You will be taking a new job for the entire month of June (all 30 days!) and have been given the choice of how you want to be paid. Below are the two options.

Option #1:
You will be paid $50,000 at the end of the 1st day then given $5000 at the end of each following day.

Option #2:
You will be given 2 pennies at the end of the 1st day then each following day you will be given enough pennies so that the total number of pennies you have is twice as much as you had the day before.

Option #1:
You will be paid $50,000 at the end of the 1st day then given $5000 at the end of each following day.

End of Day #	Total amount earned at day's end
1	$50,000
2	50,000 + 5000 = 55,000
3	50,000+5000+5000 = 60,000
4	50,000+5000+5000+5000 = 65,000
5	50,000+5000+5000+5000+5000 = 70,000
6	=75,000
7	=80,000
8	=85,000
9	=90,000
10	=95,000

you add 5000 each day starting with day #2
If you look carefully the number of 5000's added is always one less than the day number.

2. Write an equation for each option.
Option #1: $x = \#\ days$

(hint: look at the day # and see how many times you've added $5000)

$y = 50{,}000 + 5000(x-1)$

$= 50{,}000 + 5000(30 - 1)$

$\$195{,}000$

You start with 50,000

you add 5000 each day starting with day #2
If you look carefully the number of 5000's added is always one less than the day number.

Option #2:
You will be given 2 pennies at the end of the 1st day then each following day you will be given enough pennies so that the total number of pennies you have is twice as much as you had the day before.

End of Day #	Total amount earned at day's end
1	$0.02
2	0.02 + 0.02 = 0.04 = 0.02(2)
3	0.02(2)(2) = 0.08
4	0.02(2)(2)(2) = 0.16
5	0.02(2)(2)(2)(2) = 0.32
6	0.02(2)(2)(2)(2)(2) = 0.64
7	= 1.28
8	= 2.56
9	=5.12
10	=10.24

you multiply by 2 each day starting with day #2.
If you look carefully the number of times you've multiplied by 2 is always one less than the day number.

Option #2: $x = \text{\# days}$

(compare the totals to see how they are related)

$10,737,418.24$
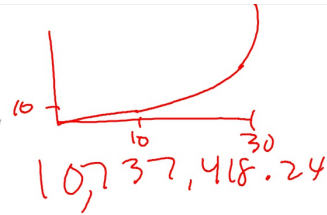
$(0.02)(2)^{30-1} =$

$y = (0.02)(2)^{x-1}$

You started with $0.02

you multiply by 2 each day starting with day #2. If you look carefully the number of times you've multiplied by 2 is always one less than the day number.

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3. Find the amount of money that you would have earned at the end of the day on June 30th for each option.

Option #1:

$y = 50,000 + 5000(30 - 1)$

$= \$195,000$

Option #2:

$y = (0.02)(2)^{30-1}$

$= \$10,737,418.24$

4. Which option would you choose and why?

Last year, 2014 the TV you wanted cost $450. This year the price increased 12%.
Find the new price.
If each year the price increases 12%, how much will it cost in 2019?

$y = 450(1.12)(1.12)(1.12)(1.12)(1.12) = 450(1.12)^5 = \$793.05$

This situation is called Exponential Growth

In the year 2000 the population of a city was 210,000. In 2001 the population decreased by 4%. Find the new population.

$100\% - 4\% = 96\%$

$210,000(.96) = 201,600$

In the year <u>2000</u> the population of a city was 210,000. In 2001 the population decreased by 4%. Find the new population.

$$210,000(.96)$$

Find the population in <u>2005</u> if each year the population decreased by 4%.

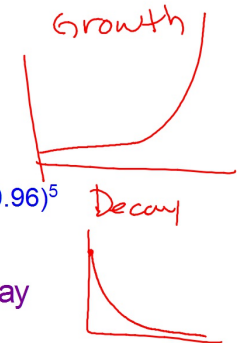$$210,000(.96)(.96)(.96)(.96)(.96)$$
$$210,000(.96)^{5} = 171228$$

In the year 2000 the population of a city was 210,000. In 2001 the population decreased by 4%. Find the new population.
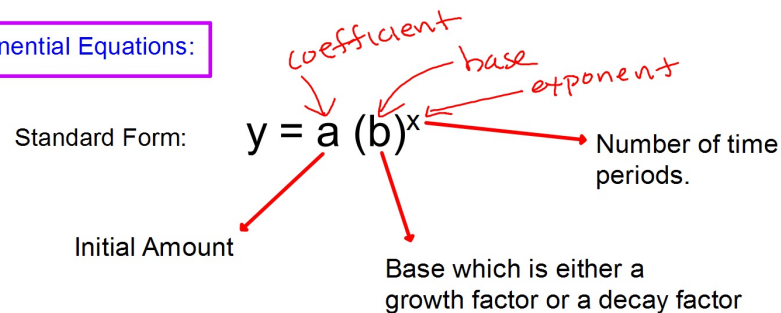
Find the population in 2005 if each year the population decreased by 4%.

Growth

$y = 210,000(0.96)(0.96)(0.96)(0.96)(0.96) = 210,000(0.96)^{5}$ Decay

This situation is called Exponential Decay

Exponential Equations:

coefficient
base
exponent

Standard Form: $y = a\,(b)^{x}$ → Number of time periods.

Initial Amount

Base which is either a growth factor or a decay factor

Find the base for each situation:

$\dfrac{x}{=}$

1. Each year there is 20% more.   b = 1.20   # years
   $100 + 20 = 120\%$

2. Each day there is 5% less.   b = .95   # day
   $100 - 5 = 95\%$

3. Each month there is 31.6% <u>more</u>.   b = 1.316   # months
   $100 + 31.6 = 131.6\%$

4. Each week there is 17.3% less.   b = .827   # weeks
   $100 - 17.3 = 82.7\%$

Standard Form: $y = a\,(b)^x$

This equation represents Exponential Growth if:

$b > 1$

This equation represents Exponential Decay if:

$b < 1$

Does each represent Exponential Growth or Decay?

1. $y = 1275(0.9975)^x$

   D

2. $0.5(1.00102)^x$

   G

3. $y = 97(0.306)^x$

   D

4. $603(1.405)^x$

   G

5. $y = 1000\left(\dfrac{11}{10}\right)^x$

   G

6. $y = 72\left(\dfrac{3}{8}\right)^{-x}$

   G

Determine the percent change each exponential equation represents and if it's growth or decay.

1. $y = 862(1.17)^x$

   $117\% - 100$
   17% inc

2. $y = 30(0.72)^x$

   $72\% - 100\%$ deay
   -28%

3. $y = 1008.3(0.092)^x$

   $9.2\% - 100\%$
   -90.8%

4. $y = 12(1.063)^x$

   $106.3\% - 100$
   6.3% inc

Use the given percent change to find the growth/decay factor (otherwise known as the base of the exponential equation)

1. 14% increase.

   $(1.14)^x$
   $100 + 14 = 114$

2. 3.25% decrease.

   $100 - 3.25$
   $= 96.75$
   $(.9675)^x$

3. 250% increase.

   $100 + 250 = 350\%$
   $(3.5)^x$

3. 0.67% decrease.

   $100 - .67$
   99.33
   $(.9933)^x$