Name: **Date:**

5 – 5.1 Derivatives of Exponential Functions, $y = e^x$

Lesson Goals:

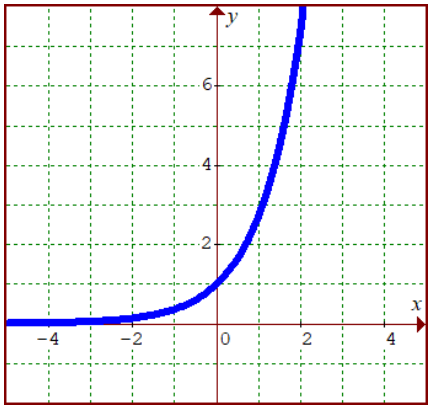
- Be able to apply the differentiation rules to find the derivative of exponential functions

1) Definition of Euler's Number, e

- This is an irrational number.
- A non-terminating, non-repeating decimal value like π.

$$e = 2.718281828459 \ldots$$

- Used as the base of an exponential function, $f(x) = e^x$ has the special property that the slope of the tangent at $x = 0$ is 1.

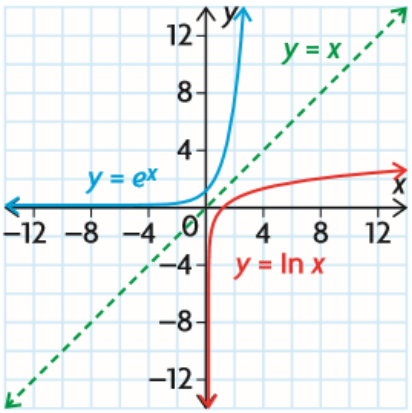


2) Properties of $y = e^x$ and the Natural Logarithm

- The inverse of $y = e^x$ is

$$y = log_e x \quad \text{or} \quad y = \ln x$$

- This is called the natural logarithm.
- "lnx" is pronounced "lawn x".



$y = e^x$	$y = \ln x$
• The domain is $\{x \in \mathbf{R}\}$.	• The domain is $\{x \in \mathbf{R} \mid x > 0\}$.
• The range is $\{y \in \mathbf{R} \mid y > 0\}$.	• The range is $\{y \in \mathbf{R}\}$.
• The function passes through (0, 1).	• The function passes through (1, 0).
• $e^{\ln x} = x$, $x > 0$.	• $\ln e^x = x$, $x \in \mathbf{R}$.
• The line $y = 0$ is the horizontal asymptote.	• The line $x = 0$ is the vertical asymptote.

3) Derivative of $f(x) = e^x$

- If $f(x) = e^x$, then $f'(x) =$
- If $f(x) = e^{g(x)}$, then $f'(x) =$

Example 1: Determine the derivative of $y = e^{-2x}$.

Example 2: Determine the derivative for each function. Express your answers in factored form.

a) $f(x) = x^2 e^{3x}$

b) $g(x) = \frac{e^{(x^2+5x)}}{\sqrt{x}}$

Example 3: Determine the equation of the tangent line to the curve $y = e^{4-3x}$ at the point where $x = 2$.

Homework: Page 232 #1-13