Natural Base e

KEY CONCEPT *For Your Notebook*

The Natural Base e

Euler's number

The natural base e is irrational. It is defined as follows:

As n approaches $+\infty$, $\left(1+\frac{1}{n}\right)^n$ approaches $e \approx 2.718281828$.

Graph: $y = e^x$

$y = 2.72^x$

Graph: $y = e^{-x}$

Think of e^{-x} as $\frac{1}{e^x} = \left(\frac{1}{e}\right)^x$

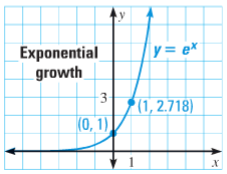
KEY CONCEPT *For Your Notebook*

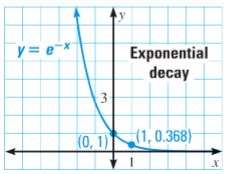
Natural Base Functions

A function of the form $y = ae^{rx}$ is called a *natural base exponential function*.

- If $a > 0$ and $r > 0$, the function is an exponential growth function.
- If $a > 0$ and $r < 0$, the function is an exponential decay function.

The graphs of the basic functions $y = e^x$ and $y = e^{-x}$ are shown below.





Simplifying Expressions:

1. $e^9 \cdot e^6 = e^{15}$

2. $\frac{60e^8}{12e^3} = \frac{60}{12} \cdot \frac{e^8}{e^3} = 5e^5$

3. $(-10e^{-5x})^3 = (-10)^3 \cdot (e^{-5x})^3 = -1000e^{-15x} = \frac{-1000}{e^{15x}}$

4. $\frac{e^{3x}}{4e} = \frac{1}{4} \cdot \frac{e^{3x}}{e^1} = \frac{1}{4}e^{3x-1}$

5. $\frac{60e^{8x}}{4e^{3x}} = \frac{60}{4} \cdot \frac{e^{8x}}{e^{3x}} = 15e^{5x}$

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Continuously Compounded Interest

$A = Pe^{rt}$