When a real-life quantity increases or decreases by a fixed percent each year (or other time period), the amount y of the quantity after t years can be modeled by one of the following equations:

Exponential Growth Model	Exponential Decay Model
$y = \underset{a}{a}(\underbrace{1+r}_{b})^{\underset{x}{t}}$	$y = a(1-r)^t$

In these equations, a = initial amount

r = percentage rate

1 + r = growth factor (b)

1 − r = decay factor

ex: growing by 11%
r = .11
1+r = 1.11

Example 2
a.) In 1970, the population of Kern County, California, where Bakersfield is located, was about 333,000. From 1970 to 2000, the county population grew at an average annual rate of about 2.4%.

i.) Write an exponential model giving the population P of Kern County t years after 1970.
$P = 333{,}000(1 + 0.024)^t$

ii.) About how many people lived in Kern County in 1990? *1990 − 1970 = 20
$P = 333{,}000(1.024)^{20}$ = 535,110 people

b.) A new car costs $25,000. The value of the car decreases by 15% each year.

i.) Write an exponential model giving the car's value y (in dollars) after t years.
$y = 25{,}000(1 - .15)^t$

ii.) ~~Graph~~ your equation from part i and use the graph to estimate the value of the car after 4 years.
$y = 25{,}000(.85)^4$ = \$13,050.16

Compound Interest interest that is paid on the initial investment and on previously earned interest

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

P = principal

r = annual rate

n = times per year

t = time

A = amount in account

Example 3
You deposit \$5500 in an account that pays 3.6% annual interest. Find the balance after 2 years if interest is compounded with the given frequency.

a.) semiannually

$A = 5500\left(1+\frac{0.036}{2}\right)^{2t}$

$A = 5500\left(1+\frac{0.036}{2}\right)^{2\cdot 2}$

$A = \$5906.82$

b.) monthly

$A = 5500\left(1+\frac{0.036}{12}\right)^{12t}$

$A = 5500\left(1+\frac{0.036}{12}\right)^{24}$

$A = \$5909.97$

Section 3 – Use Functions Involving *e*

n	10^1	10^2	10^3	10^4	10^5	10^6
$\left(1+\frac{1}{n}\right)^n$						

As n gets bigger and bigger (approaches ∞), $\left(1+\frac{1}{n}\right)^n$ approaches ________________. This number is called ____________________________ or __________________________ and is denoted ______.

Example 1
Simplify the expression.

a.) $e^9 \cdot e^6$

b.) $\frac{60e^8}{12e^3}$

c.) $\left(-10e^{-5x}\right)^3$

Example 2
Use a calculator to evaluate the expression.

a.) e^6

b.) $e^{-0.28}$

c.) $e^{3/4}$