Remember Two Important Resources

- Class Notes  
  Every example that I do in class is similar to one of the suggested exercises.

- Math Tutoring Center, Morton Hall 4th Floor Math Library
  Tues/Thurs  9am - Noon  1pm - 4pm

Another example from Section 3.5 Inverse Trig Functions

Find derivative of \( \text{arccsc}(x) \)

\[
\text{Solution}
\]

\[
\text{trick } x = \text{arccsc}(\text{arccsc}(x))
\]

\[
= \frac{1}{\sin(\text{arccsc}(x))}
\]

\[
= (\sin(\text{arccsc}(x)))^{-1}
\]
Find \( \frac{d}{dx} \) of both sides

\[
d(x) = \frac{d}{dx} \left( (\sin(\text{arccsc}(x)))^{-1} \right)
\]

\[
1 = \frac{d}{dx} f(g(h(x)))
\]

\[
= f'(g(h(x))) \cdot g'(h(x)) \cdot h'(x)
\]

\[
= -\frac{1}{\left( \sin(\text{arccsc}(x)) \right)^2} \cdot \cos(\text{arccsc}(x)) \cdot \frac{d}{dx} \text{arccsc}(x)
\]

\[
= -\left( \frac{1}{\sin(\text{arccsc}(x))} \right)^2 \cdot \cos(\text{arccsc}(x)) \cdot \frac{d}{dx} \text{arccsc}(x)
\]

\[
= -\left( \csc(\text{arccsc}(x)) \right)^2 \cdot \cos(\text{arccsc}(x)) \cdot \frac{d}{dx} \text{arccsc}(x)
\]

\[
1 = -\left( x \right)^2 \cdot \cos(\text{arccsc}(x)) \cdot \frac{d}{dx} \text{arccsc}(x)
\]
Need to find $\cos(\arccsc(x))$

Recall: $\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$

$\csc(\theta) = \frac{1}{\sin(\theta)} = \frac{\text{hypotenuse}}{\text{opposite}}$

So $\csc$ function eats angles as input, and spits out as output a number that is the ratio $\frac{\text{hypotenuse}}{\text{opposite}}$.

So the $\arccsc$ function eats a number that is the ratio $\frac{\text{hypotenuse}}{\text{opposite}}$, and spits out an angle $\theta$.

So to visualize $\arccsc(x)$ we must draw a right triangle where $x = \frac{\text{hypotenuse}}{\text{opposite}}$

then $\cos(\arccsc(x)) = \cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{\sqrt{x^2-1}}{x}$

$\text{adjacent} = \sqrt{x^2-1}$

$\text{hypotenuse} = x$
Use this in the derivative equation from page 2

\[ 1 = -x^2 \cdot \frac{\sqrt{x^2 - 1}}{x} \cdot \frac{d\text{arccsc}(x)}{dx} \]

\[ 1 = -x \sqrt{x^2 - 1} \cdot \frac{d\text{arccsc}(x)}{dx} \]

\[ \frac{d}{dx} \text{arccsc}(x) = -\frac{1}{x \sqrt{x^2 - 1}} \]

Now work on Group Work 15: Sliding Ladder

End of lecture