Warm Up

Test Feb. 22
Quiz Wed Feb. 20

Express each as a radical then evaluate:

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

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

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

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

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

Write the radical for the power and evaluate: (Use calculator but show work)

a) $64^{\frac{2}{3}}$ $= (\sqrt[3]{64})^2$ $= 4^2$ $= 16$

b) $7776^{\frac{3}{5}}$ $= (\sqrt[5]{7776})^3$ $= 6^3$ $= 216$

Worksheet Exponent Laws

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

$2 \cdot 3 \cdot 3 \; v^4v^3v^2 \; u^4u^2$

$18 \; v^9 \; u^6$

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

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

$16 \; y^5$

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

$2x^2 \; 2^2y^2x^6$

$2 \cdot 2^2 \; x^2 \; y^2 \; x^6$

$8 \; x^8y^2$

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

$= y^4 \; 2^4x^{12}y^{16}$

$= 2^4 y^4 y^{16} x^{12}$

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

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

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

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

$3 \; m^2 \; n^3$

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

$= \frac{4}{4} \; u^4 \; v^{2--2}$

$= 1 \; u^4 \; v^{2+2}$

$= 1 \; u^4 \; v^4$

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

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

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

$= \left(b^{3+2}\right)^2$

$= \left(b^5\right)^2$

$= b^{10}$

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

$= \frac{a^2 b^{-3} \; 2a^4 b^3}{2a}$

$= \frac{2a^2a^4 \; b^{-3}b^3}{2a}$

$= \frac{2a^6 \; b^0}{2a^1}$

$= \frac{2}{2} \; a^{6-1} \; b^0$

$= 1 \; a^5 \; 1$

$= a^5$

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

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

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

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

$= m^2 \; n^{10}$

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

$= \frac{x^4y^{-2}}{(2y^4)^{-2}y}$

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

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

$= \frac{x^4y^{-2--7}}{2^{-2}}$ add opp

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

$= \frac{x^4y^5}{2^{-2}}$ leave for now but we will talk about (-) exponents today

$\frac{2^0}{2^{-2}} = 2^{0--2} = 2^{+2}$

Any Homework Questions?

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3(adf),4(acd), 5(abc), 6ac), 8a,b,c, 9, 12(a,b,c), 15

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:

understood

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

NEW

Law #7b: Negative Reciprocals

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

Examples:

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

Ex) Simplify $\frac{12\,x^8\,y^{11}}{x^{13}\,y^{2}}$

Leave with positive exponents

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

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

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

Law #7c: Negative Reciprocal Quotient NEW

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

Flip fraction and exponent is now positive

- now apply exponent law for quotient

Examples:

$$\left(\frac{3}{4}\right)^{-3} = \frac{3^{-3}}{4^{-3}} = \frac{4^3}{3^3} = \frac{64}{27}$$

(3^{-3} ← move to bottom; 4^{-3} ← move to top)

OR

$$\left(\frac{3}{4}\right)^{-3} \text{ flip fraction} = \left(\frac{4}{3}\right)^3 = \frac{4^3}{3^3} = \frac{64}{27}$$

(quotient law)

Example 1 Evaluating Powers with Negative Integer Exponents

Evaluate each power.

a) 3^{-2} move

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

$= \frac{1}{9}$

OR

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

$\frac{(-3)^{-3}}{4^{-3}}$

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

$-\frac{64}{27}$

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

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

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

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

c) 0.3^{-4}

$\frac{1}{(0.3)^4}$

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

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

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

$= \frac{10\,000}{81}$

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

Evaluate each power without using a calculator.

a) $8^{-\frac{2}{3}}$ b) $\left(\frac{9}{16}\right)^{-\frac{3}{2}}$

SOLUTION

a) $8^{-\frac{2}{3}} = \frac{1}{8^{\frac{2}{3}}}$ move to bottom

$= \frac{1}{\left(\sqrt[3]{8}\right)^2}$ then do the math

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

$= \frac{1}{4}$

Write with a positive exponent

$\left(\frac{9}{16}\right)^{-\frac{3}{2}}$ quotient law first

flip entire

$= \left(\frac{16}{9}\right)^{\frac{3}{2}}$

$= \frac{16^{\frac{3}{2}}}{9^{\frac{3}{2}}}$

$= \frac{\left(\sqrt{16}\right)^3}{\left(\sqrt{9}\right)^3}$

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

$= \frac{64}{27}$

$\frac{9^{-\frac{3}{2}}}{16^{-\frac{3}{2}}}$ move

$\frac{16^{\frac{3}{2}}}{9^{\frac{3}{2}}}$

Homework

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#3a,b,c,d

#[redacted]

#6a,b,c

#7a,b,c,

#9a,c,[redacted],g

#10a,c

#12

#13a,b,d,[redacted]

$16^{-3/2}$

Test Unit 4 Probably
Friday or Monday

Write the reciprocal for each:

a) 7^{-3} b) 242 c) $\frac{1}{6}$ d) 8^{2}

Simplify the following (Leave your answer with positive exponents):

a) $(3xy^{-2})^{4}$

b) $\frac{(12r^{6}t^{3})}{(3r^{10}t^{2})}$

What is the value of $\left(\frac{a^6b^9}{a^5b^8}\right)^{-2}$ when $a = -3$ and $b = 2$?

b) $\left[\left(-\frac{3}{2}\right)^{-4}\right]^{2} \cdot \left[\left(-\frac{3}{2}\right)^{2}\right]^{3}$