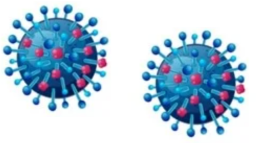
12/12

Warm Up

The most recent virus that is making people ill is multiplying quickly!

The day everyone began to get sick, 12 virus "bugs" are present. Each day after, the amount of "bugs" triples.



Write a function that models the "bugs" growth over time. Use x for the # of days and y for the # of "bugs".

How many people will be sick after a week?

$y = 12(3^x)$

How many after a week?

$y = 12(3^7)$

$= 26,244$

Homework Questions?

Page 48, #'s 1 and 2

1. In parts of the United States, wolves are being reintroduced to wilderness areas where they had become extinct. Suppose 20 wolves are released in northern Michigan, and the yearly growth factor for this population is expected to be 1.2.

a. Make a table showing the projected number of wolves at the end of each of the first 6 years.

b. Write an equation that models the growth of the wolf population.

c. How long will it take for the new wolf population to exceed 100?

2. a. The table shows that the elk population in a state forest is growing exponentially. What is the growth factor? Explain.

Growth of Elk Population

Time (yr)	Population
0	30
1	57
2	108
3	206
4	391
5	743

b. Suppose this growth pattern continues. How many elk will there be after 10 years? How many elk will there be after 15 years?

c. Write an equation you could use to predict the elk population p for any year n after the elk were first counted.

d. In how many years will the population exceed one million?

3.2 Investing for the Future

Growth Rates

The yearly growth factor for one of the rabbit populations in Problem 3.1 is about 1.8. Suppose the population data fit the equation $p = 100(1.8)^n$ exactly. Then its table would look like the one below.

Growth Factor

Growth of Rabbit Population

n	p
0	100
1	100 × 1.8 = 180
2	180 × 1.8 = 324
3	324 × 1.8 = 583.2
4	583.2 × 1.8 = 1,049.76

If I multiply a number by 1.8, what % increase will my answer be?

- Does it make sense to have a fractional part of a rabbit?
- What does this say about the reasonableness of the equation?

$180\% = 100\% + 80\%$

change

$$\%\text{ change} = \left(\frac{180-100}{100}\right)100 = \left(\frac{80}{100}\right)\cdot 100$$

$$= 80\%$$

3.1 Growth Factor = 1.8

Growth Rate = 80%

The *growth factor* 1.8 is the ratio of the population for a year divided by the population for the previous year. That is, the population for year $n + 1$ is 1.8 times the population for year n.

You can think of the growth factor in terms of a percent change. To find the percent change, compare the difference in population for two consecutive years, n and $n + 1$, with the population of year, n.

Growth of Rabbit Population

n	p
0	100
1	$100 \times 1.8 = 180$
2	$180 \times 1.8 = 324$
3	$324 \times 1.8 = 583.2$
4	$583.2 \times 1.8 = 1{,}049.76$

calculating % change

- From year 0 to year 1, the percent change is $\frac{180 - 100}{100} = \frac{80}{100} = 80\%$. The population of 100 rabbits in year 0 increased by 80%, resulting in $100 \times 80\% = 80$ additional rabbits.
- From year 1 to year 2, the percent change is $\frac{324 - 180}{180} = \frac{144}{180} = 80\%$. The population of 180 rabbits in year 1 increased by 80%, resulting in $180 \times 80\% = 144$ additional rabbits.

The percent increase is called the **growth rate.** In some growth situations, the growth rate is given instead of the growth factor. For example, changes in the value of investments are often expressed as percents.

- How are the growth rate 80% and the growth factor 1.8 related to each other?

100% + 80%

Growth Rate = % change

Problem 3.2

When Sam was in seventh grade, his aunt gave him a stamp worth $2,500. Sam considered selling the stamp, but his aunt told him that, if he saved it, it would increase in value.

A Sam saved the stamp, and its value increased by 6% each year for several years in a row.

1. Make a table showing the value of the stamp each year for the five years after Sam's aunt gave it to him.
2. Look at the pattern of growth from one year to the next. Is the value growing exponentially? Explain.
3. Write an equation for the value v of Sam's stamp after n years.
4. How many years will it take to double the value?

B Suppose the value of the stamp increased 4% each year instead of 6%.

1. Make a table showing the value of the stamp each year for the five years after Sam's aunt gave it to him.
2. What is the growth factor from one year to the next?
3. Write an equation that represents the value of the stamp for any year.
4. How many years will it take to double the value?
5. How does the change in percent affect the graphs of the equations?

C

1. Find the growth factor associated with each growth rate.

   a. 0% **b.** 15% **c.** 30%

   d. 75% **e.** 100% **f.** 150%

2. How you can find the growth factor if you know the growth rate?

D

1. Find the growth rate associated with each growth factor.

   a. 1.5 **b.** 1.25 **c.** 1.1 **d.** 1

2. How can you find the growth rate if you know the growth factor?

Homework

Finish classwork