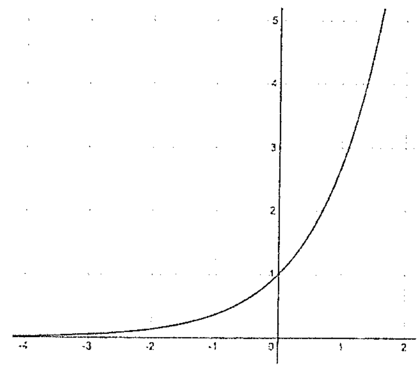
Name: Key

PreCalculus Unit 4: 4.1 Notes
Applications of Exponential Functions

Natural base e is an irrational number used in exponential functions.

The function $f(x) = e^x$ is known as the natural exponential function, where $e \approx 2.718$.



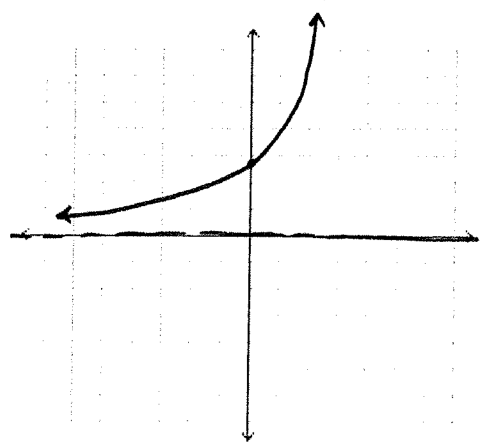
Domain: $\mathbb{R}$

Range: $y > 0$

Asymptotes: $y = 0$

Intercepts: $(0, 1)$

1. Graph the function $y = e^{(0.5x+1)} - 1$



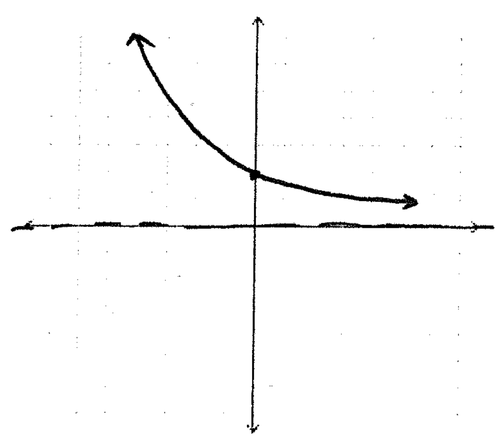
Domain: $\mathbb{R}$

Range: $y > 0$

Asymptotes: $y = 0$

Intercepts: y-int: $e \approx 2.718$

2. Graph the function $y = 2e^{-0.3x}$



Domain: $\mathbb{R}$

Range: $y > 0$

Asymptotes: $y = 0$

Intercepts: y-int: $(0, 2)$

Compound Interest

When compounding n times per year, use the formula: $A = P(1+\frac{r}{n})^{nt}$

Where $A =$ the account balance, $P =$ the initial investment, $r =$ the interest rate, $n =$ the number of compoundings per year, and $t =$ time.

For continuous compounding, use the formula: $A = Pe^{rt}$

Where $A =$ the account balance, $P =$ the initial investment, $r =$ the interest rate, and $t =$ time.

Example #1

A total of \$10,000 is invested at an annual interest rate of 2.5%, compounded annually. Find the balance in the account after 4 years. In this case, we use the formula $A = P(1+\frac{r}{n})^{nt}$

$$A = 10{,}000\left(1+\frac{.025}{1}\right)^{(1\cdot 4)} = \boxed{\$11{,}038.13}$$

Example #2

A total of \$11,000 is invested at an annual interest rate of 3%. Find the balance in the account after 5 years if the interest is compounded a) quarterly and b) continuously.

$$A = 11{,}000\left(1+\frac{.03}{4}\right)^{(4\cdot 5)} = \boxed{\$12{,}773.03}$$

$$A = 11{,}000\, e^{(.03\cdot 5)} = \boxed{\$12{,}780.18}$$

Radioactive Decay

Let Q represent a mass of carbon ^{14}C in grams, whose half-life is 57 years. The quantity of carbon present after t years is given by $Q = 100(\frac{1}{2})^{t/57}$.

a) Determine the initial quantity (when $t = 0$).

$$Q = 100\left(\tfrac{1}{2}\right)^{0/57} = \boxed{100 \text{ grams}}$$

b) Determine the mass of carbon present after 40 years.

$$Q = 100\left(\tfrac{1}{2}\right)^{40/57} = \boxed{61.48 \text{ grams}}$$

Population Growth

The approximate number of fruit flies after t hours is given by $F(t) = 20e^{0.03t}$, where $t \geq 0$.

a) Determine the population of fruit flies after 30 hours. After 50 hours?

$$F(30) = 20e^{.03(30)} = \boxed{49 \text{ flies}}$$

$$F(50) = 20e^{.03(50)} = \boxed{89 \text{ flies}}$$

b) Determine the initial population of fruit flies (when $t = 0$).

$$F(0) = 20e^{.03(0)} = \boxed{20 \text{ flies}}$$