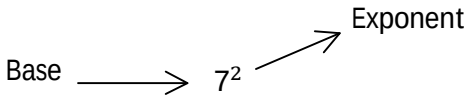
M9 - 3.1 - Add/Sub/Dist Exponents Laws

Remember:
-Never multiply the base by the exponent
-Must have same base to use laws.



When Multiplying with the same base, Add Exponents.

$2^3 \times 2^2 = (2 \times 2 \times 2) \times (2 \times 2) = 2^5$

$2^3 \times 2^2 = 2^{3+2} = 2^5$ Add Exponents

$5^2 \times 5^4 = (5 \times 5) \times (5 \times 5 \times 5 \times 5) = 5^6$

$5^2 \times 5^4 = 5^6$

When Dividing with the same base, Subtract Exponents.

$\frac{3^5}{3^2} = \frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3} = 3^3$

$\frac{3^5}{3^2} = 3^{5-2} = 3^3$ Subtract Exponents

$\frac{4^6}{4^3} = \frac{4 \times 4 \times 4 \times 4 \times 4 \times 4}{4 \times 4 \times 4} = 3^3$

$\frac{4^6}{4^3} = 4^3$

With Exponents to exponents, Multiply Exponents

$(2^2)^3 = (2 \times 2)^3 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) = 2^6$

$(2^2)^3 = 2^{2 \times 3} = 2^6$ Multiply Exponents

$(5^4)^2 = (5 \times 5 \times 5 \times 5)^2 = (5 \times 5 \times 5 \times 5) \times (5 \times 5 \times 5 \times 5) = 5^8$

$(5^4)^2 = 5^8$

Ultimately you will either use: Exponent Laws

Or

Repeated Multiplication and Division Theory

M9 - 3.2 - Dist/Neg Exponents Laws

With Product/Quotients to Exponents, Distribute Exponents

$(3 \times 4)^2 = 3^2 \times 4^2$ Distribute Exponents

$or \quad (3 \times 4)^2 = 12^2$

$(2x)^3 = (2x) \times (2x) \times (2x) = 8x^3$

$(2x)^3 = 2^3x^3 = 8x^3$

$$\left(\frac{3}{5}\right)^2 = \frac{3^2}{5^2}$$

Cannot distribute into a sum!

$(3 + 4)^2 \neq 3^2 + 4^2 = 25$

$(3 + 4)^2 = (3 + 4)(3 + 4) = 7 \times 7 = 7^2 = 49$

Negative Exponents

$5^{-2} = \frac{1}{5^2}$ *Bring to the bottom, make exponent positive*

$x^{-a} = \frac{1}{x^a}$

$\frac{1}{3^{-2}} = \frac{3^2}{1}$ *Bring to the top, make exponent positive*

$\frac{1}{x^{-a}} = x^a$

$3a^{-2} = \frac{3}{a^2}$ *Bring to the bottom, make exponent positive*

Notice the 3 doesn't come down

$3^{-3}a^{-2} = \frac{1}{3^3a^2}$ *Bring to the bottom, make exponent positive*

$(2x)^{-3} = \frac{1}{(2x)^3} = \frac{1}{8x^3}$ *Bring to the bottom, make exponent positive*

When working with negative exponents always start with a fraction "Over" sign. Put whatever stays. Move whatever needs to be moved. If nothing is left on the top, by division theory, a 1 goes there.

$$\frac{2x^5y^{-2}}{z^{-3}} = \frac{2x^5z^3}{y^2}$$

M9 - 3.2 - Negative Exponents Laws

When you can flip it!

$\left(\frac{5}{3}\right)^{-2} = \frac{5^{-2}}{3^{-2}} = \frac{3^2}{5^2}$

Distribute Exponents
Bring to the bottom, make exponent positive
Bring to the top, make exponent positive

$\left(\frac{5}{3}\right)^{-2} = \left(\frac{3}{5}\right)^{2} = \frac{3^2}{5^2}$ Flip it and make the exponent positive

Alternate Subtraction Method

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

Theory

$\frac{5^2}{5^5} = \frac{\cancel{5 \times 5}\ 1}{\cancel{5 \times 5} \times 5 \times 5 \times 5} = \frac{1}{5^3}$

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

Subtract from the top

Subtract from the bottom

$\frac{5^2}{5^{-3}} = 5^{2-(-3)} = 5^5$

$\frac{5^2}{5^{-3}} = 5^2 5^3 = 5^5$

Bring Up and Add

Theory on "Bring it to the Bottom" and Vice Versa

$3^3 = 27$

÷ 3

$3^2 = 9$

÷ 3

$3^1 = 3$

÷ 3

$3^0 = 1$

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

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

If a pattern in Math continues without proving it wrong it is considered Theory for everyone to follow.

The exponents on the left are going down by one,
The numbers on the right are being divided by 3,
This pattern must continue

M9 - 3.2 - Negative Coefficient Exponents Laws

Negative Coefficients

$-2^2 = -2^2 = -2 \times 2 = -4$

Negative numbers WITHOUT brackets stay NEGATIVE

Unnecessary brackets

$-(2)^2 = -4$

$(-2^2) = -4$

Adding a Negative In Front

$-(-2^2) = -4$

$(-2)^3 = (-2) \times (-2) \times (-2) = -8$

Negative numbers with brackets to ODD exponents stay NEGATIVE

$-(-2)^3 = 8$

$(-2)^4 = (-2) \times (-2) \times (-2) \times (-2) = 16$

Negative numbers with brackets to EVEN exponents become POSITIVE

$-(-2)^4 = -16$