

## Properties of Exponents

### Zero as an Exponent

- any nonzero number raised to the Zero power equals 1

Example)  $x^0 = 1$

$$x^1 = x$$

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### Multiplying Monomials

- Rule: Multiply the coefficients.

For like bases, keep the base, add the coefficients

Example)  $(2x^3)(4x^5) = 8x^{3+5} = 8x^8$

$$x^2 \cdot x^3 = x^{2+3} = x^5$$

$$y^{-2} \cdot y^4 = y^{4-2} = y^2$$

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### Product to a Power

-  $a^n \rightarrow$  (monomial)<sup>exponent</sup>

- Rule: Raise coefficient to the exponent. Multiply outside exponent by all exponents inside the ( )

Example)  $(2x^3)^4 = 16x^{12}$

$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$

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### Negative Exponents

- Negative exponents must flip the base's position, so the negative exponent becomes positive.

- It does not change the value of the coefficient.

Example)  $x^{-n} = \frac{1}{x^n}$

$$x^{-2} = \frac{1}{x^2} \quad y^{-3} = \frac{1}{y^3} \quad \frac{x^{-2}}{y^{-3}} = \frac{y^3}{x^2}$$

$$\left(\frac{x}{y}\right)^{-1} = \left(\frac{y}{x}\right)^1 = \frac{y}{x}$$

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### Dividing Monomials

- Divide the coefficients. For like bases, keep the base, subtract the exponents.

- Put answer where larger exponent was.

- You should never have a negative exponent.

$$\frac{x^3}{x^2} = x^{3-2} = x$$

$$\frac{6x^6}{2x^2} = 3x^{6-2} = 3x^4$$

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$$\frac{9^3}{3^2} = \frac{9 \times 9 \times 9}{3 \times 3} = 81$$

$$\frac{9^3}{9^1} = 9^{3-1} = 9^2 = 9 \times 9 = 81$$

$$\frac{x^3}{x^2} = x^{3-2} = x$$

$$\frac{4^4}{2^2} = 2^2 = 4$$

$$\frac{4^4}{4^1} = 4^{4-1} = 4^3 = 64$$

$$\frac{4^4}{2^2} = \frac{(2^2)^4}{2^2} = \frac{2^8}{2^2} = 2^{8-2} = 2^6$$

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Quotient to a Power

- Fraction to an exponent
- raise the numerator to the exponent, raise the denominator to the exponent

Example)

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$
$$\left(\frac{4}{2}\right)^2 = \frac{4^2}{2^2} = \frac{4 \times 4}{2 \times 2} = \frac{16}{4} = 4$$

← 4

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