Calc AB

# Lesson 32

9/3/15

**Agenda:** 9/3/15

HW Leader:

Lesson 32

Antiderivative

Indefinite Integral

★ Quiz 3 Tomorrow
Lessons 24-28

| Period 3 | Period 4 |
|---|---|
| Michael S. | Olivia M. |

## An Antiderivative

- The inverse operation of differentiation, is going back to the original function, called antidifferentiation.

★ No unique answer, anti differentiation yields a family of functions all differing by a constant.

$\frac{d}{dx}(x^2) = 2x$ $\quad \frac{d}{dx}(x^2+42) = 2x$ $\quad \frac{d}{dx}(x^2-165) = 2x$

Ex. Find all antiderivatives of $f(x) = \sin(x)$. Find the antiderivative with $(0,0)$ as a point on its graph.

① $\boxed{y = -\cos(x) + C}$ where $C$ is any constant

Check: $\frac{dy}{dx} = \sin(x)$ since $\frac{d}{dx}(C) = 0$. ✓

② $0 = -1 + C \Rightarrow C = 1$ so

$\boxed{y = -\cos(x) + 1}$

**Indefinite Integration** - process of finding all antiderivatives of a function

Notation $\int 2x\,dx = x^2 + C$ ← any real number called the Constant of Integration

Integral symbol ↑ ↑ indicates that x is the variable of integration

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★ No definition for finding indefinite integrals.
Requires the ability to guess based on experience, check, and if necessary make a recalibration on guess.

**Ex. 32.2** Find $\int \cos x \, dx = \boxed{\sin x + C}$

Check: $d(\sin x + C) = d(\sin x) + d(C) = \cos(x)\, dx$

**Ex 32.4** Find $\int e^x dx = \boxed{e^x + C}$

Check: $d(e^x + C) = d(e^x) + d(C) = e^x dx$

Ex. Let $\frac{dy}{dx} = x^2$. Find $y$

$$y = \int \frac{dy}{dx}\, dx = \int x^2 \, dx = \boxed{\frac{1}{3}x^3 + C}$$

Check: $d\left(\frac{1}{3}x^3 + C\right) = d\left(\frac{1}{3}x^3\right) + d(C) = \frac{3}{3}x^2 dx + 0 = x^2 dx$