

Section 4.4: Fractional Exponents and Radicals

Review Exponent Laws from Grade 9:

Law 1 $\longrightarrow a^m \times a^n =$

Example 1: $3^5 \times 3^4 =$

Law 2 $\longrightarrow a^m \div a^n =$

Example 2: $3^5 \div 3^4 =$

Law 3 $\longrightarrow (a^m)^n =$

Example 3: $(3^5)^4 =$

Law 4 $\longrightarrow a^0 =$

Example 4: $(3^5)^0 =$

Look at the Powers with Fractional Exponents

Example 5

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

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

What do you notice?

What are the equivalent expressions?

Example 6

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

$$\sqrt[3]{5} \times \sqrt[3]{5} \times \sqrt[3]{5} =$$

What do you notice?

What are the equivalent expressions?

Summary:

1. Raising a number to the exponent $\frac{1}{2}$



2. Raising a number to the exponent $\frac{1}{3}$



Fractional Exponents where the Numerator is 1

Exponent Rule

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

n: natural number
x: rational number

Example 7 Evaluate each power without using a calculator.

a) $27^{\frac{1}{3}}$

b) $0.49^{\frac{1}{2}}$

c) $(-64)^{\frac{1}{3}}$

d) $(32)^{\frac{1}{5}}$

e) $\left(\frac{16}{81}\right)^{\frac{1}{4}}$

f) $\left(\frac{4}{9}\right)^{\frac{1}{2}}$

g) $(32)^{0.2}$

Fractional Exponents where the Numerator is not 1

↳ Exponent Rule

$$x^{\frac{m}{n}} = \left(\sqrt[n]{x}\right)^m \quad \text{or} \quad x^{\frac{m}{n}} = \sqrt[n]{x^m}$$

- the numerator of a fractional exponent is the _____
 - the denominator of a fractional exponent is the _____
 - the root and power can be evaluated in any _____
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Example 8 Evaluate the following

a) $8^{\frac{2}{3}}$

b) $16^{\frac{3}{4}}$

c) $4^{\frac{3}{2}}$

Example 9. Evaluate the following powers that have negative bases.

$-8^{\frac{2}{3}}$	$(-8)^{\frac{2}{3}}$
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Example 10 Evaluate the following powers that have negative bases.

$-9^{\frac{1}{2}}$	$(-9)^{\frac{1}{2}}$
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Example 11 Write each power as a radical and then evaluate.

a) $49^{\frac{3}{2}}$

b) $(-64)^{\frac{2}{3}}$

c) $(0.36)^{1.5}$

d) $-\left(\frac{25}{36}\right)^{\frac{3}{2}}$

e) $-125^{\frac{2}{3}}$

f) $(-16)^{\frac{1}{2}}$

Example 12 Write the following in exponent form.

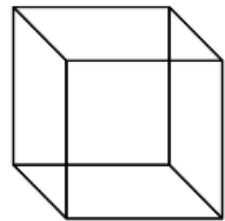
a) $(\sqrt[3]{25})^2$

b) $\sqrt{3^5}$

c) $\sqrt[4]{8^3}$

Example 13

The area, A , of a face of a cube is given by $A = V^{\frac{2}{3}}$, where V represents the volume of the cube. If $V = 64 \text{ cm}^3$ determine the value of A .



Example 14

The value of a car, V , is given by the equation $V = 32000(0.85)^{\frac{t}{2}}$, where t represents how old the car is in years. What is the value of the car after 5 years?

Work Book Questions

p.227-228 #3af, 5ab, 6ab, 10abc,
11abc, 12, 17, 18

Extra Practice Questions

p.227-228 #3bcde, 4, 7, 8bd, 9,
10def, 11def, 15, 19

