Section 7.3 Natural Base

Lesson objectives

Simplify and evaluate natural base expresssions
Graph natural base functions

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Exponential Functions:

Growth and decay graphs - today we will look at the natural base *e*. *e* is the Euler number after its discoverer, Leonhard Euler.

As n approaches $+\infty$, $(1 + {}^1/_n)^n$ approaches *e*.

$e \approx 2.718281828$

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Simplify natural base expressions.

$e^9 \cdot e^6 = \boxed{e^{15}}$

$\frac{60e^8}{12e^3} = 5e^{8-3} = \boxed{5e^5}$

$(-10e^{-5x})^3 = (-10)^3 e^{-15x}$

$-1000e^{-15x}$

$\boxed{\frac{-1000}{e^{15x}}}$

$(2e^{3x})^3 = 2^3 e^{9x} = \boxed{8e^{9x}}$

$\frac{e^5}{e^{(2x+5)}} = e^{5-(2x+5)}$

$= e^{5-2x-5}$

$= e^{-2x}$

$\boxed{= \frac{1}{e^{2x}}}$

$\sqrt{16e^6} = 4\sqrt{e^6}$

$\sqrt{e^2} \cdot \sqrt{e^2}\sqrt{e^2}$

$2 \cdot e^{-5} = \boxed{4e^3}$

$2 \cdot e^{-5} = 2 \cdot \frac{1}{e^5}$

$= \boxed{\frac{2}{e^5}}$

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Evaluate the expression:

Round to three decimal spots...

$e^6 = 403.429$

$e^{-.28} = 0.756$

$e^{\sqrt{2}} = 4.113$

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Exponential Growth or Decay:

Growth the base of the exponent is b >1
Decay the base of the exponent is 0 < b < 1

***Careful the natural base*e* is about 2.7 so are they all growth???? NO check the exponent if it is negative it is the reciprocal so that would be ${}^1/_e$ which is < 1!!!

Exp. Decay

$f(x) = 3e^{-x} = 3\left(\frac{1}{e}\right)^x$

$f(x) = \frac{1}{2}e^{4x}$ Growth

$= \frac{1}{2}(2.71\ldots)^{4x}$

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

Growth

$f(x) = -5e^{-2x}$

Decay

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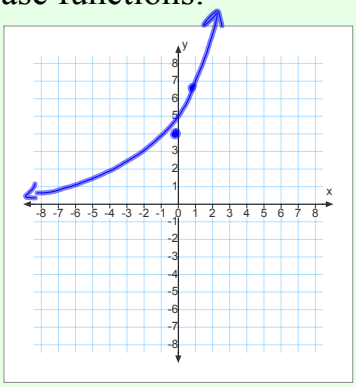
Graph natural base functions:

$f(x) = 4e^{0.5x}$ $\leftarrow 0$ $+0$

Plot (0,4)

Plot (1,6.6)



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Graph natural base functions:

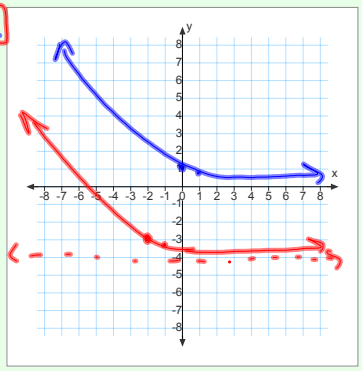
$f(x) = e^{-1/5(x+2)} - 4$

Graph: $e^{-\frac{1}{5}x}$

Plot (0, 1)

Plot (1, 0.8)

Asym: $y = -4$



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Continuously Compounded Interest:

$A = Pe^{rt}$ $A = P(1 + \frac{r}{n})^{nt}$

P is the amount deposited r is the rate in decimal form and t is the number of years...

You deposit $2000 in an account that pays 4% annual interest. After 5 years you withdraw the money...

What is the balance if interest is compounded quarterly?

$A = 2000(1 + \frac{.04}{4})^{5 \cdot 4}$ $A = \$2440.38$

What is the balance if interest is compounded continuously?

$A = 2000e^{.04(5)}$ $A = \$2442.81$

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