8.4 Solving Logarithmic and Exponential Equations

Lesson 8

Laws of Logarithms:

Product Law of Logarithms: $\log_c MN = \log_c M + \log_c N$

Quotient Law of Logarithms: $\log_c \frac{M}{N} = \log_c M - \log_c N$

Power Law of Logarithms: $\log_c M^P = P \log_c M$

Also useful; $\quad Given \quad c, L, R > 0 \quad and \quad c \neq 1,$

- $if \ \log_c L = \log_c R, \quad then \ L = R$
- $if \ L = R, \quad then \quad \log_c L = \log_c R$

Example 1: Solve the following logarithmic equations algebraically

a. $\log_6 (2x - 1) = \log_6 11$

b. $\log(8x+4) = 1 + \log(x+1)$

c. $\log_2 (x+3)^2 = 4$

Your Turn:

a. $\log_7 x + \log_7 4 = \log_7 12$

b. $\log_2 (x-6) = 3 - \log_2 (x-4)$

c. $\log_3 (x^2 - 8x)^5 = 10$

Example 2: Solving Exponential Equations Using Logarithms.

a. $4^x = 605$

Method I: Take the log of both sides

Method II: Convert to logarithmic form

b. $8\left(3^{2x}\right) = 568$

c. $4^{2x-1} = 3^{x+2}$

Your Turn: Solve.

a. $2^x = 2500$

b. $5^{x-3} = 1700$

c. $6^{3x+1} = 8^{x+3}$

Example 3: Modeling Using Logarithmic and Exponential Equations.

Exponential Growth:

A town has a current population of 12 468. The population is growing by 2% per year.

a. Write an exponential equation to model the population growth.

b. What will be the towns population in 8 years?

c. When will the population first reach 20 000 people?

Exponential Growth:

The population of a high school is growing by 1.5% per year. Currently, there 974 students in the school.

a. Write an exponential equation to model the population of the school, p , after t years.

b. What high school population should be expected in 5 years?

c. When will the population of the school reach 1 200 students?

A business invests \$450 000 in new equipment. For tax purposes, the equipment is considered to depreciate in value by 20% each year.

a. Write an exponential equation to model the value of the equipment.

b. What will be the value of the equipment in 3 years?

c. When will the value first drop to \$100 000 ?

When an animal dies, the amount of radioactive carbon-14 starts to decrease at a predictable rate. Archaeologists use this fact about C-14 in order to determine the age of fossils. the half-life of C-14 is 5730 years.

a. The oldest bones unearthed at Head-Smashed-In Buffalo Jump had 49.5% the C-14 left. How old were the bones when they were found.

Paleontologists can estimate the size of a dinosaur using only the skull. For a carnivorous dinosaur, the relationship between the length, s , in meters, of the skull and the body mass, m ,in kilograms, can be expressed using the logarithmic equation,

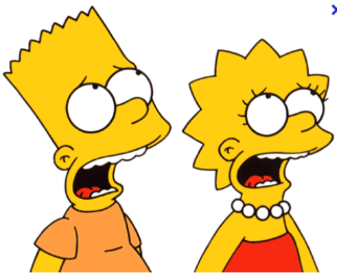
$$3.6022 \log s = \log m - 3.4444$$

a. Determine the body mass, to the nearest kilogram, of an Albertosaurus with a skull length of 0.78 m.

b. To the nearest hundredth of a metre, what was the skull length of a Tyrannosaurus Rex with an estimated body mass of 5500 kg.

Exponential And Logarithmic Functions

Unit Test in 2 Days!!!



Homework

1. Assignment Handout BLM Section 8.4
   "Solving Exponential and Logarithmic Functions"

2. Text Pages 412 - 415, Exercises # 1 - 18, 20 - 22, C1

Attachments

Translations Assignment 1.doc