Chapter 8 – Exponential & Logarithmic Functions

Chapter Overview

- What is an exponential function?
- How do I write an exponential model?
  - From a given rate and initial value
  - From two points
- How do I graph an exponential function?

- Exponential Models
  - Growth/Decay, Half-life, Compound Interest, etc…

Chapter Overview

- How do I solve exponential equations?
  - By rewriting with a common base
  - By using logarithms
- What is a logarithm?
  - Are there important Log properties I should know?
  - How do I solve an logarithmic equation?
  - How do I graph logarithmic functions?

Today's Learning Target

- I can identify an exponential equation.

- I can write an exponential model:
  - From a given rate and initial value
  - From two points

WRITE. THESE. DOWN. RIGHT. NOW.

Double Down – Part 1

Your group has 15 minutes to
solve the problem and
be ready to present your solutions.

Double Down – Part 1

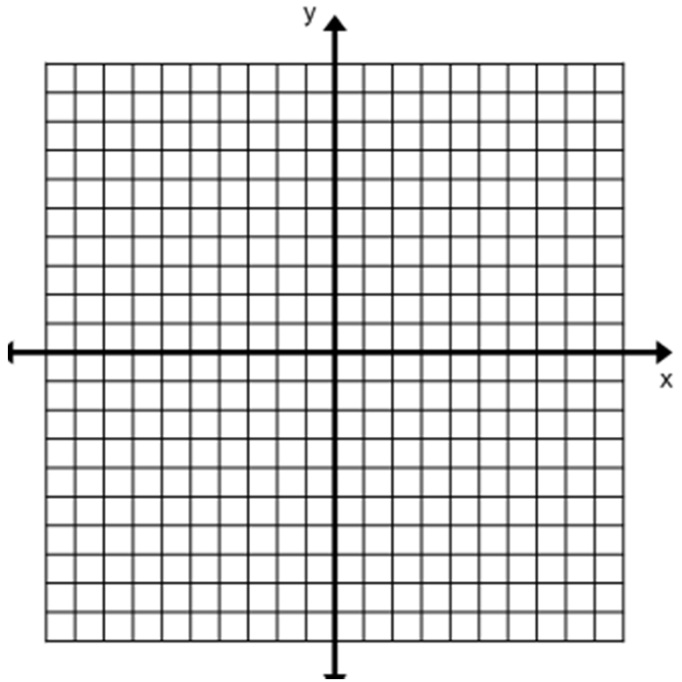
Two students were walking to school one day when they saw two teachers. Each of the four people was walking with two dogs.

1. Each dog has two ears. How many dog ears were there in all?
2. On each dog's ear there were two fleas. How many fleas were there in all? Show your calculation.
3. Each flea called two more fleas to join them. How many fleas were there in all? Explain.

What is an exponential function?

Equation

Graph



The general form of a exponential model is

$$y = a(b)^x$$

a is the initial value

b is the growth/decay factor

x is the number of times the rate is applied

How to write an exponential model given a rate and an initial value

1. Identify the growth/decay factor and the initial value.
2. Substitute the values you are given into the general form in the proper place.
3. You must be CAREFUL when it comes to ***x*** – the number of times the rate is applied.

Double Down – Part 1

The initial value of fleas was 32.

Because each flea invited two fleas, the number of fleas tripled making the growth factor 3.

This means the exponential model is…

$$y = 32(3)^x$$

In 2000, the US population was about 281 million people and was increasing by about 1.24% a year.

- Identify the initial value and the growth/decay factor.
  - a = 281 million
  - An increase of 1.24% gives a growth factor, b = 1.0124
- Substitute the values into the general form.
  - $y = 281(1.0124)^x$
- Be careful with x.
  - x is the number of years AFTER 2000.

$$y = 281(1.0124)^x$$

- Predict the US population in 2015 to the nearest million.

338 million

$$y = 281(1.0124)^x$$

- Suppose the rate of population increase changed to 1.4%. Write a new model and predict the population in 2015.

$$y = 281(1.014)^x$$

- Suppose the rate of population increase changed to 1.4%. Write a new model and predict the population in 2015.

346 million

$$y = 281(?)^{x}$$

If the US population is predicted to be 321 million by 2015, what happened to the rate of increase?

Identifying the initial value and growth/decay factor from an equation.

- $y = 1{,}000(1.2)^x$
- $y = 9(3)^x$
- $y = (0.75)^x$
- $y = 3(x)^4$

How to write an exponential model given two points

1. The independent (***x***) and the dependent (***y***) values of the two points.
2. Substitute the ***x*** and ***y*** values you are given into the general form in the proper place.
3. You now have a system of equations. Use substitution to solve for ***a*** and ***b***.
4. Write the model.

The US population was 5 million in 1800 and 76 million in 1900. Write an exponential model for the US Population if the growth factor remains constant.

- Identify the ***x*** and ***y.***

(1800, 5) and (1900, 76)

To make things easier, we can use 1800 as year 0.

(0, 5) and (100, 76)

The US population was 5 million in 1800 and 76 million in 1900. Write an exponential model for the US Population if the growth factor remains constant.

(0, 5) and (100, 76)

- Substitute the values into the general form.

$$5 = a(b)^0$$

$$76 = a(b)^{100}$$

The US population was 5 million in 1800 and 76 million in 1900. Write an exponential model for the US Population if the growth factor remains constant.

- Solve the system using substitution.

$$5 = a(b)^0$$

$$76 = a(b)^{100}$$

The US population was 5 million in 1800 and 76 million in 1900. Write an exponential model for the US Population if the growth factor remains constant.

- Write the model. $y = 5(1.0276)^x$

- Using this model, predict the US population in 2015. **1,742 million or 1.742 billion**

Find the exponential function that goes through the points (2, 2) and (3, 4).

- Identify x and y. (2, 2) and (3, 4)
- Substitute. $2 = a(b)^2$ $4 = a(b)^3$
- Solve the system. $a = \frac{1}{2}$ $b = 2$
- Write the equation. $y = \frac{1}{2}(2)^x$

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Wednesday: Page 427 #10-23, 37-42

HOMEWORK