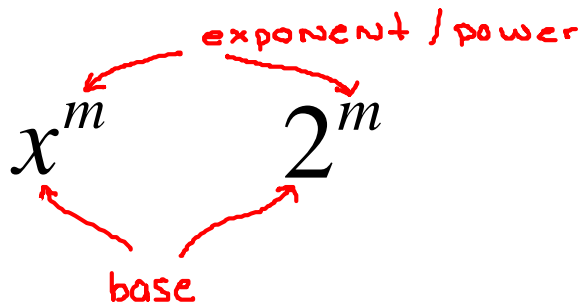


Properties of Exponents



Properties of Exponents

1. $x^m \cdot x^n = x^{m+n}$

$$x^3 \cdot x^4 = x^{3+4} = x^7$$

$$2^3 \cdot 2^2 = 2^{3+2} = 2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$\quad \quad \quad \vee \quad \quad \vee$
 $\quad \quad \quad 4 \cdot 4 \cdot 2$
 $\quad \quad \quad \vee$
 $\quad \quad \quad 16 \cdot 2 = 32$

2. $\frac{x^m}{x^n} = x^{m-n}$

$$\frac{x^5}{x^2} = x^{5-2} = x^3$$

$$\frac{2^8}{2^6} = 2^{8-6} = 2^2 = 2 \cdot 2 = 4$$

$$\frac{x^{12}}{x^{17}} = \frac{1}{x^{17-12}} = \frac{1}{x^5}$$

$$\frac{3^9}{3^{11}} = \frac{1}{3^{11-9}} = \frac{1}{3^2} = \frac{1}{3 \cdot 3} = \frac{1}{9}$$

3. $(x^m)^n = x^{m \cdot n}$

$$(x^3)^5 = x^{3 \cdot 5} = x^{15}$$

$$(2^3)^2 = 2^{3 \cdot 2} = 2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$\quad \quad \quad \vee \quad \quad \vee \quad \quad \vee$
 $\quad \quad \quad 4 \cdot 4 \cdot 4$
 $\quad \quad \quad \vee$
 $\quad \quad \quad 16 \cdot 4 = 64$

Directions: Simplify.

1. $3g^7 \cdot 2g^2$

$$\underbrace{3g^7 \cdot 2g^2}_{\text{blue bracket}} = 6g^{7+2} = \boxed{6g^9}$$

2. $-8x \cdot 2x^3 \cdot 4x^5$

$$\underbrace{-8x^1 \cdot 2x^3 \cdot 4x^5}_{\text{black bracket}} = -64x^{1+3+5} = \boxed{-64x^9}$$

3. $\frac{12x^8}{x^2}$

$$\frac{12x^8}{x^2} = 12x^{8-2} = \boxed{12x^6}$$

4. $\frac{56f^7}{14f^9}$

$$\begin{array}{r} 56 \\ 1 \cdot 56 \\ 2 \cdot 28 \\ 4 \cdot 14 \\ 4 \cdot 7 \end{array}$$

$$\begin{array}{r} 14 \\ 1 \cdot 14 \\ 2 \cdot 7 \end{array}$$

$$\frac{\overset{4}{\cancel{56}f^7}}{\cancel{14}f^9} = \frac{4f^7}{1f^9} = \frac{4}{f^{9-7}} = \boxed{\frac{4}{f^2}}$$

5. $(3x^2y)(9xy^4)$

$$\underbrace{3x^2y^1} \cdot \underbrace{9x^1y^4} = 27x^{2+1}y^{1+4} = \boxed{27x^3y^5}$$

6. $(4m^3)^2$

$$(4^1m^3)^2 = 4^{1 \cdot 2}m^{3 \cdot 2} = 4^2m^6 = \boxed{16m^6}$$

7. $(9m^2n^3)^3$

$$(9^1m^2n^3)^3 = 9^{1 \cdot 3}m^{2 \cdot 3}n^{3 \cdot 3} = 9^3m^6n^9$$

$$\begin{array}{c} 9 \cdot 9 \cdot 9 \\ \sqrt{} \\ 81 \cdot 9 = 729 \end{array} \quad \boxed{= 729m^6n^9}$$

8. $\frac{(6x)^2}{60x^3y}$

$$\frac{(6^1x^1)^2}{60x^3y} = \frac{6^{1 \cdot 2}x^{1 \cdot 2}}{60x^3y} = \frac{6^2x^2}{60x^3y} = \frac{\overset{3}{\cancel{36}x^2}}{\underset{5}{\cancel{60}x^3y}}$$

| | |
|-----------|-----------|
| <u>36</u> | <u>60</u> |
| 1·36 | 1·60 |
| 2·18 | 2·30 |
| 3·12 | 3·20 |
| 4·9 | 4·15 |
| 6·6 | 5·12 |
| | 6·10 |

$$= \frac{3x^2}{5x^3y} = \frac{3}{5x^{3-2}y} = \boxed{\frac{3}{5xy}}$$

$$9. \frac{15a \cdot 15a}{120a^2}$$

$$\frac{\overbrace{15a \cdot 15a}^{\quad}}{120a^2} = \frac{225a^{1+1}}{120a^2} = \frac{225a^2}{120a^2} = \frac{\overset{15}{\cancel{225}}}{\underset{8}{\cancel{120}}}$$

$$\begin{array}{l} \underline{225} \\ 1 \cdot 225 \\ 3 \cdot 75 \\ 5 \cdot 45 \\ 9 \cdot 25 \\ \textcircled{15} \cdot 15 \end{array}$$

$$\begin{array}{l} \underline{120} \\ 1 \cdot 120 \\ 2 \cdot 60 \\ 3 \cdot 40 \\ 4 \cdot 30 \\ 5 \cdot 24 \\ 6 \cdot 20 \\ 8 \cdot \textcircled{5} \\ 10 \cdot 12 \end{array}$$

$$= \boxed{\frac{15}{8}}$$

$$10. \frac{7b^4 \cdot 6b^3}{28b^{10}}$$

$$\frac{\overbrace{7b^4 \cdot 6b^3}^{\quad}}{28b^{10}} = \frac{42b^{4+3}}{28b^{10}} = \frac{\overset{3}{\cancel{42}}b^7}{\underset{2}{\cancel{28}}b^{10}}$$

$$\begin{array}{l} \underline{42} \\ 1 \cdot 42 \\ 2 \cdot 21 \\ 3 \cdot \textcircled{14} \\ 6 \cdot 7 \end{array}$$

$$\begin{array}{l} \underline{28} \\ 1 \cdot 28 \\ 2 \cdot \textcircled{14} \\ 4 \cdot 7 \end{array}$$

$$= \frac{3b^7}{2b^{10}} = \frac{3}{2b^{10-7}} = \boxed{\frac{3}{2b^3}}$$