

# Exponential Growth

An exponential equation is any equation that can be written in the form

$$y = a(b)^x$$

where **a** is the starting or **initial value** and **b** is the **growth factor**.

## Exponential Growth

Any constant percent of growth can be modeled by an exponential equation.

$$y = \underline{a(1+r)^x}$$

**a** is the starting (initial) value, **r** is the rate of growth written as a decimal or fraction, **x** is the number of time periods elapsed, and **y** is the final value.

### Example

A credit card account is essentially a loan. A constant percent interest is added to the balance. Sandy buys \$100 worth of groceries with her credit card. The balance grows by 4.5% interest each month. Write an equation to represent the situation. What will she owe for her groceries if no payments are made during the first 6 months?

\$130.23

$$y = 100(1 + 0.045)^x$$

Month	Account Balance
0	100
1	104.50
2	109.20
3	114.12
4	119.25
5	124.62
6	130.23

2. My Individual Retirement Account (IRA) earns 15% interest each year. I started with an initial investment of \$2,000. Write an equation to represent the situation.

$$y = 2000(1 + 0.15)^x$$

a. Estimate when will I have over \$10,000 in my IRA?

After about 12 years  
the account will be at \$10,700.50

b. How much will the initial investment be worth in 30 years?

\$132,423.54

3. You put \$250 in a savings account that earns 4% annual interest compounded yearly. You do not make any deposits or withdrawals. Write an equation for the situation.

$$y = 250(1 + 0.04)^x$$

a. How much will your investment be worth in 5 years?

\$304.16

# Exponential Decay

## Exponential Decay

Any constant percent of decay or depreciation can be modeled by an exponential equation.

$$y = a(1-r)^x$$

$a$  is the starting (initial) value,  $r$  is the rate of decay or depreciation written as a decimal or fraction,  $x$  is the number of time periods elapsed, and  $y$  is the final value.

### Examples:

4. Phillip purchases a used truck for \$11,500. The value of the truck is expected to decrease or depreciate by 20% each year. Write an equation to represent the situation & fill in the given table.

$$y = 11,500(1-0.20)^x$$

Year	Value
0	11,500
1	9,200
2	7,360
3	5,888
4	4,710.40
5	3,768.32
6	3,014.66

a. Estimate when the truck will be worth less than half its purchased price?

After 4 years (\$5750)

5. A car is presently worth \$8,000. Each year it depreciates in value by 8%. Write an equation to represent the situation.

$$y = 8000(1-0.08)^x$$

a. Estimate when will the car be worth <sup>less than</sup> ~~over~~ \$2,000?

In about 17 years, the car will be worth \$1938.58

b. How much will the car be worth in three years?

\$6,229.50

6. You purchase an iPhone 5 for \$125. The value of the cell phone decreases by about 20% annually. Write a function that models the value of the cell phone over time.

$$y = 125(1-0.20)^x$$

a. How much will it be worth in 3 years?

\$64