# 9.1 Laws of Exponents

## Essential Question

How do I use the laws of exponents to simplify expressions?

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1.   $x^0 = 1$      $\dfrac{x^7}{x^7} = 1$

     $(\odot)^0 = 1$

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2. $x^{-n} = \dfrac{1}{x^n}$

ex. $3x^{-2}$ $\qquad (3x)^{-2}$

$\dfrac{3}{x^2}$

$\dfrac{1}{x^{-n}} = x^n$

ex. $\dfrac{1}{-3x^{-2}} = \dfrac{1 \cdot x^2}{-3} = -\dfrac{x^2}{3}$

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3.   $x^m x^n = x^{m+n}$    ex.   $x^2 y^3 x^8 y^{-1} = \boxed{x^{10} y^2}$

SAME BASE   $x^2 \cdot x^3$

$xx\ xxx$

4.   $\dfrac{x^m}{x^n} = x^{m-n}$    ex.   $\dfrac{x^7 y^3}{x^3 y^{11}} = \boxed{\dfrac{x^4}{y^8}}$

$\dfrac{x^2}{x^3} = \dfrac{\cancel{x} \cdot x}{\cancel{x} x x} = \dfrac{1}{x}$

$y^{-8}$

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6.  $\left(x^m\right)^n = x^{m \cdot n}$

ex. $\left(x^2\right)^3 = x^2 \cdot x^2 \cdot x^2$

$\boxed{x^6}$

$(x+y)^2 \neq x^2 + y^2$

7.  $\left(xy\right)^n = x^n y^n$

$(xy)^2 = (xy)(xy)$

ex. $\left(2xy^2\right)^3 = 2^3 x^3 \left(y^2\right)^3$

$= 8x^3 y^6$

8.  $\left(\dfrac{x}{y}\right)^{-n} = \left(\dfrac{y}{x}\right)^n = \dfrac{y^n}{x^n}$

ex. $\left(\dfrac{4x^3}{2y^2}\right)^{-3} = \left(\dfrac{2y^2}{4x^3}\right)^3$

$= \dfrac{8y^6}{64x^9} = \boxed{\dfrac{y^6}{8x^9}}$

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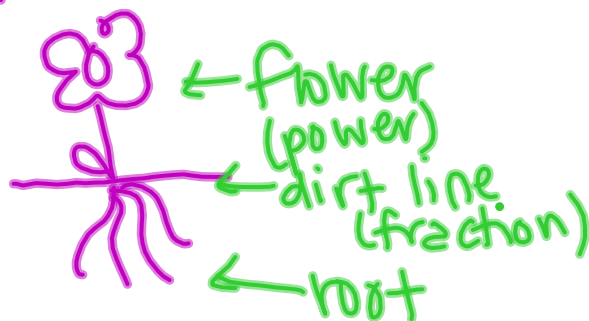**Essential Question**    How do I use the laws of exponents to simplify expressions?

9. $x^{\frac{m}{n}} = \sqrt[n]{x^m}$

     $m$ ← power

     $n$ ← root

$= \left(\sqrt[n]{x}\right)^m$

"Flower power"

← flower (power)

← dirt line (fraction)

← root

ex. $x^{\frac{1}{2}} = \sqrt{x^1}$

ex. $4^{\frac{5}{2}} = \sqrt{4^5}$

$= \left(\sqrt{4}\right)^5 = 2^5 = \boxed{32}$

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10. $\sqrt{\dfrac{x}{y}} = \dfrac{\sqrt{x}}{\sqrt{y}}$

ex. $\sqrt[3]{\dfrac{-1}{125}} = \dfrac{\sqrt[3]{-1}}{\sqrt[3]{125}} = \boxed{\dfrac{-1}{5}}$

A note... $-7^2$ vs. $(-7)^2$

$-(7)(7)$
$-49$

$(-7)(-7) = 49$