Lesson 7 - Simplifying Expressions with Exponents.

Grade 10

WWW.INTOMATH.ORG

Exponent Laws

integer exponents

$$a^0 = 1.$$

$$a^m a^n = a^{m+n}.$$

$$a^m \div a^n = a^{m-n},\ m \geq n,\ a \neq 0.$$

$$(ab)^n = a^n b^n.$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n},\ b \neq 0.$$

$$a^{-n} = \frac{1}{a^n},\ a \neq 0.$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n,\ b \neq 0,\ a \neq 0.$$

n-th root of a number

The ***n-th*** **root** of the number ***a*** is a number, that when raised to the exponent ***n*** would equal ***a.***
n should equal 2 or greater.
In the radical expression, ***n*** is called the **index** of the radical.

$$\sqrt[n]{a} = b \qquad b^n = a$$

$\sqrt{a}$ is a square root of a number.
n = 2, but we do not write it.

When n = 3 we call it a cube root of a number.

n-th root of a number

If *n* is an odd number, then any value of *a* satisfies $\sqrt[n]{a}$

If *n* is an even number, then $a \geq 0$

$2^5 = 32 \rightarrow \sqrt[5]{32} = 2$

$(-5)^3 = -125 \rightarrow \sqrt[3]{-125} = -5$

If *a* is an odd number and $a < 0$, then

$\sqrt[n]{a} = -\sqrt[n]{-a}$ $\sqrt[3]{-7} = -\sqrt[3]{7}$

Rational Exponents

If a is *a* positive number, $\frac{m}{n}$ is a fraction

(*m* is a whole number, *n* is a natural number), then

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} \qquad a^{\frac{1}{2}} = \sqrt{a}$$

$$0.3^{\frac{5}{8}} = \sqrt[8]{0.3^5} \qquad 5^{-\frac{1}{6}} = 5^{\frac{-1}{6}} = \sqrt[6]{5^{-1}} \qquad \left(\frac{1}{3}\right)^{1.7} = \left(\frac{1}{3}\right)^{\frac{17}{10}} = \sqrt[10]{\left(\frac{1}{3}\right)^{17}}$$

Propeties of Powers with Rational Exponents

If $\frac{m}{n}$ is a positive fraction, then $0^{\frac{m}{n}} = 0$

If $\frac{m}{n}$ is a negative fraction, then $0^{\frac{m}{n}}$ has no meaning

If $a > 0$, m is a whole number, n and k are natural numbers, then

$$a^{\frac{m \cdot k}{n \cdot k}} = \sqrt[n \cdot k]{a^{m \cdot k}} = \sqrt[n]{a^m} = a^{\frac{m}{n}}$$

Integer exponent laws also apply

Examples

$$\frac{16^2 \cdot 3^6}{12^4}$$

$$\left(125\,x^{-6}\right)^{-\frac{2}{3}}$$

Examples

$$\left(3^{5x-1} \cdot 3^{2-3x}\right)^2$$

$$a b^{\frac{1}{2}} \left(a^{\frac{1}{2}} + b^{\frac{1}{2}} \right) - \left(a^{\frac{1}{2}} b^{\frac{1}{6}} \right)^3$$

INTO MATH
LEARN IT FAST

YOU HAVE COMPLETED GRADE 10!