WARMUP!!

Solve the following (keep answers exact):

1) $7 = e^{x-1}$

2) $\ln(2x - 3) = 5$

State the inverse function for the following:

3) $f(x) = e^{x/3}$

4) $f(x) = \ln x + 1$ (note: this is not $\ln(x + 1)$)

1) $x = \ln 7 + 1$

2) $x = 1/2\,(e^5 + 3)$

3) $f^{-1}(x) = 3\ln x$

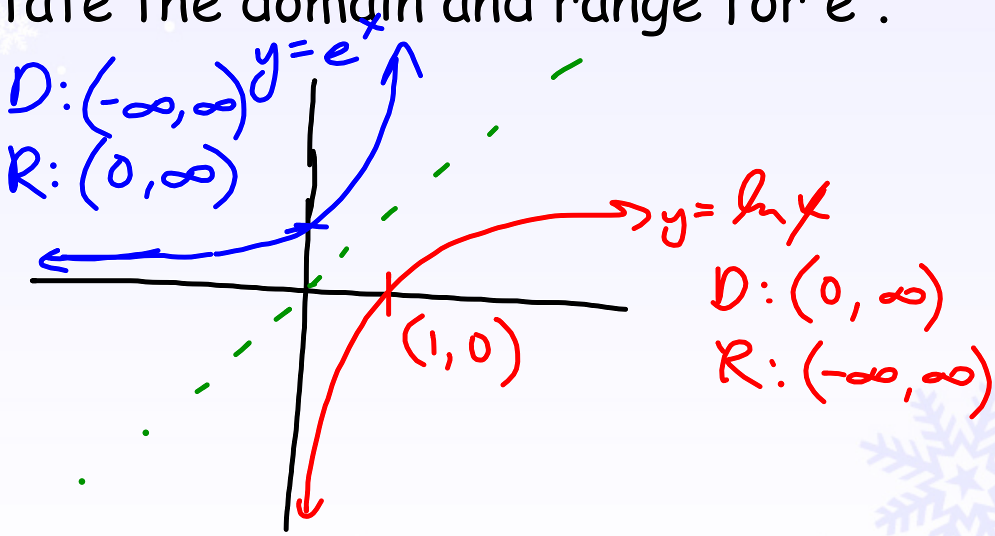
4) $f^{-1}(x) = e^{x-1}$

5.4a e^x!

Essential Learning Target:

> Knows the specific rules for calculating the derivatives of exponential functions

Warmup #2: Based on your knowledge of the graph of $y = \ln x$ and the fact that $\ln x$ and e^x are inverse functions, sketch a graph of $y = e^x$. Then state the domain and range for e^x.



Leonhard Euler, 1707 - 1783

Born in Basel, Switzerland, Euler is considered one of the greatest mathematicians of all time. His father was good friends with Johann Bernoulli, who tutored Leonhard on Saturdays.

Bernoulli's son, Daniel, got Leonhard a job at the Imperial Russian Academy of Sciences, and they ended up becoming roommates in St. Petersburg. Euler later married a Russian girl and they had 13 children, but only 5 survived beyond childhood.

Euler introduced the concept of function, and was the first to use the notation f(x) to show x as the input variable. He is the only mathmatician to have 2 numbers named after him: 'Euler's number', e, and 'Euler's constant', y (gamma). The concept of an 'Euler circuit' was generated from the 7 Bridges of Konigsberg problem. Later on we will learn 'Euler's Method' for approximating the solution to a differential equation.

Let's play, 'name that derivative'!

In your calculators, enter Y1 = e^x and Y2 = nderiv(e^x,x,x).

Then go to your table and compare!

Fill in the blank: If $y = e^x$, then $y' =$ e^x

Let's incorporate chain rule:

If $y = e^u$, then $y' =$ $e^u u'$

$dy = e^u du$

ex) If $y = e^{(3x^2 - 8x + 6)}$, then y' =

$$\frac{dy}{dx} = e^{(3x^2-8x+6)}(6x-8)$$

You try! Differentiate the following:

1) $y = e^{\sqrt{8 - x}}$

$$y' = e^{\sqrt{8-x}}\left(\tfrac{1}{2}\right)(8-x)^{-\frac{1}{2}}(-1)$$

$$= \frac{-e^{\sqrt{8-x}}}{2\sqrt{8-x}}$$

2) $y = \ln(e^x - 5)$

$$y' = \frac{e^x}{e^x - 5}$$

You try again!

Find all relative extrema and points of inflection for $g(x) = 1 + (2 + x)e^{-x}$. (JYA)

$$g'(x) = e^{-x} + (2+x)(e^{-x})(-1)$$
$$= e^{-x} - 2e^{-x} - xe^{-x} = -e^{-x} - xe^{-x} = e^{-x}(-1-x)$$

$+ \quad -$

$\nearrow \; -1 \; \searrow$

a rel max occurs @ $(-1, 1+e)$ b/c $g'(x)$ chgs from $+$ to $-$

$$g''(x) = -e^{-x}(-1-x) + e^{-x}(-1) = e^{-x} + xe^{-x} - e^{-x} = xe^{-x}$$

$- \quad +$

$\cap \; 0 \; \cup$

a poi occurs @ $(0, 3)$ b/c $g''(x)$ chgs sign

What have we learned?

- Can I solve equations involving lnx and e?
- Can I differentiate a function involving e^x?
- For what values of x is e^x not positive?