Objectives:

- Define an antiderivative.
- Compute the antiderivatives of some familiar functions.

Let $f(x)$ be any function. We call $g(x)$ an _____

if _____ .

For example, if $f(x) = 3$, some antiderivatives of $f(x)$ are: _____

A way we could represent all of these solutions is: _____

In general, we write the antiderviative of $f(x)$ as _____ .

$f(x)$	Antiderivative of $f(x)$
$f(x) = 0$	
$f(x) = 5$	
$f(x) = 3x^2$	
$f(x) = x^2$	
$f(x) = x$	
$f(x) = x^n$	
$f(x) = \frac{1}{x}$	
$f(x) = 5x^2$	
$f(x) = x - 3$	
$f(x) = e^x$	
$f(x) = b^x$	

Some Antiderivative Rules:
If the antiderivative of $f(x)$ is $F(x) + c$ and the antiderivative of $g(x)$ is $G(x) + c$ then the antiderivative of $f(x) + g(x)$ is

If the antiderivative of $f(x)$ is $F(x) + c$ and b is a constant, the antiderviative of $b \cdot f(x)$ is

Examples: Find the antiderivatives, (Don't forget "$+c$"!):

1. $F'(x) = 3x^4 + 7x^2 + 5$

2. $G'(z) = \dfrac{z^2 + 1}{\sqrt{z}}$

3. $k'(t) = \dfrac{2}{3} + \dfrac{4}{t} + \dfrac{7}{\sqrt{t}}$

More antiderivatives!

$f(x)$	Antiderivative of $f(x)$
$f(x) = \cos(x)$	
$f(x) = \sin(x)$	
$f(x) = (\sec(x))^2$	
$f(x) = \sec(x)\tan(x)$	
$f(x) = \frac{1}{1+x^2}$	
$f(x) = \frac{1}{\sqrt{1-x^2}}$	

More Examples: Find the antiderivatives:

1. $H'(x) = \sin(x) + \pi + (\sec(x))^2$

2. $s'(t) = 2^x - \cos(x)$

(Did you remember to include "$+c$"?)

Initial value problems: Given $f'(x)$, we have seen that we can find $f(x) + c$. If we also know the value of $f(x)$ at some point, we can find the value of the constant c.

1. $s'(t) = -32t + 8$ and $s(0) = 40$. Find an equation for $s(t)$.

2. $f''(\theta) = \sin(\theta) + \cos(\theta)$ and $f'(0) = 3, f(0) = 4$. (Find $f(\theta)$.)

3. A stopped car accelerated at $4\frac{\text{m}}{\text{sec}^2}$ for 6 sec. Find a formula for velocity, $v(t)$, and a formula for position, $s(t)$.

4. Acceleration due to gravity on earth is $-32\frac{\text{ft}}{\text{sec}^2}$. A pumpkin is dropped from a 64 ft tall building. How long does it take to hit the ground and what is the impact velocity?