Simplify:

# You can take 2 different approaches ...

Rewrite so all exponents are positive, then simplify.

$$\frac{13x^{5}y^{-2}z^{10}}{36x^{-4}y^{25}} = \frac{13x^{5}z^{10}x^{4}}{36y^{2}y^{2}y^{2}z^{5}}$$

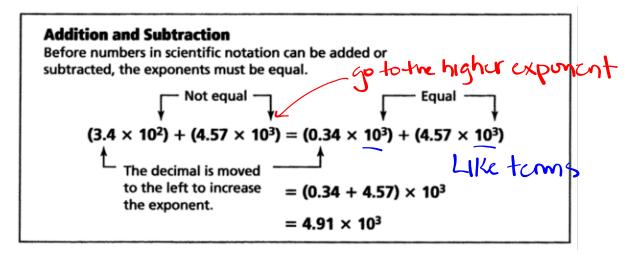
$$= \frac{x^{9}z^{5}}{2y^{3}}$$

Use properties of exponents, simplify, and then check that all exponents are positive.

$$\frac{13x^{5}y^{2}z^{10}}{26x^{4}y^{2}} = \frac{13x^{5-4}y^{-2-1}z^{10-5}}{226}$$

$$= \frac{x^{9}y^{-3}z^{5}}{2}$$

$$= \frac{x^{9}z^{5}}{2y^{3}}$$



You can't add or subtract if you don't have Like Terms.

no Like Terms

$$8.76 \times 10^{7}$$
 -  $6 \times 10^{5}$  =

Get like terms  $\rightarrow 10^{7}$ 
 $8.76 \times 10^{7}$  -  $0.06 \times 10^{7}$  :  $8.7 \times 10^{7}$ 

# Multiplication

When numbers in scientific notation are multiplied, only the number is multiplied. The exponents are added.

$$(2.00 \times 10^{3})(4.00 \times 10^{4}) = (2.00)(4.00) \times 10^{3+4}$$

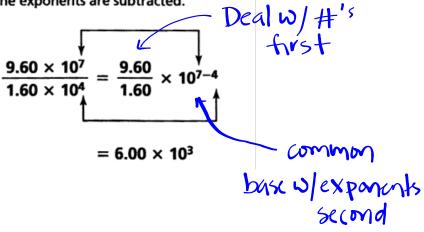
$$= 8.00 \times 10^{7}$$

$$2x^5$$
.  $6x^8 = 12x^{13}$ 

$$2\times10^{5} \cdot 6\times10^{8} = 13\times10^{13}$$

## **Division**

When numbers in scientific notation are divided, only the number is divided. The exponents are subtracted.



## **Operations with Scientific Notation - Practice**

### **Addition and Subtraction**

Before numbers in scientific notation can be added or subtracted, the exponents must be equal.

Not equal 
$$\longrightarrow$$
 Equal  $\longrightarrow$  Equal  $\longrightarrow$  (3.4 × 10<sup>2</sup>) + (4.57 × 10<sup>3</sup>) = (0.34 × 10<sup>3</sup>) + (4.57 × 10<sup>3</sup>)

The decimal is moved to the left to increase the exponent. = (0.34 + 4.57) × 10<sup>3</sup>

$$= 4.91 \times 10^{3}$$

1. 
$$(9.19 \times 10^3) + (2.3 \times 10^4)$$

2. 
$$(5 \times 10^4) - (4 \times 10^2)$$

3. 
$$(6.75 \times 10^4) - (2 \times 10^1)$$

4. 
$$(1.2 \times 10^{-3}) + (8.9 \times 10^{-3})$$

5. 
$$(9.99 \times 10^{-2}) - (1.2 \times 10^{-3})$$

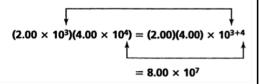
6. 
$$(4.3 \times 10^7) - (7.5 \times 10^5)$$

7. 
$$(2.345 \times 10^2) + (1.31 \times 10^0)$$

8. 
$$(7.5 \times 10^{-2}) - (2 \times 10^{-4})$$

## Multiplication

When numbers in scientific notation are multiplied, only the number is multiplied. The exponents are added.



#### Division

When numbers in scientific notation are divided, only the number is divided. The exponents are subtracted.

$$\frac{9.60 \times 10^{7}}{1.60 \times 10^{4}} = \frac{9.60}{1.60} \times 10^{7-4}$$

$$= 6.00 \times 10^{3}$$

1. 
$$(4 \times 10^2)(2.2 \times 10^5)$$

$$2. \quad \frac{9 \times 10^{-4}}{3 \times 10^{0}}$$

3. 
$$(6.02 \times 10^7)(2 \times 10^{-1})$$

$$\begin{array}{ccc}
4. & 1.4 \times 10^4 \\
 & 2 \times 10^8
\end{array}$$

5. 
$$(7 \times 10^{-3})(5 \times 10^{-10})$$

6. 
$$\frac{3.5 \times 10^{-5}}{7 \times 10^{-2}}$$

7. 
$$(4.1 \times 10^3)(5 \times 10^5)$$

8. 
$$6.6 \times 10^7$$
  
 $3 \times 10^{-6}$ 

9. 
$$(2.5 \times 10^4)(4 \times 10^{-7})$$