6.5 Solve Exponential Equations DAY ONE

What You Will Learn:

- Solve exponential equations with the same base.
- Solve exponential equations with unlike bases.
- Solve exponential equations by graphing.

Core Vocabulary:

exponential equation

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Solving Exponential Equations with the Same Base

Exponential equations are equations in which variable expressions occur as exponents.

Core Concept

Property of Equality for Exponential Equations

Words Two powers with the *same positive base b*, where $b \neq 1$, are equal if and only if their exponents are equal.

Numbers If $2^x = 2^5$, then $x = 5$. If $x = 5$, then $2^x = 2^5$.

Algebra If $b > 0$ and $b \neq 1$, then $b^x = b^y$ if and only if $x = y$.

EXAMPLE 1 Solving Exponential Equations with the Same Base

Solve each equation.

a. $3^{x+1} = 3^5$

$x+1=5$

$-1 \quad -1$

$x=4$

$3^{4+1} = 3^5 = 243$

$3^5 = 243$ ✓

b. $6 = 6^{2x-3}$

$1 = 2x-3$

$+3 \quad +3$

$\frac{4}{2} = \frac{2x}{2}$

$2 = x$

6 ✓

$6^{2(2)-3} = 6^1$ ✓

c. $10^{3x} = 10^{2x+3}$

$3x = 2x + 3$

$-2x \quad -2x$

$x = 3$

$10^{3\cdot3} = 10^9$

$10^{2(3)+3} = 10^9$

10^{3*3} 1000000000

10^9 1000000000

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Solving Exponential Equations with Unlike Bases

To solve some exponential equations, you must first rewrite each side of the equation using the same base.

EXAMPLE 2 Solving Exponential Equations with Unlike Bases

Solve (a) $5^x = 125$, (b) $4^x = 2^{x-3}$, and (c) $9^{x+2} = 27^x$.

(a) $5^x = 5^3$

$x = 3$

5^3 125

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

$2x = x-3$

$-x \quad -x$

$x = -3$

$4^{-3} = \frac{1}{4^3} = \frac{1}{64}$ ✓

$2^{-3-3} = 2^{-6} = \frac{1}{2^6} = \frac{1}{64}$

4^{-3} .015625

2^{-3-3} .015625

(c) $(3^2)^{x+2} = (3^3)^x$

$2(x+2) = 3(x)$

$2x+4 = 3x$

$-2x \quad -2x$

$4 = x$

$9^{4+2} = 9^6$ ✓

$27^4 = 531{,}441$

9^{4+2} 531441

27^4 531441

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Your Turn:

Solve (a) $\left(\frac{1}{2}\right)^x = 4$ and (b) $4^{x+1} = \frac{1}{64}$.

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

$-1(x) = 2$

$x = -2$

$(1/2)^{-2}$

4 ✓

(b) $4^{x+1} = 4^{-3}$

$x + 1 = -3$

$-1 \quad -1$

$x = -4$

✓ 4^{-4+1}

4^{-3}

.015625

.015625

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6.5 DAY ONE Assignment:

WS ALL