Laws of Exponents
Review From Gr.9

Product of powers law: $a^m \cdot a^n = a^{m+n}$

Quotient of powers law: $\dfrac{a^m}{a^n} = a^{m-n}$

Power of a power law: $(a^m)^n = a^{mn}$

Write as a single power.

a) $3^2 \cdot 3^5 = 3^{2+5} = 3^7$

b) $(4^2)^5 = 4^{2\times5} = 4^{10}$
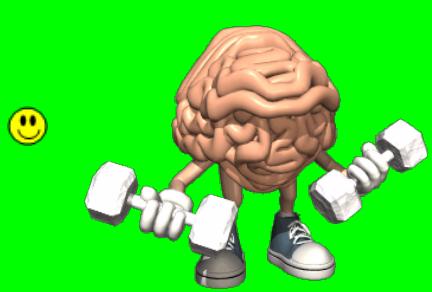
c) $(-5)^{10} \div (-5)^8 = (-5)^{10-8} = (-5)^2$

$$\frac{(-5)^{10}}{(-5)^8}$$

4.4 Fractional Exponents and Radicals

Homework Questions???

Page 218-219 #11j, 12b,d,f,h,i, 19(a,b,c), 20, 21, 22a, 23

Warm Up

Name:_____   Period:_____

Simplify then evaluate

1) $(2^4)^3$

2^{12}

$= 4096$

2) $[(-5)^2 \times 2]^3$

$(-5)^6 \times 2^3$

15625×8

125000

3) $[(-1)^{11}]^3$

$(-1)^{33}$

-1

Write each expression as a product or quotient of powers. Then evaluate.

1) $[(-3) \times (5)]^2$

$(-3)^2 \times (5)^2$

$= 9 \times 25$

$= 225$

2) $\left(\dfrac{6}{5}\right)^4$

$\dfrac{6^4}{5^4}$

Save for review tomorrow

Math 10: Numbers, Functions & Relations   Name_____

Laws of Exponents Review   Date_____

Simplify. Your answer should contain only positive exponents.

1) $\left(\dfrac{2 \cdot 2^2}{2}\right)^3$

2) $\left(\dfrac{2^8}{2^3 \cdot 2^3}\right)^4$

3) $\dfrac{2^2}{4^2}$

4) $\dfrac{\left(2^3 \cdot 2^4\right)^4}{2}$

4.4   Fractional Exponents and Radicals

LESSON FOCUS   Relate rational exponents and radicals.

Make Connections

Coffee, tea, and hot chocolate contain caffeine. The expression $100(0.87)^{\frac{1}{2}}$ represents the percent of caffeine left in your body $\frac{1}{2}$ h after you drink a caffeine beverage.

Given that $0.87^1 = 0.87$ and $0.87^0 = 1$, how can you estimate a value for $0.87^{\frac{1}{2}}$?

$$\sqrt[4]{256} = 4$$

⭐ Use a calculator to complete the table.

Column 1	Column 2
X	$X^{\frac{1}{2}}$
1	$1^{\frac{1}{2}} = \quad 1$
4	$4^{\frac{1}{2}} = \quad 2$
9	$9^{\frac{1}{2}} = 3$
16	$16^{\frac{1}{2}} = 4$
25	

a) What do you notice about the numbers in the first column?

$$x^{\frac{1}{2}} = \sqrt{x}$$

b) Compare the numbers in the first and second columns. What conclusions can you make?

c) What do you think the exponent $\frac{1}{2}$ means?

4.4 Fractional Exponents and Radicals

⭐ Use a calculator to complete the table.

| | Column 2 |
Column 1	Column 3
x	$x^{\frac{1}{3}}$
1	$1^{⅓} = 1$
8	$8^{\frac{1}{3}} = 2$
27	$27^{⅓} = 3$
64	
125	

a) What do you notice about the numbers in the first column?

$$x^{\frac{1}{3}} = \sqrt[3]{x}$$

b) Compare the numbers in the first and second columns. What conclusions can you make?

c) What do you think the exponent $\frac{1}{3}$ means?

⭐ What do you think $a^{\frac{1}{4}}$ and $a^{\frac{1}{5}}$ mean?

$$a^{\frac{1}{4}} = \sqrt[4]{a}$$

$$a^{\frac{1}{5}} = \sqrt[5]{a}$$

What does $a^{\frac{1}{n}}$ mean? Explain your reasoning.

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

Rational Exponents and Radicals ☆

Let's examine radicals...

$$\sqrt{5} \times \sqrt{5} = \sqrt{5 \times 5} = \sqrt{5^2} = \sqrt{25} = 5$$

How would this play out with exponent laws?

$$5^{\frac{1}{?}} \times 5^{\frac{1}{?}} = 5^1$$

RULE: $\sqrt{x} = x^{\frac{1}{2}}$

What about other rational exponents and radicals?

$$8^{\frac{1}{3}} \times 8^{\frac{1}{3}} \times 8^{\frac{1}{3}} =$$

Rule: $\sqrt[3]{x} = x^{\frac{1}{3}}$ $\sqrt[n]{x} = x^{\frac{1}{n}}$

Study

index will be denominator
exponent ↳ numerator

In general... $\left(\sqrt[n]{x}\right)^m$ *or* $\sqrt[n]{x^m} = x^{\frac{m}{n}}$

Rational Exponents
- **To evaluate exponents that are rational (fractions), the denominator of the fraction indicates which root to take and the numerator indicates which power the entire base is to be raised.**

Example *Write this as a radical*
exponent
16 ¼ ←*index*

$= \sqrt[4]{16}$

$= 2$

125 ⅓ ← *index*

$= \sqrt[3]{125}$

$= 5$

exponent
125 ⅔ ← *index*

$= \left(\sqrt[3]{125}\right)^2$

$= (5)^2$

$= 25$

Example 1 Evaluating Powers of the Form $a^{\frac{1}{n}} = \sqrt[n]{a}$

$=$

Evaluate each power without using a calculator.

a) $27^{\frac{1}{3}}$ b) $0.49^{\frac{1}{2}}$ c) $(-64)^{\frac{1}{3}}$ d) $\left(\frac{4}{9}\right)^{\frac{1}{2}}$

a)
$= \sqrt[3]{27}$
$= 3$

b)
$\dfrac{49^{\frac{1}{2}}}{100^{\frac{1}{2}}}$

$\dfrac{\sqrt{49}}{\sqrt{100}}$
$= \dfrac{7}{10}$
$= 0.7$

c)
$= \sqrt[3]{-64}$
$= -4$

d)
$\dfrac{4^{\frac{1}{2}}}{9^{\frac{1}{2}}}$

$\dfrac{\sqrt{4}}{\sqrt{9}}$
$= \dfrac{2}{3}$

CHECK YOUR UNDERSTANDING

Exponential form   ## Radical form

Power (exponent)

$$X^{\frac{m}{n}} = (\sqrt[n]{x})^m$$

Root (index)

Write the following in radical form and evaluate.

Ex) $8^{\frac{2}{3}}$ ← index

$= (\sqrt[3]{8})^2$

$= (2)^2$

$= 4$

If Exponent is a decimal, then rewrite exponent as a fraction (Reduce Fraction)

$32^{0.2}$ =

$32^{\frac{2}{10}}$

$= 32^{\frac{1}{5}}$

$= \sqrt[5]{32}$

$= 2$

☺

Express as a·exponent:

a) $\sqrt[5]{32}$　　b) $\sqrt[3]{-64}$　　denominator　　denominator　numerator

c) $\left(\sqrt{144}\right)^3$

$32^{\frac{1}{5}}$　　$(-64)^{\frac{1}{3}}$　　$144^{\frac{3}{2}}$

Express as a Radical:

a) $8^{\frac{5}{3}}$　　b) $49^{\frac{3}{2}}$　　c) $(-125)^{\frac{2}{3}}$

Just Discuss but don't copy

Example 2   Rewriting Powers in Radical and Exponent Form

a) Write $40^{\frac{2}{3}}$ in radical form in 2 ways.

$$\text{a) Use } a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m \text{ or } \sqrt[n]{a^m}.$$

$$40^{\frac{2}{3}} = \left(\sqrt[3]{40}\right)^2 \text{ or } \sqrt[3]{40^2}$$

b) Write $\sqrt{3^5}$ and $\left(\sqrt[3]{25}\right)^2$ in exponent form.

CHECK YOUR UNDERSTANDING

Homework

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4.4   Fractional Exponents and Radicals

Exercises

A

3   4   5   6   7

B

8   9   10   11   12   13   14   15

16   17   18   19   20   21

C

22

#3 adf
#4 acd
#5 abc
#6 ac
#8 abc
#9
#12 abf
#15

Attachments

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