

Tri Le
MATH 1314
College Algebra
Mr. Brice

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Exponents and Radical Expressions

P-2

I. Positive Integer Exponents

II. Zero as an Exponent

III. Negative Integer Exponents

IV. Rational (Fractional) Exponents

II. Zero as an Exponent

$$2^0 = 1, \quad 2^3 \cdot 2^0 = 2^{3+0} = 2^3 = 8$$

\downarrow
 $8 \cdot 1 = 8 \leftarrow$

2^0 is an identity element

$$7^0 = 1, \quad (-13)^0 = 1, \quad (4/7)^0 = 1$$

$$(\pi/17)^0 = 1, \quad (-0.117)^0 = 1$$

Any real # to the zero power is 1.
-exception! $0^0 = \text{undefined}$

$$\text{Ex: } 6y^3(2y^0)^3 = 6y^3(2^3) = 6y^3 \cdot 8 = 48y^3$$

$$\text{Ex: } [4.75^3 - (\pi/17)^2 + 22.1 - 1]^0 = 1$$

$$\text{Ex: } -9^0 = (-1)9^0 = -1$$

Make sure the calculator gives a negative answer.
If it does not, evaluate the 9^0 first, then multiply it by -1 .

Exponents and Radical Expressions

P-2

I. Positive Integer Exponents

$$2^3 = 2 \cdot 2 \cdot 2 \text{ or } 8$$

$2x$
↑
base
↑
coefficient

3 → exponent
The base is the

$$(\text{Neg})^{\text{even}} = \text{Pos}$$

$$(\text{Neg})^{\text{odd}} = \text{Neg}$$

2nd Power of Exponents

$$(x^3)^2 = x^{3 \cdot 2} = x^6$$

$$\Downarrow \\ x^3 \cdot x^3$$

III. Negative Integer Exponents

$$\text{Ex: } 2^{-3} = ?$$

$$2^3 \cdot 2^{-3} = 2^{3+(-3)} = 2^0 = 1$$

$$\downarrow \quad \downarrow \quad \downarrow \\ 8 \cdot \frac{1}{8} = 1 \leftarrow$$

$$5 \cdot \frac{1}{5} = 1 \quad \frac{2}{3} \cdot \frac{3}{2} = 1$$

$$-7 \cdot \frac{-1}{7} = 1$$

Definitions:

2 numbers whose sum is 0 - opposites

2 numbers whose product is 1 - reciprocals

All real numbers have an opposite

Exception: Zero has no reciprocal

$$\left(\frac{3}{2}\right)^{-3} = \left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} = \frac{8}{27}$$

$$(a^2 b^3)^5 = a^{10} b^{15}$$

$$2^{-3} = \left(\frac{1}{2}\right)^3 = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$$

Principle: I am free to move a factor to the other part of the fraction if I change the sign of the exponent.

$$\text{Ex: } \frac{2^{-3}}{1} = \frac{1}{2^3} = \frac{1}{8}$$

$$\text{Ex: } \frac{1}{2x^{-4}} = \frac{x^4}{2}$$

IV. Rational (Fractional) Exponents

Review: 1. $x^2 \cdot x^5 = x^7$

2. $(x^2)^5 = x^{10}$

3. $\frac{x^5}{x^3} = \frac{x^{5-3}}{1} = x^2$

$$\frac{a^3 b^{10}}{a^5 b^5} = \frac{b^5}{a^2}$$

Ex: $8^{-1} + 9^{-1} = \frac{1}{8} + \frac{1}{9} = \frac{9+8}{72} = \frac{17}{72}$

Handy-Dandy Method:

1. Denominator - multiply your denominators
2. Numerator - start in the upper left and cross multiply