

Intermediate Algebra
Skill Builder #AE - 6
Applying ALL the Exponent Rules

Following is a list of the exponent rules.

$$a^n \cdot a^m = a^{n+m} \quad (1)$$

$$(a^n)^m = a^{nm} \quad (2)$$

$$(ab)^n = a^n b^n \quad (3)$$

$$\frac{a^n}{a^m} = a^{n-m} \quad (4)$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad (5)$$

$$a^0 = 1 \quad (6)$$

$$a^{-n} = \frac{1}{a^n} \quad (7)$$

Examples

$$1. \quad 3^4 \cdot 3^{-5} \cdot 3^{-1} \stackrel{(1)}{=} 3^{4+(-5)+(-1)} = 3^{-2} \stackrel{(7)}{=} \frac{1}{3^2} = \frac{1}{9}$$

$$2. \quad (2x^3y^{-2})^{-3} \stackrel{(2),(3)}{=} 2^{-3}x^{-9}y^6 \stackrel{(7)}{=} \frac{y^6}{2^3x^9} = \frac{y^6}{8x^9}$$

$$3. \quad \frac{4ab^3c^5}{8a^3b^3c^3} \stackrel{(4)}{=} \frac{1 \cdot \cancel{4}}{2 \cdot \cancel{8}} a^{1-3} b^{3-3} c^{5-3} = \frac{1}{2} a^{-2} b^0 c^2 \stackrel{(6),(7)}{=} \frac{c^2}{2a^2}$$

$$4. \quad \left(\frac{-2x^{-1}yz^4}{5x^3y^0z^{-1}}\right)^{-3} \stackrel{(2),(3),(5),(6)}{=} \frac{(-2)^{-3}x^3y^{-3}z^{-12}}{5^{-3}x^{-9}z^3} \stackrel{(7)}{=} \frac{5^3x^9x^3}{(-2)^3y^3z^{12}z^3} \stackrel{(1)}{=} \frac{125x^{12}}{-8y^3z^{15}}$$

$$5. \quad \frac{(3a^{-3})^2(2ab^2)^{-3}}{(2^{-2}a^{-1}b^2)^{-1}} \stackrel{(2),(3)}{=} \frac{3^2a^{-6} \cdot 2^{-3}a^{-3}b^{-6}}{2^2ab^{-2}} \stackrel{(1),(7)}{=} \frac{9a^{-9}b^{-6}}{2^2 \cdot 2^3ab^{-2}} \stackrel{(7)}{=} \frac{9b^2}{2^5a \cdot a^9b^6} \stackrel{(1),(4),(7)}{=} \frac{9}{32a^{10}b^4}$$

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Simplify.

1. $2^2 \cdot 2^4 \cdot 2^{-5}$

2. $4^0 \cdot 4^{-3} \cdot 4^5$

3. $x^4 \cdot x^{-8} \cdot x \cdot x^0$

4. $a^3bc^{-5} \cdot a^{-5}b^0c^{10}$

5. $\frac{2^{-4}n^4m^{-2}p^0}{2^{-5}nm^2p}$

6. $\frac{-5^{-2}x^5y^{-1}(2z)^0}{5x^{-5}yz^2}$

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

8. $\frac{(-2x^{-1}y)^{-2}(5x^2y^{-3})^2}{(4xy^{-4})^{-2}(6xy^{11})^0}$

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Answers

1. 2
2. 16
3. $1/x^3$
4. bc^5/a^2
5. $2n^3/m^4p$
6. $-x^{10}/125y^2z^2$
7. $8b^6/27a^{12}c^{12}$
8. $100x^8/y^{16}$

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