

# Exponent Properties

## 1. Product of like bases:

$$a^m a^n = a^{m+n}$$

To multiply powers with the same base, add the exponents and keep the common base.

$$\text{Example: } x^5 x^3 = x^{5+3} = x^8$$

## 2. Quotient of like bases:

$$\frac{a^m}{a^n} = a^{m-n}$$

To divide powers with the same base, subtract the exponents and keep the common base.

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

## 3. Power to a power:

$$(a^m)^n = a^{mn}$$

To raise a power to a power, keep the base and multiply the exponents.

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

## 4. Product to a power:

$$(ab)^m = a^m b^m$$

To raise a product to a power, raise each factor to the power.

$$\text{Example: } (x^4 y^5)^3 = x^{12} y^{15}$$

## 5. Quotient to a power

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

To raise a quotient to a power, raise the numerator and the denominator to the power.

$$\text{Example: } \left(\frac{x^3}{y^2}\right)^4 = \frac{x^{12}}{y^8}$$

## 6. Zero Exponent:

$$a^0 = 1$$

Any number raised to the zero power is equal to "1".

$$\text{Example: } (8x^4)^0 = 1$$

## 7. Negative exponent:

$$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n$$

Negative exponents indicate reciprocation, with the exponent of the reciprocal becoming positive. You may want to think of it this way: unhappy (negative) exponents will become happy (positive) by having the base/exponent pair "switch floors"!

$$\text{Example: } 8^{-2} = \frac{1}{8^2} = \frac{1}{64} \quad \text{or} \quad \frac{4}{x^{-3}} = 4x^3$$

## Exponents and Multiplication

**Simplify. Your answer should contain only positive exponents.**

1)  $4^2 \cdot 4^2$

2)  $4 \cdot 4^2$

3)  $3^2 \cdot 3^2$

4)  $2 \cdot 2^2 \cdot 2^2$

5)  $2n^4 \cdot 5n^4$

6)  $6r \cdot 5r^2$

7)  $2n^4 \cdot 6n^4$

8)  $6k^2 \cdot k$

9)  $5b^2 \cdot 8b$

10)  $4x^2 \cdot 3x$

11)  $6x \cdot 2x^2$

12)  $6x \cdot 6x^3$

$$13) 7v^3 \cdot 10u^3v^5 \cdot 8uv^3$$

$$14) 9xy^2 \cdot 9x^5y^2$$

$$15) 6m^3n^3 \cdot 8m^2n^3$$

$$16) 6x^2 \cdot 6x^3y^4$$

$$17) 7u^2v^5 \cdot 9uv^3$$

$$18) uv \cdot 4uv^5$$

$$19) 10xy^3 \cdot 8x^5y^3$$

$$20) 3u^4v^5 \cdot 7u^2v^3$$

$$21) (2x^2)^2$$

$$22) (p^4)^4$$

$$23) (k^3)^4$$

$$24) (7k)^2$$

$$25) (x^2)^3$$

$$26) (2b^2)^4$$

## Exponents and Division

Simplify. Your answer should contain only positive exponents.

1)  $\frac{5^4}{5}$

2)  $\frac{3}{3^3}$

3)  $\frac{2^2}{2^3}$

4)  $\frac{2^4}{2^2}$

5)  $\frac{3r^3}{2r}$

6)  $\frac{7k^2}{4k^3}$

7)  $\frac{10p^4}{6p}$

8)  $\frac{3b}{10b^3}$

9)  $\frac{8m^3}{10m^3}$

10)  $\frac{7n^3}{2n^5}$

$$11) \frac{2n^2}{n}$$

$$12) \frac{8x^3}{10x^5}$$

$$13) \frac{12x^3}{9y^8}$$

$$14) \frac{14x^4y^7}{6x^5y^4}$$

$$15) \frac{11u^4}{17u^7v^9}$$

$$16) \frac{4y^4}{14yx^8}$$

$$17) \frac{12yx^4}{10yx^8}$$

$$18) \frac{18x^8y^8}{10x^3}$$

$$19) \frac{5n^8}{20n^8}$$

$$20) \frac{16yx^4}{9x^8y^2}$$

## Powers of Products and Quotients

**Simplify. Your answer should contain only positive exponents.**

1)  $(3a^2)^3$

2)  $(2n^4)^4$

3)  $(3x^4)^4$

4)  $(6b^2)^2$

5)  $(7y^4)^2$

6)  $(3ab^4)^4$

7)  $(2x^4y^4)^3$

8)  $(5mn^3)^3$

9)  $(x^2y^2)^2$

10)  $(6yx^4)^2$

11)  $(u^4v^3)^2$

12)  $(2x^4y^4)^4$

13)  $(3x^2 \cdot 2x^2)^2$

14)  $(2p^3 \cdot 2p)^2$

15)  $(4n^3 \cdot n^2)^2$

16)  $(3x \cdot 2x)^2$

17)  $(4x^4 \cdot x^4)^3$

18)  $(4n^4 \cdot n)^2$

## Exponents and Multiplication

Simplify. Your answer should contain only positive exponents.

$$1) 4^2 \cdot 4^2$$
$$4^4$$

$$2) 4 \cdot 4^2$$
$$4^3$$

$$3) 3^2 \cdot 3^2$$
$$3^4$$

$$4) 2 \cdot 2^2 \cdot 2^2$$
$$2^5$$

$$5) 2n^4 \cdot 5n^4$$
$$10n^8$$

$$6) 6r \cdot 5r^2$$
$$30r^3$$

$$7) 2n^4 \cdot 6n^4$$
$$12n^8$$

$$8) 6k^2 \cdot k$$
$$6k^3$$

$$9) 5b^2 \cdot 8b$$
$$40b^3$$

$$10) 4x^2 \cdot 3x$$
$$12x^3$$

$$11) 6x \cdot 2x^2$$
$$12x^3$$

$$12) 6x \cdot 6x^3$$
$$36x^4$$

$$13) 7v^3 \cdot 10u^3v^5 \cdot 8uv^3 \\ 560v^{11}u^4$$

$$14) 9xy^2 \cdot 9x^5y^2 \\ 81x^6y^4$$

$$15) 6m^3n^3 \cdot 8m^2n^3 \\ 48m^5n^6$$

$$16) 6x^2 \cdot 6x^3y^4 \\ 36x^5y^4$$

$$17) 7u^2v^5 \cdot 9uv^3 \\ 63u^3v^8$$

$$18) uv \cdot 4uv^5 \\ 4u^2v^6$$

$$19) 10xy^3 \cdot 8x^5y^3 \\ 80x^6y^6$$

$$20) 3u^4v^5 \cdot 7u^2v^3 \\ 21u^6v^8$$

$$21) (2x^2)^2 \\ 4x^4$$

$$22) (p^4)^4 \\ p^{16}$$

$$23) (k^3)^4 \\ k^{12}$$

$$24) (7k)^2 \\ 49k^2$$

$$25) (x^2)^3 \\ x^6$$

$$26) (2b^2)^4 \\ 16b^8$$



## Exponents and Division

Simplify. Your answer should contain only positive exponents.

1)  $\frac{5^4}{5}$

$5^3$

2)  $\frac{3}{3^3}$

$\frac{1}{3^2}$

3)  $\frac{2^2}{2^3}$

$\frac{1}{2}$

4)  $\frac{2^4}{2^2}$

$2^2$

5)  $\frac{3r^3}{2r}$

$\frac{3r^2}{2}$

6)  $\frac{7k^2}{4k^3}$

$\frac{7}{4k}$

7)  $\frac{10p^4}{6p}$

$\frac{5p^3}{3}$

8)  $\frac{3b}{10b^3}$

$\frac{3}{10b^2}$

9)  $\frac{8m^3}{10m^3}$

$\frac{4}{5}$

10)  $\frac{7n^3}{2n^5}$

$\frac{7}{2n^2}$

$$11) \frac{2n^2}{n}$$
$$2n$$

$$12) \frac{8x^3}{10x^5}$$
$$\frac{4}{5x^2}$$

$$13) \frac{12x^3}{9y^8}$$
$$\frac{4x^3}{3y^8}$$

$$14) \frac{14x^4y^7}{6x^5y^4}$$
$$\frac{7y^3}{3x}$$

$$15) \frac{11u^4}{17u^7v^9}$$
$$\frac{11}{17u^3v^9}$$

$$16) \frac{4y^4}{14yx^8}$$
$$\frac{2y^3}{7x^8}$$

$$17) \frac{12yx^4}{10yx^8}$$
$$\frac{6}{5x^4}$$

$$18) \frac{18x^8y^8}{10x^3}$$
$$\frac{9x^5y^8}{5}$$

$$19) \frac{5n^8}{20n^8}$$
$$\frac{1}{4}$$

$$20) \frac{16yx^4}{9x^8y^2}$$
$$\frac{16}{9x^4y}$$

## Powers of Products and Quotients

Simplify. Your answer should contain only positive exponents.

1)  $(3a^2)^3$   
 $27a^6$

2)  $(2n^4)^4$   
 $16n^{16}$

3)  $(3x^4)^4$   
 $81x^{16}$

4)  $(6b^2)^2$   
 $36b^4$

5)  $(7y^4)^2$   
 $49y^8$

6)  $(3ab^4)^4$   
 $81a^4b^{16}$

7)  $(2x^4y^4)^3$   
 $8x^{12}y^{12}$

8)  $(5mn^3)^3$   
 $125m^3n^9$

9)  $(x^2y^2)^2$   
 $x^4y^4$

10)  $(6yx^4)^2$   
 $36y^2x^8$

11)  $(u^4v^3)^2$   
 $u^8v^6$

12)  $(2x^4y^4)^4$   
 $16x^{16}y^{16}$

13)  $(3x^2 \cdot 2x^2)^2$   
 $36x^8$

14)  $(2p^3 \cdot 2p)^2$   
 $16p^8$

15)  $(4n^3 \cdot n^2)^2$   
 $16n^{10}$

16)  $(3x \cdot 2x)^2$   
 $36x^4$

17)  $(4x^4 \cdot x^4)^3$   
 $64x^{24}$

18)  $(4n^4 \cdot n)^2$   
 $16n^{10}$