 \sqrt{y}) dy$$

$$\int \left( \frac{\cos \theta}{1 - \cos^2 \theta} \right) d\theta$$

## Initial Conditions & Particular Solutions

Solve each differential equation.

$$g'(x) = 6x^2, g(0) = -1$$

$$f''(x) = x^2, f'(0) = 6, f(0) = 3$$

# THE END



Visit [PlottsMath](#) for assignment details