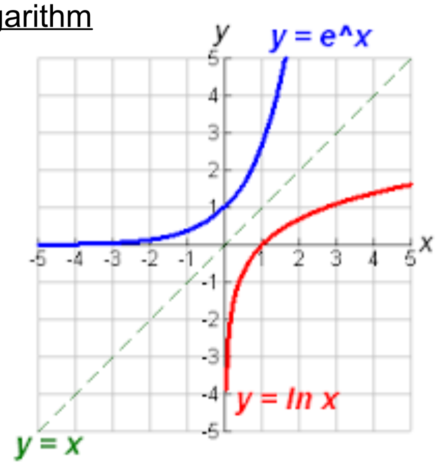
Date: ____________________

5.1 Derivatives of Exponential Functions, $y = e^x$

5.2 The Derivative of the General Exponential Function, $y = b^x$

1) Defining Euler's Number and the Natural Logarithm



- Euler's number, e, is a special irrational number like pi, and can also be called the natural number (rational approximation is e=2.718)
- The inverse of an exponential function with base e ($y = e^x$) is a logarithmic function with base e ($y=\log_e x$). This is also referred to as the natural logarithm which is represented by $y = \ln x$.

2) Derivatives of Exponential Functions of the Form $y = e^x$

Use Desmos to graph $y = e^x$ and its derivative. What do you notice?

All of the derivative rules still apply. Use your previous knowledge along with your new discovery to find the derivative of the following functions:

a) $f(x) = e^{4x}$

b) $g(x) = -3x^2(e^x + 1)$

c) $h(x) = e^{2x}\sin x$

d) $y = \dfrac{e^x - 2}{\cos x}$

3) Finding the Derivative of a General Exponential Function, $y = b^x$

For any exponential function that has a base that is a value other than e, $f(x) = b^x$, $f'(x) = b^x \ln b$.

All derivative rules still apply when dealing with composite functions involving exponential expressions.

Practice Problems:

Differentiate each of the following:

1) $y = 2^x$

2) $f(x) = 3x(3^x)$

3) $g(x) = 4^{2x+3}$

4) $h(x) = \sqrt{2^x}$

5) $y = 3^x - \sin x + 2 \cos x$