7.3: Use Functions involving "e"

e – Natural base

e is found using the expression:

$$(1+\frac{1}{n})^{n}$$

by plugging in various numbers we can approximate e

$1 \rightarrow (1+{}^{1}/_{1})^{1}$

$(1+1)^{1}$

$2^{1} = 2$

$2 \rightarrow (1+{}^{1}/_{2})^{2}$

$(1\,{}^{1}/_{2})^{2} = 2.25$

⋮

$10 \rightarrow (1+{}^{1}/_{10})^{10} = 2.59374$

$100 \rightarrow (1+{}^{1}/_{100})^{100} = 2.70481 \approx 2.7$

$1000 \rightarrow (1+{}^{1}/_{1000})^{1000} = 2.71692 \approx 2.71$

$10000 \rightarrow (1+{}^{1}/_{10000})^{10000} = 2.71815 \approx 2.718$

$100000 \rightarrow (1+{}^{1}/_{100000})^{100000} = 2.71827 \approx 2.7182$

so, as $e \rightarrow \infty$ (e approaches infinity)

$e \approx 2.71828$

$e^{0} = 1$

$e^{1} = 2.718$

example 1: Simplify

a. $e^7 \cdot e^4$ $= e^{11}$

b. $2e^{-3}\ 6e^5 = 12e^2$

c. $\dfrac{24e^8}{4e^5}$ $6e^3$

d. $(10e^{-4x})^3$

$10^3 e^{-4x \cdot 3}$

$1000e^{-12x}$

e) $\sqrt[3]{8e^{6x}}$

$2e^{2x}$

2 | 8
2 | 4
2 | 2
1

$e^x e^x e^x \quad e^x e^x e^x$

***works just like last semester:

$\sqrt[3]{x^5}$

XXXXX

$x\sqrt{x^2}$

Example 2: use a calculator to evaluate

a. $e^{3/4} \approx 2.117$

b. $e^{-.28}$ $(-.28)$ $e \approx .7558$

(2)

Graphing e

Standard Form:

$$y = a \cdot e^{r(x-h)} + k$$

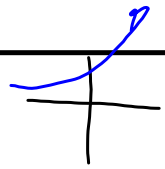
$b = e^r$

y-intercept: (0, a)

2nd point: (1, ab)

If r is positive it is an exponential growth

If r is negative it is an exponential decay

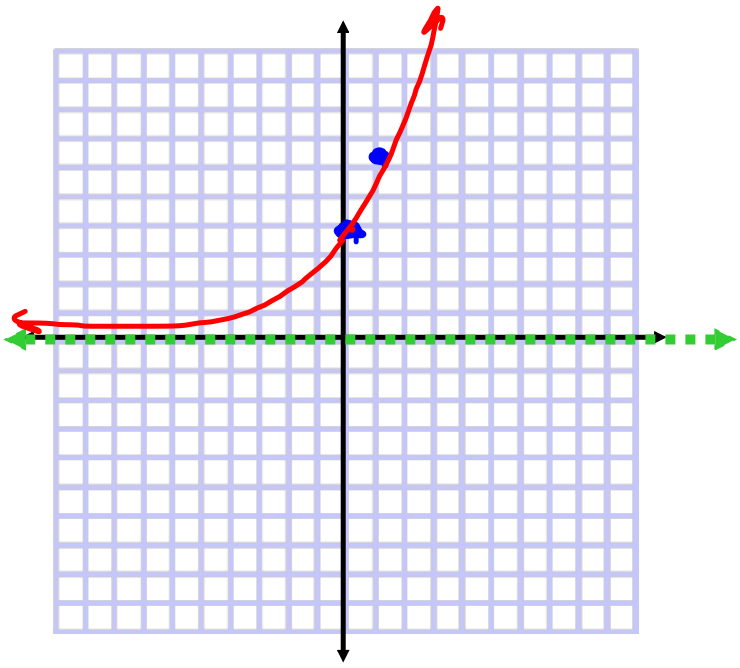


Example 3: Graph

a. $y = 4e^{0.5x}$

$a = 4$ $b = e^{0.5}$

$b \approx 1.6$



Pts: (0, 4)

(1, 6.4)

Shift: None

Asymptote: $y = 0$

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

c. $y = e^{-1.5(x+2)} - 4$

$a = 1$ $b = e^{-1.5}$

$b \approx .22$

Pts: $(0, 1)$

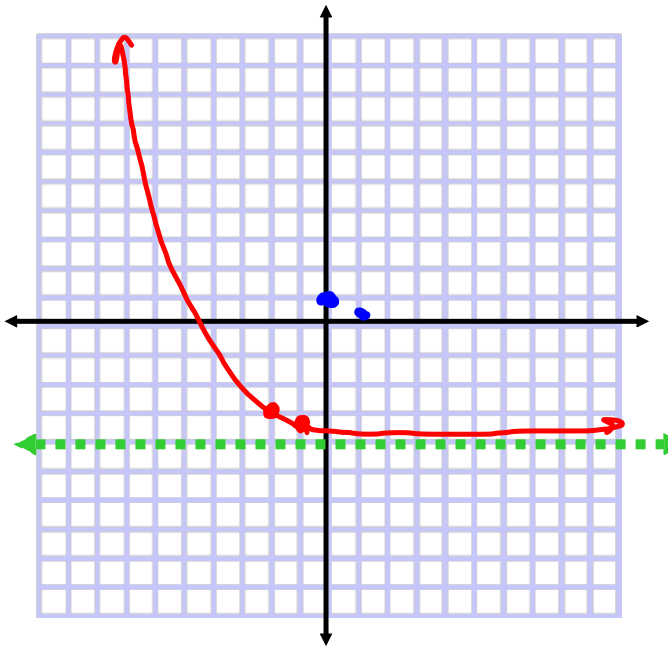
$(1, .22)$

Shift: Left 2 Down 4

Asymptote: $y = -4$

Domain: $(-\infty, \infty)$

Range: $(-4, \infty)$



Continuously Compounded Interest

$$A = Pe^{rt}$$

P = initial amount
r = %
t = years

Example:
You deposit $3,000 into an account that pays 3.5% annual interest compounded continuously. What is the balance after 3 years.

$A = Pe^{rt}$

$P = 3000$

$r = .035$

$t = 3$

$3000e^{.035(3)}$

$3000e^{.105}$

$3000(1.11)$

$\$3330.00$