#17 Exponential Growth + Decay

10/13/15

Standard Form

$y = a(b^x)$ ∴

$y = a(b^{x-n}) + k$

x = independent (in the exponent)

y = dependent

a = initial value

b = growth/decay Factor

Growth

Growth factor $b > 1$

$1 = 100\%$

Growth Rate r as a decimal

$1 + r = b$

Decay

Decay factor $0 < b < 1$ between 0% – 100%

Decay rate r as a decimal

$1 - r = b$

3.6%
.036

98%
.98

.5%
.005

Ex Given the following equations, tell me Growth or Decay and rate and initial value

(A) $y = 100(.75)^x$
decay, .25, 25%
initial value 100

(B) $y = .5(.5)^x$
decay, .5
initial value .5

(C) $y = 2(2)^x$
Growth, 1 rate 100%
initial value 2

(D) $y = 3(1.3)^x$
Growth, .3 rate 30%
initial value 3

(E) $y = 50(1.03)^x$
Growth .03 rate 3%

(F) $y = 3(.05)^x$
Decay .95 rate 95%

Populations

(1) San Fransico is a great city. Their population in 2010 was 1.3 million people. If their population grows 1.6% per year, what will their population be in 2050?

Initial value 1.3 millions
growth rate 1.6% → .016
growth factor 1.016
equation $y = 1.3(1.016)^x$

x = years since 2010

y = Population after x years in millions

after 40 years

$y = 1.3(1.016)^{40}$

$y = 2.45$ millions of people

(2) A zombie population is growing. Right now there are 1,700 zombies in the city. Each Day the zombies bite 2 people. x = days, y = population

(A) Equation = initial value 1,700
growth factor 2
rate 100%
$y = 1700(2)^x$

(B) Next/Now Rule
Next = Now · 2 starting 1700

(C) When will the zombies Reach over 600,000?
8.46 days

(D) How many zombies will there be after 16 days? x = 16
$1700(2^{16}) = 111,411,200$ zombies

Investments

(1) You invest $1,000 when you were born to buy a car later on. Your account earns 6% interest per year

(A) Equation

initial $ 1000

growth rate 6% → .06

growth factor 1.06

$y = 1000(1.06)^x$

x = years

y = investment after x years

(B) On your 16th birthday, how much money will your investment have?

$y = 1000(1.06)^{16} = \$2,540.35$

(C) When you're 18, how much will you have to put toward your 1st semester in college?

$y = 1000(1.06)^{18} = \$2,854.34$

(2) A $27,000 car depreciates in value 2% per month the first year after being bought.

(A) Equation 2% → .02

$y = 27000(.98)^x$

Now/Next Rule

Next = Now (.98) starting @ 27000

(B) How much is the car worth after 6 months? ... 12 months?

$y = 27000(.98)^6 = \$23,918$

$y = 27000(.98)^{12} = \$21,187$