Closing today: 3.5(part 1)
Closing Mon: 3.5(part 2)
Closing Wed: 3.6-9
Closing next Fri: 3.9
Office Hours: 1:30-3:30 in Com B-006

Entry Task 1 (from a test):

Find $\frac{dy}{dx}$ for $y^5 - x = yx^2 + 1$.

Recall: Inverse Functions

We write inverses as $y = f^{-1}(x)$
which is equivalent to $f(y) = x$.

Entry Task 2:

$y = \tan^{-1}(x)$ corresponds to
$\tan(y) = x$ for $-\frac{\pi}{2} < y < \frac{\pi}{2}$.

Implicitly differentiate to find $\frac{dy}{dx}$

Summary Inverse Trig Rules

$\frac{d}{dx}(\sin^{-1}(x)) = \frac{1}{\sqrt{1-x^2}}$	$\frac{d}{dx}(\cos^{-1}(x)) = -\frac{1}{\sqrt{1-x^2}}$
$\frac{d}{dx}(\tan^{-1}(x)) = \frac{1}{1+x^2}$	$\frac{d}{dx}(\cot^{-1}(x)) = -\frac{1}{1+x^2}$
$\frac{d}{dx}(\sec^{-1}(x)) = \frac{1}{\mathrm{x}\sqrt{x^2-1}}$	$\frac{d}{dx}(\csc^{-1}(x)) = -\frac{1}{\mathrm{x}\sqrt{x^2-1}}$

3.6 Derivatives of Logarithms and Logarithmic Differentiation

Quick test of basic understanding

Solve $3^x + 1 = 11$

Recall your logarithm facts:

1. $y = \ln(x) \quad \leftrightarrow \quad e^y = x$

2. $e^{\ln(x)} = x \quad \text{and} \quad \ln(e^y) = y$

3. $\ln(ab) = \ln(a) + \ln(b)$

   $\ln\left(\frac{a}{b}\right) = \ln(a) - \ln(b)$

   $\ln(x^n) = \text{n} \ln(x)$

4. $\text{y} = \log_a(x) \leftrightarrow \quad a^y = x$

   (so $\ln(x) = \log_e(x)$)

Power functions:

$$\frac{d}{dx}\left[\left(g(x)\right)^{n}\right] = n\left(g(x)\right)^{n-1}g'(x)$$

Example:

$$\frac{d}{dx}[(x^3 + 2x)^{10}] =$$

Exponential functions:

$$\frac{d}{dx}\left[e^{g(x)}\right] = e^{g(x)}g'(x)$$

$$\frac{d}{dx}\left[a^{g(x)}\right] = a^{g(x)}\ln(a)g'(x)$$

Examples:

$$\frac{d}{dx}\left[e^{(x^4-5x)}\right] =$$

$$\frac{d}{dx}\left[7^{(x^4-5x)}\right] =$$

What do we do if the variable *x* is in BOTH the base and exponent?

Example: $y = (3x + 1)^x$

Answer: *Logarithmic Differentiation*

Step 1: Take log of both sides

Step 2: Differentiate implicitly

Step 3: Solve for y'.