

## Section 9.2: Rational Exponents Academic Systems

**Exponent rules:** Assuming that variables satisfy basic conditions outline in the text book, we have the following rules:

a.)  $a^x a^y = a^{x+y}$

b.)  $\frac{a^x}{a^y} = a^{x-y}$

c.)  $(a^x)^y = a^{xy}$

d.)  $a^{-x} = \frac{1}{a^x}$

e.)  $a^0 = 1, a \neq 0$  and  $0^0$  is undefined.

f.)  $x^{1/n} = \sqrt[n]{x}, n > 0$

### Section: 9.2: Rational Exponents

1.) Evaluate  $\sqrt[5]{-32}$

$$= \sqrt[5]{(-2)^5}$$

$$= -2$$

2.) Evaluate  $\sqrt[4]{\frac{625}{1296}}$

$$= \sqrt[4]{\frac{5^4}{2^4 3^4}}$$

$$= \frac{5}{6}$$

3.) Rewrite  $\sqrt[5]{312^4}$  using rational exponents:

$$= \sqrt[5]{(2^3 \cdot 3 \cdot 13)^4}$$

$$= \sqrt[5]{2^{12} \cdot 3^4 \cdot 13^4}$$

$$= 4 \sqrt[5]{2^2 \cdot 3^4 \cdot 13^4}$$

4.) Find  $x^{\frac{1}{5}} \cdot x^{\frac{2}{5}}$

$$= x^{\frac{1}{5} + \frac{2}{5}}$$

$$= x^{\frac{3}{5} + \frac{10}{5}}$$

$$= x^{13/5}$$

5.) Simplify  $\sqrt[3]{192a^3b^5c^9}$

$$= \sqrt[3]{2^6 \cdot 3 \cdot a^3 b^5 c^9}$$

$$= 2^2 a b c \sqrt[3]{3b^2}$$

6.) Simplify  $\sqrt[3]{128x} + 2\sqrt[3]{16x^4} - \sqrt[3]{54x}$

$$= \sqrt[3]{2^7 x} + 2\sqrt[3]{2^4 x^4} - \sqrt[3]{3^3 \cdot 2x}$$

$$= 4\sqrt[3]{2x} + 4x\sqrt[3]{2x} - 3\sqrt[3]{2x}$$

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

$$= (1 + 4x)\sqrt[3]{2x}$$

7.) Simplify  $3\sqrt{2y}(7\sqrt{10y} + 4\sqrt{3})$

$$= 21\sqrt{20y^2} + 12\sqrt{6y}$$

$$= 42y\sqrt{5} + 12\sqrt{6y}$$

=

8.) Simplify  $(5\sqrt{2y} - \sqrt{3x})(5\sqrt{2y} + \sqrt{3x})$

$$= 25(2y) + 5\sqrt{6xy} - 5\sqrt{6xy} - 3x$$

$$= 50y - 3x$$

9.) Simplify  $\frac{x-\sqrt{3}}{x+\sqrt{3}}$

$$= \frac{x-\sqrt{3}}{x+\sqrt{3}} \cdot \frac{x-\sqrt{3}}{x-\sqrt{3}}$$

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

10.) Evaluate the expression  $\left(x^{\frac{2}{3}}y^{\frac{3}{5}}z^{\frac{4}{7}}\right)^3$

using only positive exponents.

$$= \left(\frac{y^{\frac{3}{5}}}{x^{\frac{2}{3}} z^{\frac{4}{7}}}\right)^3$$

$$= \frac{y}{x^2 z^{\frac{12}{7}}}$$