

Simplify:

$$\frac{13x^5 y^{-2} z^{10}}{2b x^{-4} y z^5}$$

You can take 2 different approaches ...

Rewrite so all exponents are positive, then simplify.

$$\begin{aligned} \frac{13x^5 y^{-2} z^{10}}{2b x^{-4} y z^5} &= \frac{13x^5 z^{10} x^4}{2b y^2 \cdot y \cdot z^5} \\ &= \frac{x^9 z^5}{2y^3} \end{aligned}$$

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

$$\begin{aligned} \frac{13x^5 y^{-2} z^{10}}{2b x^{-4} y z^5} &= \frac{13x^{5-4} y^{-2-1} z^{10-5}}{2b} \\ &= \frac{x^1 y^{-3} z^5}{2} \\ &= \frac{x^1 z^5}{2y^3} \end{aligned}$$

Addition and Subtraction

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

Not equal

Equal

go to the higher exponent

$$(3.4 \times 10^2) + (4.57 \times 10^3) = (0.34 \times 10^3) + (4.57 \times 10^3)$$

The decimal is moved to the left to increase the exponent.

Like terms

$$= (0.34 + 4.57) \times 10^3$$
$$= 4.91 \times 10^3$$

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

$$3.4 a^2 + 4.57 a^3$$

Can't add these,
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.

$$(2.00 \times 10^3)(4.00 \times 10^4) = (2.00)(4.00) \times 10^{3+4}$$
$$= 8.00 \times 10^7$$

$$2 \times 10^5 \cdot 6 \times 10^8 = 12 \times 10^{13}$$

$$2 \times 10^5 \cdot 6 \times 10^8 = 12 \times 10^{13+1}$$
$$1.2 \times 10^{14}$$

Division

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

$$\frac{9.60 \times 10^7}{1.60 \times 10^4} = \frac{9.60}{1.60} \times 10^{7-4}$$
$$= 6.00 \times 10^3$$

Deal w/ #'s
first

common
base w/ exponents
second

Operations with Scientific Notation - Practice

Addition and Subtraction

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

$$\begin{array}{l} \text{Not equal} \qquad \qquad \qquad \text{Equal} \\ \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \\ (3.4 \times 10^2) + (4.57 \times 10^3) = (0.34 \times 10^3) + (4.57 \times 10^3) \\ \uparrow \qquad \qquad \qquad \uparrow \\ \text{The decimal is moved} \\ \text{to the left to increase} \\ \text{the exponent.} \\ = (0.34 + 4.57) \times 10^3 \\ = 4.91 \times 10^3 \end{array}$$

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.

$$\begin{array}{c} \downarrow \qquad \qquad \qquad \downarrow \\ (2.00 \times 10^3)(4.00 \times 10^4) = (2.00)(4.00) \times 10^{3+4} \\ \qquad \qquad \qquad \uparrow \qquad \qquad \qquad \uparrow \\ \qquad \qquad \qquad = 8.00 \times 10^7 \end{array}$$

Division

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

$$\begin{array}{c} \downarrow \qquad \qquad \qquad \downarrow \\ \frac{9.60 \times 10^7}{1.60 \times 10^4} = \frac{9.60}{1.60} \times 10^{7-4} \\ \qquad \qquad \qquad \uparrow \qquad \qquad \qquad \uparrow \\ \qquad \qquad \qquad = 6.00 \times 10^3 \end{array}$$

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

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

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

4. $\frac{1.4 \times 10^4}{2 \times 10^8}$

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

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

10. $\frac{4.6 \times 10^{-4}}{2.3 \times 10^0}$

