

Exponent Rules

Simplifying Monomials

- There are no power of powers
- Each base appears exactly once
- All fractions are simplified
- There are no negative exponents

ConceptSummary Properties of Exponents		
For any real numbers x and y , integers a and b :		
Property	Definition	Examples
Product of Powers	$x^a \cdot x^b = x^{a+b}$	$3^2 \cdot 3^4 = 3^{2+4}$ or 3^6 $p^2 \cdot p^9 = p^{2+9}$ or p^{11}
Quotient of Powers	If $x \neq 0$, $\frac{x^a}{x^b} = x^{a-b}$.	$\frac{9^5}{9^2} = 9^{5-2}$ or 9^3 $\frac{b^6}{b^4} = b^{6-4}$ or b^2
Negative Exponent	$x^{-a} = \frac{1}{x^a}$ and $\frac{1}{x^{-a}} = x^a$, $x \neq 0$	$3^{-5} = \frac{1}{3^5}$ $\frac{1}{b^{-7}} = b^7$
Power of a Power	$(x^a)^b = x^{ab}$	$(3^3)^2 = 3^{3 \cdot 2}$ or 3^6 $(d^2)^4 = d^{2 \cdot 4}$ or d^8
Power of a Product	$(xy)^a = x^a y^a$	$(2k)^4 = 2^4 k^4$ or $16k^4$ $(ab)^3 = a^3 b^3$
Power of a Quotient	$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$, $y \neq 0$, and $\left(\frac{x}{y}\right)^{-a} = \left(\frac{y}{x}\right)^a$ or $\frac{y^a}{x^a}$, $x \neq 0$, $y \neq 0$	$\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2}$ $\left(\frac{a}{b}\right)^{-5} = \frac{b^5}{a^5}$
Zero Power	$x^0 = 1$, $x \neq 0$	$7^0 = 1$

Simplify each expression

Ex 1) $x^7 \cdot x^4$

Ex 2) $\frac{x^8}{x^3}$

Ex 3) x^{-4}

Ex 4) $(x^6)^3$

Ex 5) $(3xy)^3$

Ex 6) $\left(\frac{2x^5}{y^2}\right)^3$

Ex 7) $(3x^5y^7)^0$

Simplify each expression

Ex 8) $(2a^{-2})(3a^3b^2)(c^{-2})$

Ex 9) $\frac{15c^5d^3}{-3c^2d^7}$

Ex 10) $\left(\frac{-2a^4}{b^2}\right)^3$

Name: _____
Exponent Rules Practice

Date: _____
Period: _____

Example

Simplify. Assume that no variable equals 0.

a. $(3m^4n^{-2})(-5mn)^2$

$$\begin{aligned}(3m^4n^{-2})(-5mn)^2 &= 3m^4n^{-2} \cdot 25m^2n^2 \\ &= 75m^4m^2n^{-2}n^2 \\ &= 75m^{4+2}n^{-2+2} \\ &= 75m^6\end{aligned}$$

b. $\frac{(-m^4)^3}{(2m^2)^{-2}}$

$$\begin{aligned}\frac{(-m^4)^3}{(2m^2)^{-2}} &= \frac{-m^{12}}{\frac{1}{4m^4}} \\ &= -m^{12} \cdot 4m^4 \\ &= -4m^{16}\end{aligned}$$

Simplify each expression, assume that no variable equals zero

1. $c^{12} \cdot c^{-4} \cdot c^6$

2. $\frac{b^8}{b^2}$

3. $(a^4)^5$

4. $\frac{x^{-2}y}{x^4y^{-1}}$

5. $\left(\frac{a^2b}{a^{-3}b^2}\right)^{-1}$

6. $\left(\frac{x^2y}{xy^3}\right)^2$

$$7. \frac{1}{2}(-5a^2b^3)^2(abc)^2$$

$$8. m^7 \cdot m^8$$

$$9. \frac{8m^3n^2}{4mn^3}$$

$$10. \frac{2^3c^4t^2}{2^2c^4t^2}$$

$$11. 4j(-j^{-2}k^2)(3j^3k^{-7})$$

$$12. \frac{2mn^2(3m^2n)^2}{12m^3n^4}$$