

## 6.1 PROPERTIES OF EXPONENTS

### KEY CONCEPT

For Your Notebook

#### Properties of Exponents

Let  $a$  and  $b$  be real numbers and let  $m$  and  $n$  be integers.

Property Name	Definition	Example
<b>Product of Powers</b>	$a^m \cdot a^n = a^{m+n}$	$5^3 \cdot 5^{-1} = 5^{3+(-1)} = 5^2 = 25$
<b>Power of a Power</b>	$(a^m)^n = a^{mn}$	$(3^3)^2 = 3^{3 \cdot 2} = 3^6 = 729$
<b>Power of a Product</b>	$(ab)^m = a^m b^m$	$(2 \cdot 3)^4 = 2^4 \cdot 3^4 = 1296$
<b>Negative Exponent</b>	$a^{-m} = \frac{1}{a^m}, a \neq 0$	$7^{-2} = \frac{1}{7^2} = \frac{1}{49}$
<b>Zero Exponent</b>	$a^0 = 1, a \neq 0$	$(-89)^0 = 1$
<b>Quotient of Powers</b>	$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$	$\frac{6^{-3}}{6^{-6}} = 6^{-3-(-6)} = 6^3 = 216$
<b>Power of a Quotient</b>	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$	$\left(\frac{4}{7}\right)^2 = \frac{4^2}{7^2} = \frac{16}{49}$

SIMPLIFY.

20.  $\frac{x^{-3}}{y^{-1}z^4}$

$\frac{1}{x^3 y^{-1} z^4}$

$\frac{y^1}{x^3 z^4}$

21.  $\frac{x^{-2}y^2}{3x^5y^{-3}}$

$\frac{1}{3} x^{-2-5} y^{2+3}$

$\frac{1}{3} x^{-7} y^5$

$\frac{y^5}{3x^7}$

22.  $\left(\frac{2x}{5y^3}\right)^{-2}$

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

$\frac{25y^6}{4x^2}$

## ALL PROPERTIES TOGETHER

$$24. \frac{(3x^{-2}y^3)(5xy^{-8})}{(x^{-3})^4y^{-2}}$$

$$\frac{15x^{-1}y^{-5}}{x^{-12}y^{-2}}$$

$x^{-1-(-12)} \quad y^{-5-(-2)}$

$$15x^{11}y^{-3}$$

$$\boxed{\frac{15x^{11}}{y^3}}$$

$$25. (a^{-3}b^2)^4(-2a^3b^7)^{-3}$$

$$\frac{a^{-12}b^8}{(-2a^3b^7)^{-3}} = \frac{a^{-12}b^8}{-8a^9b^{21}}$$

$a^{-12-9} \quad b^{8-21}$

$$\frac{1}{-8} a^{-21} b^{-13}$$

$$\boxed{\frac{1}{-8a^{21}b^{13}}}$$

## ALL PROPERTIES TOGETHER

26.  $\left(\frac{p^{-3}}{4r}\right)^{-3} \left(\frac{5r}{p^{-7}}\right)^{-2}$

$$\left(\frac{4r^3}{p^{-3}}\right) \left(\frac{p^{-7}}{5r}\right)^2$$

$$\frac{64r^3}{p^{-9}} \cdot \frac{p^{-14}}{25r^2}$$

$$\frac{64 \cdot p^{-14} \cdot r^3}{25 \cdot p^{-9} \cdot r^2}$$

$$\frac{64}{25} \cdot p^{-14-(-9)} \cdot r^{3-2}$$

$$\frac{64}{25} \cdot p^{-5} \cdot r^1$$

$$\boxed{\frac{64r}{25p^5}}$$

27.  $\left[\frac{(2xy^{-2})^{-2}}{(xy^{-4})^{-1}}\right]^2$

$$\frac{(2xy^{-2})^4}{(xy^{-4})^2}$$

$$\frac{16x^4y^{-8}}{x^2y^{-8}}$$

$$16x^{4-2}y^{-8-(-8)}$$

$$16x^2y^0$$

$$\boxed{16x^2}$$