




PRE-CALC & TRIG

Day 66



6.4 Rational Exponents

Objective: To simplify expressions with rational exponents

$$(a)^{\frac{m}{n}} = (a^{\frac{1}{n}})^m = \sqrt[n]{a^m}$$

Simplifying Expressions with Rational Exponents (without a calculator):

1.) $16^{\frac{1}{2}}$

2.) $27^{-\frac{2}{3}}$

3.) $5^{\frac{1}{2}} \times 5^{\frac{1}{2}}$

4.) $5^{\frac{1}{4}} \times 125^{\frac{1}{4}} =$

5.) $(-32)^{\frac{4}{5}}$

Simplifying Expressions with Rational Exponents:

$$1.) \quad 16^{\frac{1}{2}} = \sqrt[2]{16}^1 = 4$$

$$2.) \quad 27^{-\frac{2}{3}} = \frac{1}{\sqrt[3]{27}^2} = \frac{1}{3^2} = \frac{1}{9}$$

$$3.) \quad 5^{\frac{1}{2}} \times 5^{\frac{1}{2}} = \sqrt{5} \times \sqrt{5} = \sqrt{25} = 5 \quad \text{or} \quad 5^{\frac{1}{2}} \times 5^{\frac{1}{2}} = 5^{\frac{2}{2}} = 5^1 = 5$$

$$4.) \quad 5^{\frac{1}{4}} \times 125^{\frac{1}{4}} = \sqrt[4]{5} \times \sqrt[4]{125} = \sqrt[4]{625} = 5$$

$$5.) \quad (-32)^{\frac{4}{5}} = \sqrt[5]{-32}^4 = (-2)^4 = 16$$

Properties of Rational Exponents to Remember;

Let a and b be real numbers and let m and n be rational numbers.

Property	Equation	Example
<i>Product of Powers</i>	$a^m * a^n = a^{m+n}$	$3^{1/2} \cdot 3^{3/2} = 3^{(1/2+3/2)} = 3^2 = 9$
<i>Power of a Power</i>	$(a^m)^n = a^{m*n}$	$(4^{3/2})^2 = 4^{(3/2*2)} = 4^3 = 64$
<i>Power of a Product</i>	$(ab)^m = a^m b^m$	$(9 \cdot 4)^{1/2} = 9^{1/2} \cdot 4^{1/2} = 3 \cdot 2 = 6$
<i>Negative Exponent</i>	$a^{-m} = \frac{1}{a^m}, a \neq 0$	$25^{-1/2} = \frac{1}{25^{1/2}} = \frac{1}{5}$
<i>Zero Exponent</i>	$a^0 = 1, a \neq 0$	$9^0 = 1$
<i>Quotient of Powers</i>	$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$	$\frac{6^{5/2}}{6^{1/2}} = 6^{(5/2-1/2)} = 6^2 = 36$
<i>Power of a Quotient</i>	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$	$\left(\frac{8}{27}\right)^{1/3} = \frac{8^{1/3}}{27^{1/3}} = \frac{2}{3}$

For Next Time:

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60, 61, 89