EXPONENTS! Oct. 30

Product Property	$a^m \cdot a^n = a^{m+n}$
Quotient Property	$\dfrac{a^m}{a^n} = a^{m-n}$, if $a \neq 0$
Power of a Power Property	$(a^m)^n = a^{mn}$
Power of a Product Property	$(ab)^m = a^m \cdot b^m$
Power of a Quotient Property	$\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m}$, if $b \neq 0$
Definition of a Negative Exponent ★	$a^{-m} = \dfrac{1}{a^m}$ and $\dfrac{1}{a^{-m}} = a^m$, if $a \neq 0$
Definition of a Zero Exponent	$a^0 = 1$, if $a \neq 0$
Definition of a Rational Exponent ★	If $b > 0$, $n > 0$, and m and n are integers, then $b^{m/n} = \sqrt[n]{b^m} = \left(\sqrt[n]{b}\right)^m$

Examples $n > 1$

1 $(x^n)^2 (x^{n+1})^3$

$X^{2n} \cdot X^{3n+3}$

$X^{2n+3n+3} = X^{5n+3}$

2 $\dfrac{x^{2n} y^{n-1}}{x^n y^n}$

$\dfrac{X^{2n-n}}{Y^{n-(n-1)}} = \dfrac{X^n}{Y}$

3 $\dfrac{(3x^{-2}y)^{-1}}{(xy^2)^{-2}} = \dfrac{(xy^2)^2}{(3x^{-2}y)^1} = \dfrac{x^2y^4}{3x^{-2}y} = \dfrac{x^4y^3}{3}$

$\dfrac{x^2y^4x^2}{3y}$

4 $\dfrac{5x^{-2}}{y^3}\cdot\left(\dfrac{y^2}{10x}\right)^{-2}$

$$\frac{5}{x^2y^3}\cdot\frac{y^{-4}}{10^{-2}x^{-2}}$$

$x^0=1$

$$\frac{5}{y^3}\cdot\frac{10^2}{y^4}$$

$$\frac{500}{y^7}$$

5 6^{-3}

$$=\frac{1}{6^3}=\frac{1}{216}$$

36
$\times 6$

6 $\left(\dfrac{-2}{5}\right)^{-2}$

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

Definition of a Rational Exponent	If $b>0$, $n>0$, and m and n are integers, then $b^{m/n}=\sqrt[n]{b^m}=\left(\sqrt[n]{b}\right)^m$

7 $81^{3/4}$

$$\sqrt[4]{81^3}=\left(\sqrt[4]{81}\right)^3=3^3=27$$

$9\cdot 9$
$3^2\cdot 3^2$

8 $(-32)^{-3/5}$

$$=\frac{1}{(-32)^{3/5}}=\frac{1}{\left(\sqrt[5]{-32}\right)^3}=\frac{1}{(-2)^3}$$

$-4\cdot 8$
$-2\cdot 2\cdot 2\cdot 2\cdot 2=-\frac{1}{8}$

9 $\dfrac{49^{1/2}}{49^1}=49^{-1/2}$

$$=\frac{1}{49^{1/2}}=\frac{1}{\sqrt[2]{49^1}}=\frac{1}{7}$$

10 $16^{1/2}\cdot 16^{1/4}$

$$=16^{3/4}=\left(\sqrt[4]{16}\right)^3=2^3=8$$

11 $9^{3/2} \cdot 3^2 = \mathbf{3^x}$ **Find *x*** $= 5$

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

$$3^3 \cdot 3^2 = 3^x$$

$$3^5 = 3^x$$