Grade Level/Course: Algebra 1/Algebra 2
Lesson/Unit Plan Name: Solve Exponential Equations
Rationale/Lesson Abstract: This lesson will enable students to solve exponential equations by changing bases and using the property of equality of exponential functions.

Timeframe: Depending on your students' need, this lesson can take 1 or 2 1-hour periods. The break-down is as follows:

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Warm-Up

1. Write 2•2•2•2 in exponential form.

2. What is one way to represent 27 in exponential form?

3. Given that $x \neq 0$ and $z \neq 0$, choose Yes or No to indicate which of the following expressions are equivalent to $\frac{x}{z}$.

A) $\frac{x}{z}$ ◯ Yes ◯ No

B) $\frac{x \quad z}{x \; z}$ ◯ Yes ◯ No

C) $\frac{x \; z}{x \; z}$ ◯ Yes ◯ No

<u>Warm-Up Solutions</u>

1. $2 \cdot 2 \cdot 2 \cdot 2 = 2^4$

2. $27 = 3^3$

Activity/Lesson:

Scaffolding Part 1 (pre-lesson):

$$64 = 4^2 \bullet 2 \bullet 2$$

$$= 4^3$$

$$\therefore 27 = 3^3$$

Scaffolding Part 2 (pre-lesson):

Depending on your students' mastery of exponents, you may want to spend the beginning of the lesson reviewing exponent properties. The property they MUST have mastered to succeed in this lesson is the Power of a Power Property, which states: $\left(x^a\right)^b = x^{a \bullet b}$

<u>Property of Equality of Exponential Functions:</u>
If b is a positive number other than 1, then $b^x = b^y$ if and only if $x = y$. In other words, if the bases are the same, then the exponents must be equal.

Example 1: Solve.

$12 = 12^x$ ← The bases are exactly the same

$12^1 = 12^x$ $12 = 12^1$

∴ [illegible] Property of Equality of Exponential Functions

Example 2: Solve.

$8^{x-3} = 8^4$ ← The bases are exactly the same

[illegible] Property of Equality of Exponentials

[illegible] Inverse operations

$x = 7$

Example 2: CHECK SOLUTION

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

$8^{7-3} = 8^4$ Substitute our answer, $x = 7$.

[redacted]

You Try: Solve.

1. = x **2.** = **3.** − = −

Solutions to You Tries:

[illegible]

[illegible]

Example 3: Solve

=

=

=

Example 4: Solve

Example 6: Solve

=

Change the base Change the base

Teacher Talk with Student Help

Are the bases the same here? *No.*

What base do I want to change 32 to? *Base 4.*

Would it be easy to change 32 to base 4? *No.*

Why not? *Because there is no integer exponent for 4 that will equal 32.*

So we'll have to change bases on BOTH sides of the equation.

What base can I change 4 into? *Base 2.*

Can I also change 32 to base 2? *Yes.*

$2^5 = \left(2^2\right)^{x-3}$ Change bases

$2^5 = 2^{2(x-3)}$ Power of a Power Property

[illegible]

$5 + 6 = 2x - 6 + 6$ Inverse operation

$11 = 2x$ Simplify

[illegible]

$\frac{11}{2} = x$

You Try: Solve.

7. 16 =

8.

9. − =

Solutions to You Tries:

Challenge Problems:

1. Solve = !

2. Solve $125^{2x\ 1} = 25^{4x}$

3. Solve

Solutions to Challenge Problems:

x =	=	$= \frac{3}{8}$
	2^4 2 $= 2^2$	$= -$
8^2 $= 4$	=	$= -$
= +	3 2 1	$= 1$
= +	= +	$= -$
9 4 27		$= ! -$
+ =	3 4 3^3	$= !$

Exit Ticket

Name: ____ Date: ____________ Period/Block: _____

1. Solve $=$

2. Solve $1 = 27^{+1}$

Exit Ticket

Name: ____ Date: ____________ Period/Block: _____

1. Solve $=$

2. Solve $1 = 27^{+1}$

Exit Ticket

Name: ____ Date: ____________ Period/Block: _____

1. Solve $=$

2. Solve $1 = 27^{+1}$