Warm Up

$x^{\frac{m}{n}}$ ($m \Rightarrow$ exponent, $n \Rightarrow$ index) $= (\sqrt[n]{x})^m$

Express each as a radical then evaluate:

a) $(32)^{\frac{3}{5}} = (\sqrt[5]{32})^3 = (2)^3 = 8$

(power or exponent form)

b) $(729)^{\frac{2}{3}} = (\sqrt[3]{729})^2 = (9)^2 = 81$

Express each as a power:

a) $\sqrt[5]{184} = 184^{\frac{1}{5}}$

b) $(\sqrt[3]{54})^4 = 54^{\frac{4}{3}}$

c) $(\sqrt[4]{8^2})$ ✓ $= 8^{\frac{2}{4}} = 8^{\frac{1}{2}}$

Express each in simplest radical form:(Entire to Mixed)

a) $\sqrt{112} = \sqrt{16 \cdot 7} = \sqrt{16} \cdot \sqrt{7} = 4\sqrt{7}$

b) $\sqrt[3]{1536} = \sqrt[3]{512 \cdot 3} = \sqrt[3]{512}\ \sqrt[3]{3} = 8\sqrt[3]{3}$

Any Homework Questions?

Worksheet next page solutions

QUIZ WEDNESDAY

#1 of warmup

-Change from Exponent Form to Radicals form (The reverse)

-Evaluate Exponent form $8^{\frac{2}{3}}$ (Use Sheets)

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

2^2

$= 4$

#3 of Warmup

-Change radical from Entire to Mixed (USe Sheets)

-Write powers with positive exponents only (Use reciprocals and today's class notes)

-2 law of exponent questions (Simplify and leave answer with positive exponent)

Exponent Laws Assignment Date_____

Simplify. Your answer should contain only positive exponents.

1) $2v^4 \cdot 3u^4v^3 \cdot 3u^2v^2$

$18u^9v^6$

2) $4y^3 \cdot 4y^2$

$16y^5$

3) $2x^2 \cdot (2yx^3)^2$

$8x^8y^2$

4) $y^4 \cdot (2x^3y^4)^4$

power of product (multiply exponents)

$16x^{12}y^{20}$

y^4 2^4 x^{12} y^{16} product law! (add)

$2^4\ y^4 \cdot y^{16}$

$16\ y^{20}\ x^{12}$

5) $\frac{3m^{-1}n^2}{m^{-3}n^{-1}}$

$3m^2n^3$

$3m^{-1+3}\ n^{2+1}$

6) $\frac{4u^4v^2}{4v^{-2}}$

4^4v^4

4^4v^{2+2}

7) $\left(\frac{b^2 \cdot b^1}{b^{-2}}\right)^2$

b^{10}

$\left(\frac{b^3}{b^{-2}}\right)^2$

$(b^{3+2})^2$

$(b^5)^2$

8) $\frac{(a^{-2}b^3)^{-1} \cdot 2a^4b^3}{2a}$

a^4

9) $\left(\frac{m^2n^2 \cdot m^3n^2}{m^4n^{-1}}\right)^2 = n^2\ n^{10}$

product law on top

$= \left(\frac{m^5n^4}{m^4n^{-1}}\right)^2$ quotient law

$= \left(m^{5-4}\ n^{4+1}\right)^2$

$\left(m^1\ n^5\right)^2$

power law (xexp)

m^2n^{10}

10) $\frac{x^4y^{-2}}{(2y^1)^{-2} \cdot yx^0}$

power of product

$4x^4y^5$ or $\frac{x^4}{2^{-2}}y^5$

$\frac{x^4y^{-2}}{2^{-2}y^{-8}y^1x^0}$

$= \frac{x^4y^{-2}}{2^{-2}y^{-7}x^0}$ quotient law

$= \frac{x^{4-0}y^{-2+7}}{2^{-2}}$

$\frac{x^4y^5}{2^{-2}}$

$= 2^2x^4y^5$

$4x^4y^5$

$\frac{3^{-1}xy^2}{2^{-2}} = \frac{2^2xy^2}{3^1}$

From Last Day

LAWS OF EXPONENTS

From Last Day

Laws Of Exponents

Law #1: Product Rule

$$b^m \times b^n = b^{m+n}$$

- when multiplying powers with the **same** base you add the exponents

Exercise:

Simplify the following using the laws of exponents

a) $3^2 \times 3^4$ **b)** $4^3 \times 3^4$ **c)** $(q^7)(q)$ **d)** $p \times p^3 \times p^2$

e) $(2x^3)(4x^2)$ **f)** $(3z^3)(6z^{12})$

From Last Day

Law #2: Quotient Rule

$$b^m \div b^n = b^{m-n}$$

- when dividing powers with the **same** base you subtract the exponents

Exercise:

Simplify the following using exponent laws

a) $5^{23} \div 5^{12}$

b) $\dfrac{x^{34}}{x^{19}}$

c) $c^3 \div e^2$

d) $\dfrac{12x^3}{4x}$

e) $\dfrac{25c^{30}}{5c^{23}}$

From Last Day

Law #3: Power Rule

when raising a power to another power...MULTIPLY the exponents."

$$(b^m)^n = b^{mn}$$

Law #4: Power of Product

When raising a product to a power ...each factor needs to have the exponent applied to them (remember to multiply their exponents)

$$(ab)^m = a^m b^m$$

- when brackets are involved you must multiply the exponents

Exercise:

Simplify the following using Laws of Exponents

a) $(m^3)^4$ b) $(x^2y^4)^3$ c) $(2d^3)^3$ d) $(2m^4n)^2(m^3n^2)$

Law #5: Power of Quotient Rule

From Last Day

When raising a quotient to an exponent....applied exponent to bot top and bottom (Remember to multiply exponents)

$$\left(\frac{a}{b}\right)^n = \left(\frac{a^n}{b^n}\right)$$

Law #6: Zero Rule

$$b^0 = 1$$

- any power raised to the exponent 0 (zero) is equal to 1

NEW

Law #7a: Negative Reciprocals

$$x^{-n} = \frac{1}{x^n}$$

remember the reciprocal of

$\frac{1}{2}$ is 2

so

2^{-1} is the reciprocal of 2^1

Examples:

$$\frac{6^{-2}}{1} = \frac{1}{6^2}$$

$$= \frac{1}{36}$$

$$\frac{3}{1} \Rightarrow \text{Recip } \frac{1}{3}$$

3^1 3^{-1}

NEW

Law #7b: Negative Reciprocals

$\frac{1}{2^{-1}} = 2^1$ $\qquad \frac{1}{x^{-n}} = x^n$

Examples:

$$\frac{1}{5^{-3}} = 5^3 = 5 \cdot 5 \cdot 5 = 125$$

Ex) Simplify $\frac{12x^8y^{11}}{x^{13}y^2}$ Leave with positive exponents

$12\, x^{8-13}\, y^{11-2}$

$= 12\, x^{-5}\, y^9$ Remember $\frac{12x^{-5}y^9}{1}$

$= \frac{12\, y^9}{x^5}$

Law #7c: Negative Reciprocal Quotient NEW

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b^n}{a^n}\right)$$

$$\left(\frac{b}{a}\right)^{n}$$

Flip fraction and exponent is now positive

- now apply exponent law for quotient

Examples:

flip fraction, is pos, no sub. is +3

$$\left(\frac{3}{4}\right)^{-3} = \left(\frac{4}{3}\right)^{+3}$$

power of a quotient

Ex) $\left(\frac{a^2 b^5}{q^7 b^1}\right)^{-2}$

$\left(q^{-5} b^{4}\right)^{-2}$

power of power: $q^{10} b^{-8}$

$= \frac{q^{10}}{b^8}$

neg recip: $\left(\frac{b^4}{q^5}\right)^{-2}$

$= \frac{b^{-8}}{q^{-10}}$

$\frac{q^{10}}{b^8}$

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

$= \frac{4^3}{3^3}$

$= \frac{64}{27}$

Example 1 Evaluating Powers with Negative Integer Exponents

Evaluate each power.

a) 3^{-2} b) $\left(-\frac{3}{4}\right)^{-3}$ c) 0.3^{-4}

a) $\frac{3^{-2}}{1}$

$= \frac{1}{3^2}$

$= \frac{1}{9}$

b) flip fraction (reciprocal) then exponent is positive

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

$= \frac{-4^3}{3^3}$

$= -\frac{64}{27}$

c) $\Rightarrow \left(\frac{3}{10}\right)^{-4}$

$= \left(\frac{10}{3}\right)^4$

$= \frac{10^4}{3^4}$

$= \frac{10000}{81}$

Homework

Page 233-234

#3a,b,c,d

#4a,c

#6a,b,c

#7a,b,c,

#9a,c,e,g

#10a,e

#12

#13a,b,c,e

Quiz Wednesday

Test Unit 4 Probably Sept 26

3a) $\frac{1}{5^4} = 5^{-4}$

b) $\left(-\frac{1}{2}\right)^{-3}$ Flip Fraction $= \left(\frac{-2}{1}\right)^3$

$= (-2)^3$

4a) $4^2 = 16$

$4^{-2} = \frac{1}{4^2} = \frac{1}{16}$