

1)  $x^5 \cdot x^2 = x^7$

2)  $7x^3y^2 \cdot 5xy^9$

3)  $a^{10} \cdot a^2 \cdot a^{-6}$

4)  $(z^5)^5 = z^{25}$

5)  $(m^{-8})^{-3} = m^{24}$

6)  $(x^2y^4m^3)^8$   
 $x^{16}y^{32}m^{24}$

7)  $(2ab)^5 = 2^5a^5b^5$

8)  $\left(\frac{m^3p^5}{n^7}\right)^6 \left(\frac{m^2np^3}{m^4p^2}\right)^3$

9)  $p^2 \cdot (p^5)^2$

10)  $\frac{5x^{-4}}{x^{-9}}$

8)  $\left(\frac{m^3p^5}{n^7}\right)^6 \left(\frac{m^2np^3}{m^4p^2}\right)^3$   
 $\left(\frac{m^{18}p^{30}}{n^{42}}\right) \left(\frac{m^6n^0p^9}{m^{12}p^6}\right)$   
 $\left(\frac{m^{18}p^{30}}{n^{42}}\right) \left(\frac{m^{-6}p^3}{1}\right)$   
 $\frac{m^{12}p^{33}}{n^{42}}$

9)  $p^2 \cdot (p^5)^2$   
 $p^2 \cdot p^{10} = p^{12}$

10)  $\frac{5x^{-4}}{x^{-9}} = 5x^5$

-4 ⊖ 9

Use a calculator to complete the table.

$x$	$x^{\frac{1}{2}}$
1	$1^{\frac{1}{2}} =$
4	$4^{\frac{1}{2}} =$
9	
16	
25	

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

4.4 Fractional Exponents and Radicals

$$x^{\frac{1}{3}} = \sqrt[3]{x}$$

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

$$x^{\frac{1}{10}} = \sqrt[10]{x}$$

Use a calculator to complete the table.

$x$	$x^{\frac{1}{3}}$
1	$1^{\frac{1}{3}} = 1$
8	$8^{\frac{1}{3}} = 2$
27	$27^{\frac{1}{3}} = 3$
64	
125	

4.4 Fractional Exponents and Radicals

Rational Exponents and Radicals

Let's examine radicals...

$$\sqrt{5} \times \sqrt{5} = 5$$

How would this play out with exponent laws?

$$5^{\frac{1}{2}} \times 5^{\frac{1}{2}} = 5^1$$

RULE:  $\sqrt{x} = x^{\frac{1}{2}}$

What about other rational exponents and radicals?

$$8^{\frac{1}{3}} \times 8^{\frac{1}{3}} \times 8^{\frac{1}{3}} =$$

Rule:  $\sqrt[3]{x} = x^{\frac{1}{3}}$

In general...  $(\sqrt[n]{x})^m$  or  $\sqrt[n]{x^m} = x^{\frac{m}{n}}$

Rational Exponents

- To evaluate exponents that are rational (fractions), the denominator of the fraction indicates which root to take and the numerator indicates which power the entire base is to be raised.

Example

$$16^{\frac{1}{4}} \quad \left( \sqrt[4]{x} \right)^m \text{ or } \sqrt[n]{x^m} = x^{\frac{m}{n}} \quad 125^{\frac{2}{3}}$$

$$125^{\frac{2}{3}}$$

$$16^{\frac{1}{2}} \xrightarrow{\text{radical}} \sqrt{16}$$

$$16^{\frac{2}{3}} \xrightarrow{\text{radical}} \sqrt[3]{16^2}$$

$$9^{\frac{3}{2}} \xrightarrow{\text{radical}} \left(\sqrt[3]{16}\right)^2$$

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

$$3^3 = 27$$

$$\left(\sqrt[3]{27}\right)^5 \xrightarrow{\text{power}} 27^{\frac{5}{3}}$$

$$81^{0.25} \xrightarrow[\text{radical.}]{\frac{1}{4}}$$

$$\sqrt[4]{81}$$

$$32^{1.2} = 32^{\frac{6}{5}} = \left(\sqrt[5]{32}\right)^6$$

$$0.\bar{3} = \frac{1}{3}$$

$$0.2 = \frac{1}{5}$$

$$0.5 = \frac{1}{2}$$

$$0.\bar{6} = \frac{2}{3}$$

$$0.4 = \frac{2}{5}$$

$$1.5 = \frac{3}{2}$$

$$0.25 = \frac{1}{4}$$

$$0.75 = \frac{3}{4}$$

Express as a power exponent: Express as a Radical:

a)  $\sqrt[5]{32}$   
 $32^{\frac{1}{5}}$

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

b)  $\sqrt[3]{-64}$   
 $(-64)^{\frac{1}{3}}$

b)  $49^{\frac{3}{2}}$   
 $(\sqrt{49})^3$

c)  $(\sqrt{144})^3$   
 $144^{\frac{3}{2}}$

c)  $(-125)^{\frac{2}{3}}$   
 $(\sqrt[3]{-125})^2$

# Homework

Page 227-228

## 4.4 Fractional Exponents and Radicals

### Exercises

A  
 3 4 5 6 7

B  
 8 9 10 11 12 13 14 15  
 16 17 18 19 20 21

C  
 22

3, 4, 5, 6  
 8, 9, 10, 11  
 12