

- Assignment 4 is due on November 26.
- Test 2 begins on December 4.
  
- **Before next class:**
  - **Watch videos 5.2, 5.3, 5.4**
  - Download next class slides.  
No need to look at them.

## Definition of arctan

1. Sketch the graph of  $\tan$ .
2. Prove that  $\tan$  is not one-to-one.
3. Select the largest interval containing 0 such that the restriction of  $\tan$  to it is one-to-one. We define  $\arctan$  as the inverse of this restriction. For  $x \in ???$ ,  $y \in ???$

$$\arctan y = x \quad \iff \quad y = \tan x$$

4. What is the domain of  $\arctan$ ? What is the range of  $\arctan$ ? Sketch the graph of  $\arctan$ .
5. Compute

5.1  $\arctan(\tan(1))$

5.2  $\arctan(\tan(3))$

5.3  $\arctan\left(\tan\left(\frac{\pi}{2}\right)\right)$

5.4  $\arctan(\tan(-6))$

5.5  $\tan(\arctan(0))$

5.6  $\tan(\arctan(10))$

## Derivative of arctan

Obtain (and prove) a formula for the derivative of arctan.

*Hint:* Call  $f(t) = \arctan t$  and differentiate

$$\forall t \in \dots \quad \tan(f(t)) = t$$

Find simple expressions for these quantities and state the domain on which they are valid:

1.  $\sin(\arccos x)$

2.  $\sec(\arccos x)$

3.  $\sec(\arctan x)$

4.  $\tan(\operatorname{arcsec} x)$

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4.  $\tan(\operatorname{arcsec} x)$

*Hint:* There are two standard ways to attack these problems:

- Use a trig identity  
e.g.: a trig identity relating  $\sin$  and  $\cos$  for (1)
- Or draw a right triangle with side lengths 1 and  $x$   
e.g.: with an angle  $\theta$  such that  $\cos \theta = x$  for (1)

If you need to take a square root, you must figure out which branch (+ or -) you are choosing.