

WARM-UP

Complete the following questions

1. Find the prime factorization of 64. (use a factor tree if needed) $64: 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

2. How could you write that factorization with exponents? 2^6

3. Is there another way to write 64 using exponents but not the prime factorization?

8^2
 4^3

Solving Exponential Equations

Steps:

1. Get the bases the same
2. Distribute the exponents if needed
3. Set exponents equal
4. Solve for the variable

$$\square = \square$$

$$(a^x)^y = a^{xy}$$

$$(a^x)^{y+z} = a^{xy+xz}$$

Example 1

$$4^{5x+1} = 4^{11}$$

$$5x+1 = 11$$

$$\begin{array}{r} -1 \quad -1 \\ \hline \end{array}$$

$$\begin{array}{r} 5x = \frac{10}{5} \\ \hline \end{array}$$

$$x = 2$$

Example 2

$$5^{8x+17} = \frac{1}{125}$$
$$5^{8x+17} = 5^{-3} \quad \begin{matrix} 125 \\ 5^3 \end{matrix}$$
$$8x+17 = -3$$
$$\begin{matrix} -17 & -17 \end{matrix}$$
$$\frac{8x}{8} = \frac{-20}{8}$$
$$x = \frac{-5}{2}$$

$$a^5 = 2^5$$
$$a = 2$$

$$3^2 = 3^2 \quad \square$$

9 ←

Example 3

$$8^{3x} = 4^{5x+12}$$

$2 \cdot 2 \cdot 2$ \leftarrow $(2^3)^{3x} = (2^2)^{5x+12}$ \rightarrow $2 \cdot 2$

$$2^{9x} = 2^{10x+24}$$
$$9x = 10x + 24$$
$$\begin{array}{r} -10x \\ \hline -x = 24 \end{array}$$
$$x = -24$$

$2^{3(3x)} = 2^{2(5x+12)}$

$$2^{x+5} = 1$$
$$2^{x+5} = 2^0$$

$$x+5=0$$

$$x=-5$$

$$3^{x+7} = 5^{x-1}$$

$$1) 3^{-x} = 243$$

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

$$3) 2^{-3m} = 1$$

$$4) 3^{-2n} = 81$$

$$5) 5^{-n-2} = 25$$

$$\begin{array}{c} 216 \\ / \quad \backslash \\ 6 \quad 36 \\ \quad / \quad \backslash \\ \quad 6 \quad 6 \end{array}$$

$$6) \quad 216^{-2m} = \frac{1}{6}$$

$$(6^3)^{-2m} = 6^{-1}$$

$$6^{-6m} = 6^{-1}$$

$$\frac{-6m}{-6} = \frac{-1}{-6}$$

$$m = \frac{1}{6}$$

$$\begin{aligned} 7) \quad 16^{-3v} &= 4^{-v} \\ (4^2)^{-3v} &= 4^{-v} \\ -6v &= -1v \\ +1v & \quad +1v \\ \hline -5v &= 0 \\ \underline{-5} & \quad \underline{-5} \\ v &= 0 \end{aligned}$$

$$8) 64^{3x} = 4^2$$

$$9) \left(\frac{1}{4}\right)^{3n} = 64$$

$$10) 16^{-2p} = 64^{3p-2}$$

$$11) 216^x = 36$$

$$12) \left(\frac{1}{16} \right)^{x+3} = 64^{-x}$$

$$13) 36^{-3b} = 6^3$$

$$14) 216^{-n} = 36$$

$$15) 81^{-2x} = 27$$

$$16) \frac{4^x}{8^{-x-2}} = 64$$

$$\frac{2^{2x}}{(2^3)^{-x-2}} = 2^6 \quad \frac{2^{2x}}{2^{-3x-6}} = 2^6$$
$$2^{2x - (-3x-6)} = 2^6$$

$$2x - (-3x - 6) = 6$$
$$2x + 3x + 6 = 6$$
$$5x + 6 = 6$$
$$5x = 0$$
$$x = 0$$

$$17) \frac{1}{25} \cdot \left(\frac{1}{625}\right)^{2-n} = 1$$

Discussion:

1. What is a solution relate to in graphing?
2. Can I get no solution as an answer?
 - A) How can I tell in an equation?
 - B) What does that mean graphically?