Lesson 15: Why Were Logarithms Developed?

Classwork

Exercises

1. Solve the following equations. Remember to check for extraneous solutions because logarithms are only defined for positive real numbers.
2. How do you know if you need to use the definition of logarithm to solve an equation involving logarithms as we did in Lesson 15 or if you can use the methods of this lesson?

Lesson Summary

A table of base logarithms can be used to simplify multiplication of multi-digit numbers:

1. To compute for positive real numbers and look up the values and in the logarithm table.
2. Add and The sum can be written as , where is an integer and is the decimal part.
3. Look back at the table and find the entry closest to the decimal part, .
4. The product of that entry and is an approximation to

A similar process simplifies division of multi-digit numbers:

1. To compute for positive real numbers and look up the values and in the logarithm table.
2. Calculate . The difference can be written as , where is an integer and is the decimal part.
3. Look back at the table to find the entry closest to the decimal part, .
4. The product of that entry and is an approximation to

For any positive values and , if we can conclude that This property is the essence of how a logarithm table works, and it allows us to solve equations with logarithmic expressions on both sides of the equation.

Problem Set

1. Use the table of logarithms to approximate solutions to the following logarithmic equations
   1. [Hint: Begin by writing as ]
2. Use logarithms and the logarithm table to evaluate each expression.
3. Solve for :
4. Solve for : .
5. Solve for
6. If and are positive real numbers, and express in terms of .
7. If ,, and are positive real numbers, and , express in terms of and .
8. If and are positive real numbers, and , express in terms of
9. If and are positive real numbers, and express in terms of .
10. If , , and are positive real numbers, and express in terms of and .
11. Solve the following equations.
12. Suppose the formula gives the population of a city growing at an annual percent rate , where is the population years ago.
    1. Find the time it takes this population to double.
    2. Use the structure of the expression to explain why populations with lower growth rates take a longer time to double.
    3. Use the structure of the expression to explain why the only way to double the population in one year is if there is a percent growth rate.
13. If , , and , find in terms of and.
14. Jenn claims that because , then
    1. Is she correct? Explain how you know.
    2. If , express in terms of and . Explain how this result relates to your answer to part (a).
    3. Find other values of , , and so that
15. In Problem 7 of the Lesson 12 Problem Set, you showed that for , . It follows that . What does this tell us about the relationship between the expressions and ?
16. Use the change of base formula to solve the following equations.
17. Solve the following equation: