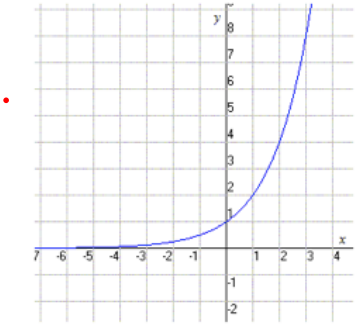
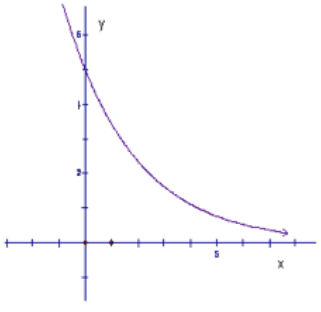
Exponential equations are integral for the modeling of numerous real life applications. These applications come from manipulation of exponential growth and decay.

Exponential equations of the form $y = ab^x$ where $a > 0$ and $b > 1$ are called exponential growth. We can see this in the graph because the graph increasing or gets bigger from left to right.



Exponential equations of the form $y = ab^x$ where and $a > 0$ $0 < b < 1$ are called exponential decay. We can see this in the graph because the graph decreases or gets smaller from left to right.



Example 1 : State whether the following equations are growth or decay

$y = 2 \cdot 3^x$ Growth

$y = 3 \cdot \left(\frac{1}{2}\right)^x$ .5 decay

$y = \frac{3}{4} \cdot 5^x$ growth

$y = \frac{5}{3} \cdot \left(\frac{7}{4}\right)^x$ 1.75 Grow

$y = 7 \cdot 0.8^x$ decay

Exponential growth functions model important situations today such as:

a) The spread of viruses: _____

b) Human Population: _____

c) Economic Growth: _____

d) Finances: _____

e) Processing power of Computers: _____

f) Internet traffic growth: _____

The equation that models exponential growth is:

$$y = a(1 \pm r)^t$$

a is the initial value **r** is the rate of change (expressed as a **DECIMAL)**

y is the final amount and **t** is the time

What does the 1 represent in our equation?

100% of what we start with.

How do we know that this equation is modeling growth and not decay?

$1+r>1$

To change a **rate** or percent to a **decimal** I divide my rate by 100, or move the decimal point over 2 places to the left.

Example 2: A college's tuition has risen 5% each year since 2000. The tuition in 2000 was $10,850. $y = a(1+r)^t$

a) Write an equation to represent the amount of the tuition t years after 2000.

$y = 10{,}850(1+.05)^t$

b) How much will tuition cost for those attending college in 2014? What about 2015?

$y = 10{,}850(1+.05)^{14}$ 21,482.26

Example 3: The prize for a radio station contest begins with a $100 gift car. Once a day, a name is announced. The person has 15 minutes to call or the prize increases by 2.5% for the next day.

a) Write an equation to represent the amount of the first card in dollars after t days with no winners.

$y = 100(1+.025)^t$

b) How much will the gift card be worth if no one wins after 10 days?

$y = 100(1+.025)^{10}$ 128

The equation that models exponential decay is:

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

a is the initial value **r** is the rate of change (expressed as a **DECIMAL)**

y is the final amount and **t** is the time

What does the 1 represent in our equation?

100% of what we start with.

How do we know that this equation is modeling decay and not growth?

$1 - r < 1$

S/O @katlong

#amazingartist

Example 4: A fully inflated child's raft for a pool is losing 6.6% of its air every day. The raft originally contained 4500 cubic inches of air.

a) Write an equation to represent the loss of air.

$$Y = 4500(1 - .066)^t$$

b) Estimate the amount of air in the raft after 7 days.

$$Y = 4500(1 - .066)^7 \quad 2,790.23$$

Example 5: Identify the following situations as growth or decay and identify the key word.

a) In 2008 the town of flat creek had a population of about 280,000 and a growth rate of 0.85% per year.

b) During an economic recession, a charitable organization found that its donations dropped by 1.1% per year. Before the recession, its donations were $390,000.

c) In 2000, 2200 students attended Polaris High School. The enrollment has been declining 2% annually?