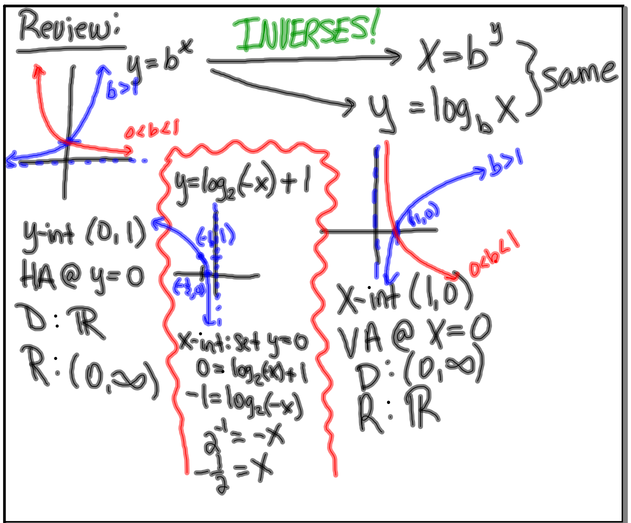

Nov 3-1:38 PM

Derivative of ln x

We want to find the derivative of: $y = \ln x$ $\log_e = \ln$

So we need to change it to something we can differentiate:

$$e^y = x$$

We will need to use implicit differentiation:

$$e^y \cdot \frac{dy}{dx} = 1$$

Now we just need to solve:

$$\frac{dy}{dx} = \frac{1}{e^y}$$

And by substitution we get:

$$\frac{dy}{dx} = \frac{1}{x} \cdot 1$$

Oct 15-12:01 PM

Derivative of ln x

If u is a differentiable function of x and $u > 0$,

$$\frac{d}{dx}\ln u = \frac{1}{u}\frac{du}{dx}$$

$\frac{d}{dx}\ln u$ = 1 over the inside times the derivative of the inside

Find $\frac{dy}{dx}$ if $y = \ln(3x^2)$

$$y' = \frac{1}{3x^2} \cdot 6x$$

$$y' = \frac{2}{x}$$

Oct 15-12:01 PM

Derivative of $\log_a x$

We want to find the d/dx of $\log_a x$ but we don't know the rule or short cut, but if we recall change of base we can re-write the log as a natural log and then we can differentiate:

$y = \log_a x$

Change of base formula

$$y = \frac{\ln x}{\ln a} = \frac{1}{\ln a} \cdot \ln x$$

$$y' = \frac{1}{\ln a} \cdot \frac{1}{x} \cdot 1$$

(Note: ln a is a constant!)

Oct 15-12:04 PM

Derivative of $\log_a x$

If u is a differentiable function of x and $u > 0$,

$$\frac{d}{dx}\log_a u = \frac{1}{u \ln a}\frac{du}{dx}$$

$\frac{d}{dx}\log_a u$ = 1 over (the inside times ln of base) times the derivative of inside

Example: Find the rate of change of $y = \log_3\sqrt{(2x-1)}$

$$y = \log_3(2x-1)^{1/2}$$

$$y' = \frac{1}{(2x-1)^{1/2} \cdot \ln 3} \cdot \frac{1}{2}(2x-1)^{-1/2} \cdot 2$$

$$y' = \frac{1}{(2x-1)^{1/2} \cdot \ln 3 \cdot (2x-1)^{1/2}} = \frac{1}{(2x-1)\ln 3}$$

Oct 15-12:06 PM