Lesson 5: Solving Equations with Exponents

Recall: Solving any equation means find the **value of the variable** that **makes the equation true**. When solving equations involving exponents, pay attention to the location of your variable in the equation.

Variable already isolated

• Apply correct order of operations (exponents before multiplication) and evaluate

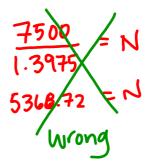
Ex 1) Solve $A = 100(1.07)^5$

$$A = 140,255...$$

Variable is being multiplied by a power

Solve using inverse operations

Ex 2) Solve
$$7500 = N(1.25)^{1.50}$$
 $7500 = N$
 $1.25^{1.5}$
 $5366.56.7$



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Variable is the base of a power

- Use inverse operations to isolate the power
- The exponent in the power becomes the type of root needed to solve for the base
 - \circ exponent of 2 \rightarrow square root
 - o exponent of $3 \rightarrow$ cube root
 - o exponent of $4 \rightarrow 4^{th}$ root
 - o etc..
- When taking an even root, ask yourself: should I consider the negative answer as well?

Ex 3) Solve
$$5000 = 2000(B)^{10}$$

$$\frac{5000}{2000} = 8^{10}$$

$$10\sqrt{\frac{5000}{2000}} = B$$

Variable is the exponent

Strategy #1 – Guess and Check

Since we don't (yet!) know how to "undo" the raising of a base to an unknown variable, we can use a "guess and check" strategy

Ex 4) Solve
$$1000 = 500(1.10)^t$$

$$\frac{1000}{500} = |.|0^t$$

$$2 = |.|0^t$$

$$7.28 = t$$

$$1.|0^7 = |.9487$$

$$|.|0^8 = 2.1435$$

$$|.|0^{7.5} = 2.0438$$

$$|.|0^{7.28} = 2.001$$

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Strategy #2 - Change of Base

Consider the equation $a^x = a^y$. Since the bases are equal, it follows that the exponents must be the same as well.

If
$$a^x = a^y$$
, Then $x = y$.

IMPORTANT: We are NOT "Cancelling the bases."
We ARE creating a NEW equation that has the same solution as our original equation.

Steps to follow:

- Rewrite all powers with a common base.
- Simplify to get a single power on each side of the equation.
- · Create a new equation with the exponents
- Solve the new equation to get the solution(s) of the original equation

a)
$$3^{3x} = 81$$
b) $5^{2x-1} = \frac{1}{125}$
c) $(2^x)(64) = (\sqrt{32})^x$

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

$$5^{2x-1} = \frac{1}{5^3}$$

$$2^{x+6} = ((2^5)^{\frac{1}{2}})^x$$

$$2^{x+6} = ((2^5)^{\frac{1}{2}})^x$$

$$2^{x+6} = 2^{\frac{1}{2}}$$

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