

Read 4.9

## Antiderivative of a function

Rectilinear motion, free fall

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ □臣 ○のへ⊙

web page : https://sites.math.washington.edu/ ~ep2/classes/125/125.html

- email : ep2@uw.edu
- Exam dates
- WebAssign

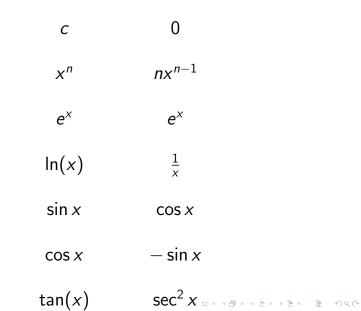
# Things to review

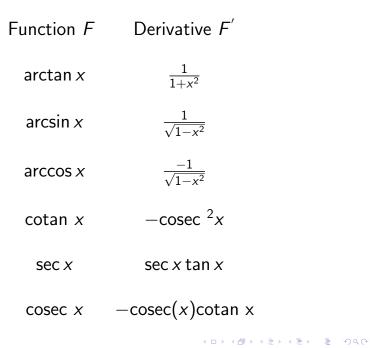
• Elementary functions :  $x^n$ ,  $\frac{1}{x}$ ,  $\sqrt{x}$ ,  $e^x \ln x$ , trig functions.

• Derivatives: formulas, rules , interpretation.

▲□▶ ▲□▶ ▲ 三▶ ▲ 三▶ 三 のへぐ

### Function F Derivative F'





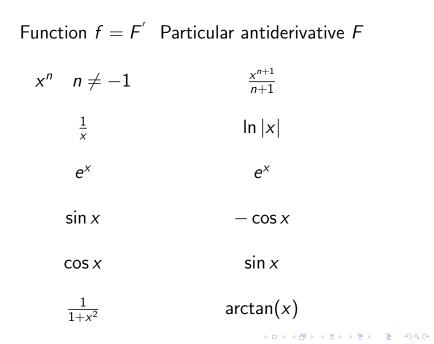
In this class we study **antiderivatives**. Given a function f (we think of f = F') we want to find another function F such that F' = f

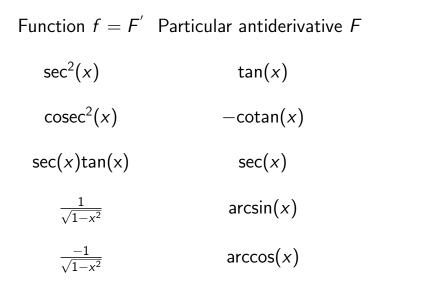
Def: A function F defined on an interval I is called an **antiderivative** of another function f defined on Iif and only if F'(x) = f(x) for all x in I.

## Example

### Find an andiderivative for f(x) = 2x

◆□▶ ◆□▶ ◆ 臣▶ ◆ 臣▶ ○ 臣 ○ の Q @





#### Does every function have an antiderivative?

▲□▶▲圖▶▲≣▶▲≣▶ ≣ のQ@

### If a function f has an antiderivative F, is it unique?

▲□▶▲圖▶▲≣▶▲≣▶ ≣ めぬぐ

## Differentiation rules

$$(c F)' = c F'$$
  
 $(F + G)' = F' + G'$ 

▲□▶ ▲□▶ ▲ 三▶ ▲ 三 ● ● ●

# **Antidifferentiation rules**

Assume F' = f and G' = g

### An antiderivative of cf is cF

An antiderivative of (f + g) is F + G.

Find an antiderivative for

$$f(x) = 3\sqrt{x} + \frac{\cos x}{2} + \frac{1}{x^2}$$

then find ALL antiderivatives.



# Challenge question

Find an antiderivative for f(x) = |x - 1|, then find ALL antiderivatives.

## Application to rectilinear motion

 s(t) position of a certain object, with respect to a given origin, at time t

• v(t) = s'(t) velocity of the object at time t.

# Free fall

Given that an object in free fall has a constant acceleration  $g = -9.8 \text{ m/sec}^2$  (=-32 feet/sec <sup>2</sup>)find a general formula for the position of the object at time *t*.

A ball is dropped from a location 100 m above the ground. Find the distance of the ball above the ground level at time t.

▲□▶ ▲□▶ ▲ 三▶ ▲ 三▶ 三 のへぐ

How long does it take the ball to reach the ground?

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 三臣 - 釣��

### With what velocity does it strike the ground?

▲□▶ ▲圖▶ ▲臣▶ ▲臣▶ ―臣 …の�?

A motorist is driving along a straight road with  $v(t) = 30(t - t^2) \text{ km/h}$ . After 1 hr it reaches town A. Find the distance of the motorist from town A after 2 hr.