Algebra RH

Essential Question: How do we solve for an unknown exponent?

<u>DO NOW:</u>

a) Solve for x: $9x^{\frac{2}{3}} + 7 = 71$

$$x = \left(\frac{9}{64}\right)^{\frac{3}{2}}$$

$$x = \left(\frac{\sqrt{9}}{\sqrt{64}}\right)^{3}$$

$$\left(\frac{3}{8}\right)^{3}$$

$$\frac{27}{512}$$

b) When simplified, the expression $(\sqrt[3]{m^4})(m^{-\frac{1}{2}})$ is equivalent to

(1) $\sqrt[3]{m^{-2}}$

$\left(m^{\frac{4}{3}}\right)\left(m^{-\frac{1}{2}}\right)$

(3) $\sqrt[5]{m^{-4}}$

(2) $\sqrt[4]{m^3}$

$\left(m^{\frac{8}{6}}\right)\left(m^{-\frac{3}{6}}\right)$

(4) $\sqrt[6]{m^5}$

$m^{\frac{5}{6}}$

$\sqrt[6]{m^5}$

RECAP: When solving for an unknown **base**...

1) Isolate the **exponential** component.

2) Raise both sides to the **reciprocal** of the exponent.

3) Use power over root to simplify.

Example: Solve for x: $9^x = 27$

- What makes this equation different from question a) in the Do Now?

    the unknown is the exponent, not the base

- When solving for an unknown **exponent**, we must find a **common base**. What is a common base for 9 and 27?

- Let's solve!

$$9^x = 27$$
$$(3^2)^x = (3^3)$$
$$3^{2x} = 3^3$$

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

check

$$9^x = 27$$
$$9^{\frac{3}{2}} = 27$$
$$(\sqrt{9})^3 = 27$$
$$27 = 27 ✓$$

To solve for an **unknown exponent**:

1) _Rewrite the equation with common bases_

2) _set the exponents equal to each other_

3) _Solve for the variable_

Solve each equation for the unknown variable.

1) $2^{\frac{x}{3}} = 32$

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

$$\frac{x}{3} = 5$$

$$x = 15$$

2) $8^{2x+1} = 4^{4x}$

$$\left(2^{3}\right)^{2x+1} = \left(2^{2}\right)^{4x}$$

$$2^{6x+3} = 2^{8x}$$

$$6x+3 = 8x$$
$$-6x \qquad -6x$$

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

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

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

$$\left(2^{2}\right)^{-1} = 2^{x+4}$$

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

$$-2 = x+4$$

$$-6 = x$$

4) $\left(\frac{1}{3}\right)^{x} = 9^{x+7}$

$$\left(3^{-1}\right)^{x} = \left(3^{2}\right)^{x+7}$$

$$-x = 2x+14$$

$$-3x = 14$$

$$x = \frac{14}{-3}$$

5) $\left(\frac{1}{25}\right)^{2x} = 125^{x-1}$

6) $x^{-3} = \frac{27}{64}$

> #6 IS NOT THE SAME AS THE OTHER PROBLEMS! DO NOT CONFUSE THE TWO TYPES OF EQUATIONS!!!

SUMMARY:
- When the variable is the _____, remember **reciprocal exponents**, and **power over root**.
- When the variable is in the _____, remember **common base**, and **power to a power**.