Positive Exponents

Multiply the base by itself as many times as the exponent tells you to.

$$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$$

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Negative Exponents

Put a 1 over the base and multiply the base by itself as many times as the exponent tells you to.

$$3^{-5} = \frac{1}{3 \times 3 \times 3 \times 3 \times 3} = \frac{1}{243}$$

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Exponents on Fractions

Multiply the fraction by itself as many times as the exponent tells you to. (Numerator times numerator. Denominator times denominator.)

$$\left(\frac{2}{5}\right)^2 = \left(\frac{2^2}{5^2}\right) = \frac{2 \times 2}{5 \times 5} = \frac{4}{25}$$

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Exponents on Negative Numbers

Multiply the base by itself as many times as the exponent tells you to.
If the exponent is even, the number will be positive.
If the exponent is odd, the number will be negative.

$$-4^2 = -4 \times -4 = +16$$
$$-4^3 = -4 \times -4 \times -4 = -64$$
$$-4^4 = -4 \times -4 \times -4 \times -4 = 256$$

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1 as an Exponent

Any number raised to the power of 1 is equal to itself.

$$3^1 = 3$$

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0 as an Exponent

A number raised to the power of 0 is 1.

$$3^0 = 1$$

Except for 0. $0^0 = undefined$

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Multiplying Exponents

To multiply exponents with the same base, add the exponents.

$$3^2 \times 3^3 = 3^{2+3} = 3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$$

If the bases are different, you can't multiply them.

$$x^2 \times y^2 = x^2y^2$$

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Dividing Exponents

When dividing exponents with the same base, subtract the exponents (not the bases).

$$\frac{2^6}{2^3} = 2^{6-3} = 2^3 = 8$$

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Exponents on Parentheses [Addition/Subtraction]

Do NOT simply put the exponent on each number or letter. Multiply the entire expression in parentheses by itself as many times as the exponent tells you to.

$$(x+6)^2 = (x+6)(x+6) = x^2 + 12x + 36$$

NOT $(x+6)^2 = (x^2+6^2)$

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Exponents on Parentheses [Multiplication]

Distribute the exponent to all the numbers and letters in the parentheses.

$$(4x)^3 = (4^3)(x^3) = 64x^3$$

NOT $4x^3$

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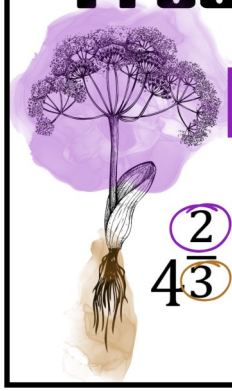
Fractional Exponents



The flower is the power;

the root is the root.

$$4^{\frac{2}{3}} = \sqrt[3]{4^2} = \sqrt[3]{16} = 2\sqrt[3]{2}$$

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Raising a Power to a Power

To raise an exponent to a power, multiply the exponent by the other exponent.

$$(7^2)^3 = 7^{2\times3} = 7^6 = 7 \times 7 \times 7 \times 7 \times 7 \times 7 = 117649$$

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Adding & Subtracting Exponents

If the BASES and EXPONENTS are the same, add the coefficients.

$$x^4 + 3x^2 + 2y^3 - x^2 = x^4 + 2x^2 + 2y^3$$

If the bases or exponents are different, you can't add them.

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Exponents with Different Bases

If the bases are not the same, break them down to the lowest common base: 9 and 27 are powers of what number?

$$9^5 \times 27^2 = (3^2)^5 \times (3^3)^2 = 3^{10} \times 3^6 = 3^{16}$$

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Solving for a Variable When It's an Exponent

If the bases are the same, the exponents form their own equation. Follow the rules of exponents to set up and solve.

Solve for m.

$$(9^x)(27^x) = 3^{xm}$$

$$9^x = (3^2)^x = 3^{2x}$$
$$27^x = (3^3)^x = 3^{3x}$$
$$(3^{2x})(3^{3x}) = 3^{xm}$$

$$2x + 3x = xm$$
$$5x = xm$$
$$5 = m$$

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