Solving Exponential Equations

Lesson 3

Exponential Equation - An equation that has a variable in the exponent.

Exponential expressions can be written in different ways. It is often useful to rewrite the exponential expression using a different base. If we can express two exponential expressions with the same base, we can equate them to each other.

For instance,

$$2^x = 8^{x-1}$$

$$2^x = \left(2^3\right)^{x-1}$$ Express the base on each side as a power of 2

$$2^x = 2^{3(x-1)}$$

$$2^x = 2^{3x-3}$$

Since the bases on both sides of the equation are the same, the exponents must be equal.

$$x = 3x - 3$$ Equate the exponents

$$3 = 2x$$

$$x = \frac{3}{2}$$

Example 1: Changing the base of powers.

Rewrite each expression as a power with a base of 3.

27 9^2 $27^{\frac{1}{3}}\left(\sqrt[3]{81}\right)^2$

Your Turn: Write each expression as a power with a base of 2.

4^3 $\frac{1}{8}$ $8^{\frac{2}{3}}\left(\sqrt{16}\right)^3$

Example 2: Solve an Equation by Changing the Base

Solve each equation algebraically. Check your answers algebraically and using technology

$4^{x+2} = 64^{x}$

$4^{2x} = 8^{2x-3}$

Your Turn:

Solve each equation algebraically. Check your answers algebraically and using technology

$2^{4x} = 4^{x+3}$

$9^{4x} = 27^{x-1}$

Consider the exponential equation $3^x = 4^{2x-1}$

Can you solve this one using the same method as the last one? Explain.

$$3^x = 4^{2x-1}$$

What are the limitations when solving exponential equations that have terms with different bases?

Example 3: Solve Problems Involving Exponential Equations With Different Bases

Justin plans to buy a car. He has saved $5000. The car he wants costs $5900. How long will Justin have to invest his money in a term deposit that pays 6.12% per year, compounded quarterly, before he has enough to buy the car?

The compound interest formula is $\boxed{A = P(1+i)^n}$

where A is the amount of money at the end of the investment
P is the principal amount invested
i is the interest rate per compounding period, expressed as a decimal
n is the number of compounding periods

List the known values and substitute them into the formula.

$A =$

$P =$

$i =$

$n = ?$

Homework

1. Assignment Handout: BLM 7-4; Solving Exponential Equations.

2. Text Pages 364 - 365, Exercises # 1 - 5, 7, 9 - 14, 16, 17, C2

Attachments

Translations Assignment 1.doc