Algebra 1 7.6

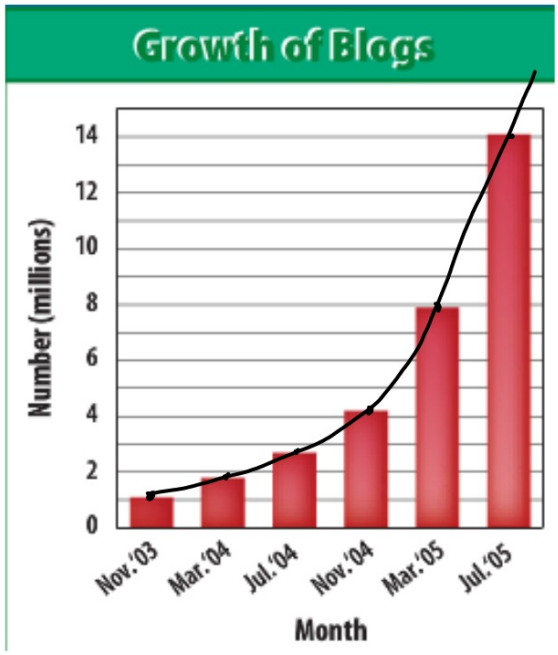
Solve problems involving exponential growth ↑

Solve problems involving exponential decay ↓

exponent

base

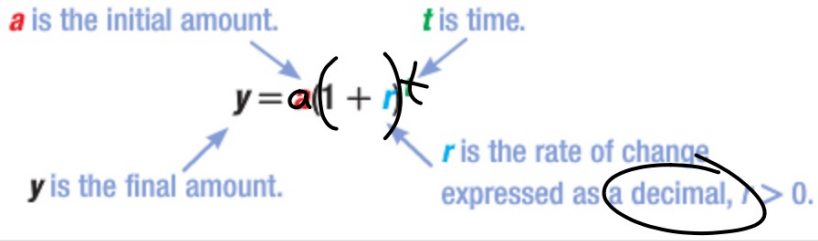
whiteboards



Gema

1 Exponential Growth The equation for the number of blogs is in the form $y = a(1 + r)^t$. This is the general equation for exponential growth.

KeyConcept Equation for Exponential Growth



What is the unit for time? (Can vary...need to know what it is for each problem)

Gema ^15

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r=0.05

1. TUITION A college's tuition has risen 5% each year since 2000. If the tuition in 2000 was $10,850, write an equation for the amount of the tuition t years after 2000. Predict the cost of tuition for this college in 2015. t=15

a

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

1. Write equation (must have a variable)
2. Use the equation (answer the question)

-1

$y = 10{,}850(1+0.05)^{15}$

$= 10{,}850(1.05)^{15}$

$= 10{,}850(2.0789\ldots)$

22556.37075

$22,556.37

Compound interest is interest earned or paid on both the initial investment and previously earned interest. It is an application of exponential growth.

Compounded < > ly

" " n

daily 365
weekly 52
monthly 12
quarterly 4

KeyConcept Equation for Compound Interest

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

A is the current amount.

n is the number of times the interest is compounded each year, and *t* is time in years.

P is the principal or initial amount.

r is the annual interest rate expressed as a decimal, $r > 0$.

Will give this formula on quiz/test if needed
(but you have to know what to do with it). Time is always in YEARS for CI.

If n = 12:
They get 1/12 of their interest 12 times per year.

If n = 4:
They get 1/4 of their interest 4 times per year.
etc.

monthly
annually
quarterly
etc.

Real-World Example 2 Compound Interest

FINANCE Maria's parents invested $14,000 at 6% per year compounded monthly. How much money will there be in the account after 10 years?

P = 14000 r = 0.06 n = 12 t = 10

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

$$A = 14000\left(1 + \frac{0.06}{12}\right)^{12 \cdot 10}$$

$$= 14{,}000(1.005)^{120}$$

$$= 14{,}000(1.819396\ldots)$$

$$= 25471.55428$$

$25471.55

$$\begin{array}{r} 25471.55 \\ -14000 \\ \hline 11471.55 \end{array}$$

Gema

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2. FINANCE Determine the amount of an investment if $300 is invested at an interest rate of 3.5% compounded monthly for 22 years.

P

$r = 0.035$ $n = 12$ t

$264 = 12 \cdot 22$

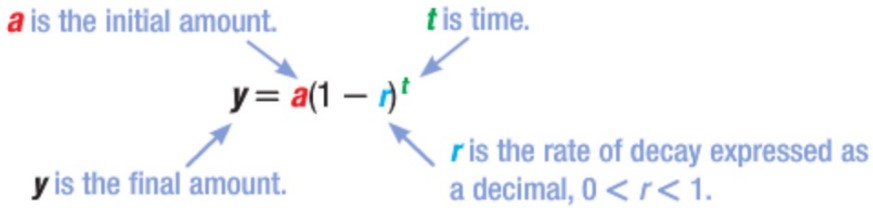
$$A = 300\left(1 + \frac{.035}{12}\right)^{264}$$

$$A = 300(1.00291\ldots)^{264}$$

$$= 300 \cdot 2.1573\ldots$$

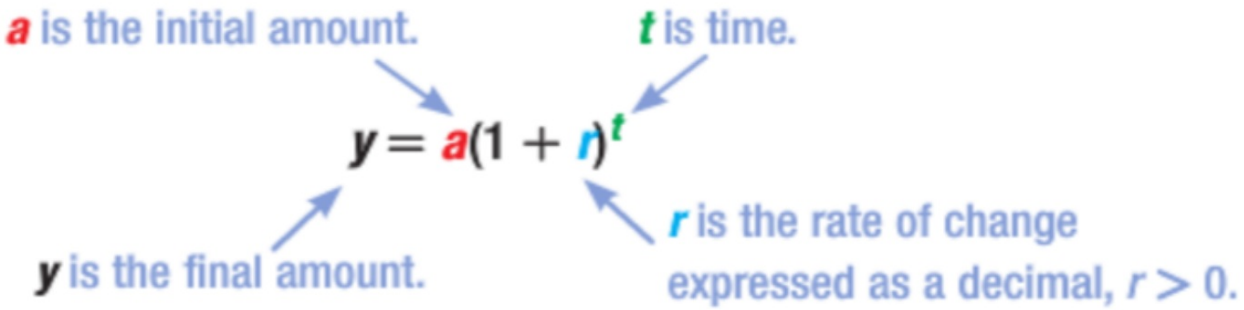
$$= 647.20$$

KeyConcept Equation for Exponential Decay (decrease)

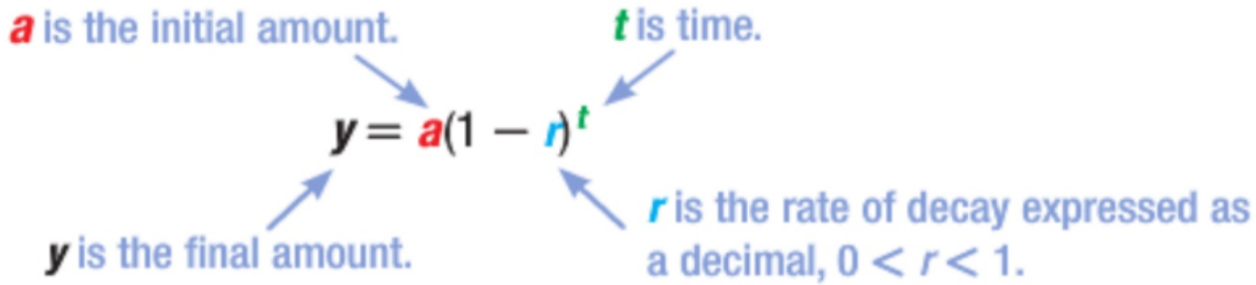


How is this formula different from the exponential increase formula?
Time unit can vary...

Equation for Exponential Growth



Equation for Exponential Decay



Is it getting more (growth) or less (decay)?

Real-World Example 3 Exponential Decay

SWIMMING 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.

Must have a variable!

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

Is it increasing (+) or decreasing (-)?

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3. POPULATION The population of Campbell County, Kentucky, has been decreasing at an average rate of about 0.3% per year. In 2000, its population was 88,647. Write an equation to represent the population since 2000. If the trend continues, predict the population in 2010.

Equations need a variable!

Real-World Example 1 Exponential Growth

CONTEST The prize for a radio station contest begins with a $100 gift card. 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 gift card in dollars after t days with no winners.

must have a variable