SEW Math 090

Worksheet 7.1: Radicals and Rational Exponents

Summer 2016

1. Each of the following is written in radical notation. Rewrite each with a rational exponent.

(a) $\sqrt{10} = 10^{1/2}$

(b) $\sqrt[3]{x} = x^{1/3}$

(c) $\sqrt{x^3} = x^{3/2}$

(d) $\sqrt[4]{a^2} = a^{2/4} = a^{1/2}$

(e) $\sqrt[5]{7} = 7^{1/5}$

(f) $\sqrt[3]{y^6} = y^{6/3} = y^2$

2. Each of the following is written with a rational exponent. Rewrite each in radical notation.

(a) $5^{1/2} = \sqrt{5}$

(b) $100^{1/2} = \sqrt{100}$

(c) $y^{1/5} = \sqrt[5]{y}$

(d) $x^{4/3} = \sqrt[3]{x^4}$

(e) $a^{2/3} = \sqrt[3]{a^2}$

(f) $x^{3/6} = \sqrt[6]{x^3}$

3. Simplify each of the following. You can convert from radical notation to fraction exponents, or vice verse, if that's helpful. Remember to take the root, before taking the power!

Which of these roots is not a real number?

(a) $\sqrt{64} = 8$

(b) $\sqrt[3]{64} = 4$

(c) $\sqrt{-64} = \sqrt{-1} \cdot 8$ or $= (-2^6)^{1/2}$ (Does not exist.)

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

(e) $\sqrt[5]{32} = 2$

(f) $\sqrt[3]{-1} = -1$

(g) $\sqrt[4]{-1}$ Does not exist. or $= (-1)^{1/4}$

(h) $16^{3/4} = 8$

(i) $16^{-3/4} = \frac{1}{8}$

(j) $-16^{3/4} = -8$

(k) $(-16)^{3/4} = (-2^4)^{3/4} =$
$(-1)^{1/4} \cdot 8$
(Does not exist.)

(l) $-27^{-4/3} = -\frac{1}{81}$

(m) $\left(\frac{49}{100}\right)^{1/2} = \frac{7}{10}$

(n) $\left(\frac{49}{100}\right)^{-1/2} = \frac{10}{7}$

(o) $\left(\frac{100}{9}\right)^{-3/2} = \frac{27}{1000}$

4. Use the laws of exponents to simplify each of the following. Give your answer using only positive exponents.

(a) $x^{1/4}x^{-5/4} = x^{-1} = \frac{1}{x}$

(b) $2^{2/3}2^{-5/3} = 2^{-1} = \frac{1}{2}$

(c) $(x^{1/2})^8 = x^4$

(d) $\frac{p^{5/3}}{p^{2/3}} = p^1$

(e) $(a^{1/3}a^{1/4})^{12} = (a^{5/12})^{12} = a^5$

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

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1. Simplify each of the following expressions.

(a) $\sqrt{48} = 4\sqrt{3}$

(b) $\sqrt{108} = 6\sqrt{3}$

(c) $\sqrt{125} = 5\sqrt{5}$

(d) $\sqrt[3]{125} = 5$

(e) $\sqrt[3]{81} = 3\sqrt[3]{3}$

(f) $2\sqrt{24} = 4\sqrt{6}$

(g) $4\sqrt{63} = 12\sqrt{3}$

(h) $\sqrt{\frac{50}{2}} = 5$

(i) $\sqrt[3]{\frac{3}{24}} = \frac{1}{2}$

(j) $\sqrt{\frac{x^3}{x}} = x$

(k) $\sqrt{25x^4y^2} = 5x^2y$

(l) $\sqrt{125p^3q^2} = 5pq\sqrt{5p}$

(m) $\sqrt[3]{54a^6b^4} = 3a^2b\sqrt[3]{2b}$

(n) $\sqrt[4]{10cd^7} = d\sqrt[4]{10cd^3}$

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

2. Add or subtract the following radical expressions, if possible. You may need to simplify first to find like terms.

(a) $3\sqrt{5} - 6\sqrt{5}$ $= -3\sqrt{5}$

(b) $10\sqrt{10} - 8\sqrt{10} + \sqrt{2}$ $= 2\sqrt{10} + \sqrt{2}$ (Also $= \sqrt{2}(2\sqrt{5} + 1)$)

(c) $\sqrt[4]{5c} + \sqrt[3]{5c}$ = Can't be simplified.
(or $= \sqrt[4]{5c}\left(1 + \sqrt[12]{5c}\right)$)

(d) $\frac{3}{4}a\sqrt[4]{b} + \frac{1}{6}a\sqrt[4]{b} = \left(\frac{3}{4} + \frac{1}{6}\right)a\sqrt[4]{b} = \frac{11}{12}a\sqrt[4]{b}$

(e) $9y^2\sqrt{2} + 4\sqrt{2}$ $= \sqrt{2}(4 + 9y^2)$

(f) $4\sqrt{7} + \sqrt{63} - 2\sqrt{28}$ $= 4\sqrt{7} + 3\sqrt{7} - 4\sqrt{7} = 3\sqrt{7}$

(g) $4\sqrt[3]{x^4} - 2x\sqrt[3]{x}$ $= 4x\sqrt[3]{x} - 2x\sqrt[3]{x} = 2x\sqrt[3]{x}$

(h) $x\sqrt[3]{64x^5y^2} - x^2\sqrt[3]{x^2y^2} + 5\sqrt[3]{x^8y^2}$ $= 4x^2\sqrt[3]{x^2y^2} - x^2\sqrt[3]{x^2y^2} + 5x^2\sqrt[3]{x^2y^2}$
$= (4x^2 - x^2 + 5x^2)\sqrt[3]{x^2y^2} = 8x^2\sqrt[3]{x^2y^2}$