Before we begin, are there any questions from last day's work?
pp. 329-331 # 7, 11, 2, 4, 5
Extra Practice p.330 # 9, 10

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) use the exponent laws to simplify and evaluate expression
b) solve exponential equations by using common bases.

1.5.1: Simplifying and Evaluating Expressions
Using the Laws of Exponents

Date: _Sept. 11/19_

Ex. 1 Evaluate without using a calculator. [You must use the laws of exponents]

a) 3^{-2} b) $\left(\dfrac{1}{4}\right)^{-2}$ c) $\dfrac{1}{4^{-2}}$ d) $\left(\dfrac{3}{4}\right)^{-2}$ e) $\left(-\dfrac{2}{5}\right)^{-3}$ f) $\left(\dfrac{81}{16}\right)^{\frac{1}{2}}$ g) $27^{\frac{2}{3}}$ h) $64^{\frac{4}{3}}$ i) $\left(\dfrac{16}{81}\right)^{\frac{1}{4}}$

$=\left(\dfrac{1}{3}\right)^2$ $=\left(\dfrac{4}{1}\right)^2$ $=\left(\dfrac{4}{1}\right)^2$ $=\left(\dfrac{4}{3}\right)^2$ $=\left(\dfrac{-5}{2}\right)^3$ $=\dfrac{\sqrt{81}}{\sqrt{16}}$ $=\left(27^{\frac{1}{3}}\right)^2$ $=\left(\sqrt[3]{64}\right)^4$ $=\dfrac{\sqrt[4]{16}}{\sqrt[4]{81}}$

$=\dfrac{1^2}{3^2}$ $=4^2$ $=4^2$ $=\dfrac{4^2}{3^2}$ $=\dfrac{(-5)^3}{2^3}$ $=\dfrac{9}{4}$ $=\left(\sqrt[3]{27}\right)^2$ $=(4)^4$ $=\dfrac{2}{3}$

$=\dfrac{1}{9}$ $=16$ $=16$ $=\dfrac{16}{9}$ $=\dfrac{-125}{8}$ $=(3)^2$ $=256$

$=16$ $=\dfrac{16}{9}$ $=9$

Ex. 2 Simplify using the laws of exponents.

a) $\sqrt{x^6 y^{12}}$

$=\left(x^6 y^{12}\right)^{\frac{1}{2}}$

$=\left(x^6\right)^{\frac{1}{2}}\left(y^{12}\right)^{\frac{1}{2}}$

$=x^3 y^6$

b) $x^2 \div x^{\frac{3}{2}}$

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

$=x^{\frac{4}{2}-\frac{3}{2}}$

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

or $=\sqrt{x}$

c) $\left(x^{\frac{2}{5}}\right)^{\frac{5}{8}}$

$=x^{\frac{2}{5}\times\frac{5}{8}}$

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

d) $\sqrt{81x^{16}y^{100}}\left(2x^{-4}y^3\right)^2$

$=\sqrt{81}\left(x^{16}\right)^{\frac{1}{2}}\left(y^{100}\right)^{\frac{1}{2}}\left(2\right)^2\left(x^{-4}\right)^2\left(y^3\right)^2$

$=9x^8 y^{50}\cdot 4x^{-8}y^6$

$=36x^{8+(-8)}y^{50+6}$

$=36y^{56}$

$$b^x \cdot b^y$$

$$= b^{x+y}$$

$$b^x \div b^y$$

$$= b^{x-y}$$

$$\left(b^x\right)^y$$

$$= b^{xy}$$

$$b^0$$

$$= 1$$

$$9^2 \cdot 9^3$$

$$= 9^{2+3}$$

$$= 9^5$$

$$9^8 \div 9^2$$

$$= 9^{8-2}$$

$$= 9^6$$

$$\left(9^3\right)^2$$

$$= 9^6$$

$$\frac{1}{4^2}$$

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

$$= \frac{1}{\frac{1}{16}}$$

$$\Rightarrow = 1 \div \frac{1}{16}$$

$$= 1 \times \frac{16}{1}$$

$$= 16$$

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

$$= 4^2$$

$$\frac{1}{a^3}$$

$$\frac{a^{-3}b^4 c^{-5}}{d^{6-7}f^8}$$

$$= \frac{b^4 e^7}{d^6 f^8 a^3 c^5}$$

$$\frac{-20}{4} \qquad \frac{20}{-4} \qquad -\frac{20}{4}$$

$$= -5 \qquad = -5 \qquad = -5$$

$$\frac{-3}{4}x \qquad \frac{3}{-4}x \qquad -\frac{3}{4}x \qquad \frac{-3}{-4}x$$

Ex. 3

a) Simplify $\dfrac{a^3b^2c^3}{\sqrt{a^2b^4}}$, and then evaluate for $a=4$, $b=9$, and $c=-3$.

b) Verify your answer by evaluating the expression *without* simplifying first.

$$= \frac{a^3b^2c^3}{(a^2b^4)^{\frac{1}{2}}}$$

$$= \frac{a^3b^2c^3}{(a^2)^{\frac{1}{2}}(b^4)^{\frac{1}{2}}}$$

$$= \frac{a^3b^2c^3}{a^1b^2}$$

$$= a^{3-1}b^{2-2}c^3$$

$$= a^2b^0c^3$$

$$= a^2(1)c^3$$

$$= a^2c^3 \quad \text{Simplified}$$

$$= (4)^2(-3)^3$$

$$= 16(-27)$$

$$= -432$$

$$= \frac{(4)^3(9)^2(-3)^3}{\sqrt{(4)^2(9)^4}}$$

$$= \frac{64(81)(-27)}{\sqrt{16(6561)}}$$

$$= \frac{-139\,968}{\sqrt{104\,976}}$$

$$= \frac{-139\,968}{324}$$

$$= -432$$

1.5.2: Solving Exponential Equations Using Common Bases

Date: Sept. 11/19

Ex. 1 Solve each exponential equation by determining a common base.

a) $2^x = 32$

$2^x = 2^5$

$\therefore x = 5$

b) $3^{5x+8} = 27^x$

$3^{5x+8} = (3^3)^x$

$3^{5x+8} = 3^{3x}$

$\therefore 5x+8 = 3x$

$5x - 3x = -8$

$2x = -8$

$x = \dfrac{-8}{2}$

$x = -4$

c) $3^{2x+5} = 27^{4x}$

$3^{2x+5} = (3^3)^{4x}$

$3^{2x+5} = 3^{12x}$

$\therefore 2x+5 = 12x$

$2x - 12x = -5$

$-10x = -5$

$x = \dfrac{-5}{-10}$

$x = \dfrac{1}{2}$

d) $4^{5x-1} = 2^{2(x+11)}$ ******

$(2^2)^{5x-1} = 2^{x+22}$

$2^{10x-2} = 2^{x+22}$

$\therefore 10x-2 = 2x+22$

$10x - 2x = 22+2$

$8x = 24$

$x = 3$

e) $4^{3x} = 8^{x+1}$

$(2^2)^{3x} = (2^3)^{x+1}$

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

$\therefore 6x = 3x+3$

$6x - 3x = 3$

$3x = 3$

$\therefore x = 1$

f) $3(2^{x-1}) = 96$

$\dfrac{3(2^{x-1})}{3} = \dfrac{96}{3}$

$2^{x-1} = 32$

$2^{x-1} = 2^5$

$\therefore x - 1 = 5$

$x = 6$

g) $5(3^{x+3}) = 405$

$3^{x+3} = \dfrac{405}{5}$

$3^{x+3} = 81$

$3^{x+3} = 3^4$

$\therefore x+3 = 4$

$x = 1$

h) $\sqrt{2} = 4^{x+1}$

$2^{\frac{1}{2}} = (2^2)^{x+1}$

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

$\therefore \dfrac{1}{2} = 2x+2$

$\dfrac{1}{2} - 2 = 2x$

$\dfrac{1}{2} - \dfrac{4}{2} = 2x$

$-\dfrac{3}{2} = 2x$

$-\dfrac{3}{4} = x$

i) How could you check your solutions using graphing technology?

Answer: Use the intersection method; i.e. $y_1 = 2^x$, $y_2 = 32$

Review the learning goals. Were we successful today?

Homework: p.387 #1, 2a, 3a, 5, 6
Worksheet 1.5.3

Answer any remaining homework questions
Students ask for "at desk" clarification.

1.5.3 Solving Exponential Equations Using Common Bases   Date: _____

1. Solve each exponential equation by determining a common base.

a) $2^x = 64$

b) $5^{2x+6} = 125$

c) $5^x = \dfrac{1}{25}$

d) $4^x = \dfrac{1}{8}$

2. Simplify.

a) $\dfrac{27^3 \times 9^{-2}}{81}$

b) $\dfrac{25^{m+3n}}{125^{2m+1}}$

3. Solve.

a) $3(2^x) = 48$

b) $4(7^{2x-1}) = 28$

c) $9^{x+1} = 27^{3x-4}$

d) $2^{2x+4} - 5 = 59$

4. Solve.

a) $2^{x^2+5x} = 64$

b) $(3^{x-3})^x = \dfrac{1}{9}$

c) $3^{3x+1} = 27(9^x)$

d) $(2^{x+2})(4^{x-1})(8^{2x-3}) = 256^x$

Answers

1a) 6   b) $\dfrac{-3}{2}$ c) –2   d) $\dfrac{-3}{2}$ 2a) 3   b) $5^{6n-4m-3}$

3a) 4   b) 1   c) 2   d) 1   4a) –6 or 1   b) 2 or 1   c) 2   d) 9