Name: _____ Date: _____

Learning Goal 5.2	Use exponent laws to evaluate expression with positive and negative rational exponents.

Recall:

1. $3^6 3^2 =$ 3^{6+2} $= 3^8$

2. $6^3 6^7 6^2 6^5 =$ $= 6^{3+7+2+5}$ $= 6^{17}$

3. $7^6 7^3 7^1 =$ $= 7^{6+3+1}$ $= 7^{10}$

Extend the idea to non-whole number exponents:

4. $2^{1/2} 2^{1/2} =$ $= 2^{\frac{1}{2}+\frac{1}{2}}$ $= 2^1$ $= 2$ $= \left(2^{\frac{1}{2}}\right)^2$ $= \left(2^2\right)^{\frac{1}{2}}$ $= 2$

5. $5^{0.25} 5^{0.25} 5^{0.25} 5^{0.25} =$ $= 5^{0.25+0.25+0.25+0.25}$ $= 5^1$ $= 5$ $\left(5^{0.25}\right)^4$ $= \left(5^4\right)^{0.25}$

6. $11^{1/3} 11^{1/3} 11^{1/3} =$ $= 11^{\frac{1}{3}+\frac{1}{3}+\frac{1}{3}}$ $= 11^1$ $= 11$

Take a silent moment. What do you think the **fractional exponents** represent?

RADICALS !! :)

If you have a fractional exponent
- the numerator is the regular exponent
- the denominator is the index of the radical.

$-8 \neq \frac{1}{8}$

Example Write each power as a radical, then simplify.

1. $1000^{1/3}$

$= \sqrt[3]{1000}$

$= 10$

2. $0.25^{-1/2}$

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

$= (4)^{\frac{1}{2}}$

$= \sqrt{4}$

$= 2$

3. $(-8)^{1/3}$

$= \sqrt[3]{-8}$

$= \sqrt[3]{-2 \times -2 \times -2}$

$= -2$

4. $\left(\frac{16}{81}\right)^{-1/4}$

$= \left(\frac{81}{16}\right)^{\frac{1}{4}}$

$= \sqrt[4]{\frac{81}{16}}$

$= \frac{3}{2}$

What if the exponent is not a unit fraction? Take a silent minute to consider.

$40^{\frac{2}{3}}$ $40 < 4 \leq 2$ $10 \leq 2$ 5

$(40^2)^{\frac{1}{3}} = \sqrt[3]{40^2}$ $= \sqrt[3]{1600}$ $= \sqrt[3]{2^6 5^2} = 2^2 \sqrt[3]{5^2}$	$(40^{\frac{1}{3}})^2 = (\sqrt[3]{40})^2$ $= (\sqrt[3]{2^3 \times 5})^2$ $= (2\sqrt[3]{5})^2 = 2^2 \sqrt[3]{5^2}$

* the numerator is just a regular exponent *

$1.2 = \frac{6}{5}$ $\frac{75 \div 25}{100 \div 25} = \frac{3}{4}$

Example Write each power as a radical, then simplify.

1. $0.01^{3/2}$

$= \left(\frac{1}{100}\right)^{3/2}$

$= \left(\sqrt{\frac{1}{100}}\right)^3$

$= \left(\frac{1}{10}\right)^3$

$= \frac{1}{1000}$

2. $(-27)^{4/3}$

$= \left(\sqrt[3]{-27}\right)^4$

$= (-3)^4$

$= 3^4$

$(= 81)$

$27 < 9 \leq 3$ $= 3^3$

3. $81^{-3/4}$

$= \left(\frac{1}{81}\right)^{3/4}$

$= \left(\sqrt[4]{\frac{1}{81}}\right)^3$

$= \left(\frac{1}{3}\right)^3$

$= \frac{1^3}{3^3} = \frac{1}{27}$

4. $0.75^{-1.2}$

$= \left(\frac{3}{4}\right)^{-6/5}$

$= \left(\frac{4}{3}\right)^{6/5} > 1$

$= \sqrt[5]{\left(\frac{4}{3}\right)^6}$

$= \sqrt[5]{\frac{4^6}{3^6}} = \frac{4}{3}\sqrt[5]{\frac{4}{3}}$