

[See this page in the course material.](#)

Learning Outcomes

- Multiply numbers expressed in scientific notation
- Divide numbers expressed in scientific notation

Multiplying Numbers Expressed in Scientific Notation

Numbers that are written in scientific notation can be multiplied and divided rather simply by taking advantage of the properties of numbers and the rules of exponents that you may recall. To multiply numbers in scientific notation, first multiply the numbers that aren't powers of 10 (the a in $a \times 10^n$). Then multiply the powers of ten by adding the exponents.

This will produce a new number times a different power of 10 . All you have to do is check to make sure this new value is in scientific notation. If it isn't, you convert it.

Let's look at some examples.

Example

$$\left(3 \times 10^8\right)\left(6.8 \times 10^{-13}\right)$$

Show Solution

Regroup using the commutative and associative properties.

$$\left(3 \times 6.8\right)\left(10^8 \times 10^{-13}\right)$$

Multiply the coefficients.

$$\left(20.4\right)\left(10^8 \times 10^{-13}\right)$$

Multiply the powers of 10 using the Product Rule. Add the exponents.

$$20.4 \times 10^{-5}$$

Convert 20.4 into scientific notation by moving the decimal point one place to the left and multiplying by 10^1 .

$$\left(2.04 \times 10^1\right) \times 10^{-5}$$

Group the powers of 10 using the associative property of multiplication.

$$2.04 \times \left(10^1 \times 10^{-5}\right)$$

Multiply using the Product Rule—add the exponents.

$$2.04 \times 10^{1+(-5)}$$

Answer

$$\left(3 \times 10^8\right) \left(6.8 \times 10^{-13}\right) = 2.04 \times 10^{-4}$$

Example

$$\left(8.2 \times 10^6\right) \left(1.5 \times 10^{-3}\right) \left(1.9 \times 10^{-7}\right)$$

Show Solution

Regroup using the commutative and associative properties.

$$\left(8.2 \times 1.5 \times 1.9\right) \left(10^6 \times 10^{-3} \times 10^{-7}\right)$$

Multiply the numbers.

$$\left(23.37\right)\left(10^6\right)\left(10^{-3}\right)\left(10^{-7}\right)$$

Multiply the powers of 10 using the Product Rule—add the exponents.

$$23.37 \times 10^{-4}$$

Convert 23.37 into scientific notation by moving the decimal point one place to the left and multiplying by 10^1 .

$$\left(2.337 \times 10^1\right) \times 10^{-4}$$

Group the powers of 10 using the associative property of multiplication.

$$2.337 \times \left(10^1 \times 10^{-4}\right)$$

Multiply using the Product Rule and add the exponents.

$$2.337 \times 10^{1+(-4)}$$

Answer

$$\left(8.2 \times 10^6\right)\left(1.5 \times 10^{-3}\right)\left(1.9 \times 10^{-7}\right)=2.337 \times 10^{-3}$$

example

Multiply. Write answers in decimal form: $\left(4 \times 10^5\right)\left(2 \times 10^{-7}\right)$.

Show Solution

Solution

	$\left(4 \times 10^5\right)\left(2 \times 10^{-7}\right)$
Use the Commutative Property to rearrange the factors.	$4 \cdot 2 \cdot 10^5 \cdot 10^{-7}$
Multiply 4 by 2 and use the Product Property to multiply 10^5 by 10^{-7} .	8×10^{-2}
Change to decimal form by moving the decimal two places left.	$\frac{8}{100} = 0.08$

try it



[See this interactive in the course material.](#)



[See this interactive in the course material.](#)

In the following video you will see an example of how to multiply two numbers that are written in scientific notation.



[Video Link](#)

Dividing Numbers Expressed in Scientific Notation

In order to divide numbers in scientific notation, you once again apply the properties of numbers and the rules of exponents. You begin by dividing the numbers that aren't powers of 10 (the a in $a \times 10^n$). Then you divide the powers of ten by subtracting the exponents.

This will produce a new number times a different power of 10. If it isn't already in scientific notation, you convert it, and then you're done.

Let's look at some examples.

Example

$$\frac{2.829 \times 10^{-9}}{3.45 \times 10^{-3}}$$

Show Solution

Regroup using the associative property.

$$\left(\frac{2.829}{3.45}\right)\left(\frac{10^{-9}}{10^{-3}}\right)$$

Divide the coefficients.

$$(0.82)\left(\frac{10^{-9}}{10^{-3}}\right)$$

Divide the powers of 10 using the Quotient Rule. Subtract the exponents.

$$0.82 \times 10^{-9 - (-3)} = 0.82 \times 10^{-6}$$

Convert 0.82 into scientific notation by moving the decimal point one place to the right and multiplying by 10^{-1} .

$$(8.2 \times 10^{-1}) \times 10^{-6}$$

Group the powers of 10 together using the associative property.

$$8.2 \times (10^{-1} \times 10^{-6})$$

Multiply the powers of 10 using the Product Rule—add the exponents.

$$8.2 \times 10^{-1 + (-6)}$$

Answer

$$\frac{2.829 \times 10^{-9}}{3.45 \times 10^{-3}} = 8.2 \times 10^{-7}$$

Example

$$\frac{\left(1.37 \times 10^4\right)\left(9.85 \times 10^6\right)}{5.0 \times 10^{12}}$$

Show Solution

Regroup the terms in the numerator according to the associative and commutative properties.

$$\frac{\left(1.37 \times 9.85\right)\left(10^6 \times 10^4\right)}{5.0 \times 10^{12}}$$

Multiply.

$$\frac{13.4945 \times 10^{10}}{5.0 \times 10^{12}}$$

Regroup using the associative property.

$$\left(\frac{13.4945}{5.0}\right)\left(\frac{10^{10}}{10^{12}}\right)$$

Divide the numbers.

$$\left(2.6989\right)\left(\frac{10^{10}}{10^{12}}\right)$$

Divide the powers of 10 using the Quotient Rule—subtract the exponents.

$$\begin{array}{c} \left(2.6989\right)\left(10^{10-12}\right) \\ 2.6989 \times 10^{-2} \end{array}$$

Answer

$$\frac{\left(1.37 \times 10^4\right)\left(9.85 \times 10^6\right)}{\left(5.0 \times 10^{12}\right)}=2.6989 \times 10^{-2}$$

example

Divide. Write answers in decimal form: $\frac{9 \times 10^3}{3 \times 10^{-2}}$.

Show Solution

Solution

	$\frac{9 \times 10^3}{3 \times 10^{-2}}$
Separate the factors.	$\frac{9}{3} \times \frac{10^3}{10^{-2}}$
Divide 9 by 3 and use the Quotient Property to divide 10^3 by 10^{-2} .	3×10^5
Change to decimal form by moving the decimal five places right.	$300,000$

try it



[See this interactive in the course material.](#)



[See this interactive in the course material.](#)

Notice that when you divide exponential terms, you subtract the exponent in the denominator from the exponent in the numerator. You will see another example of dividing numbers written in scientific notation in the following video.



[Video Link](#)

The following video is a mini-lesson on how to convert decimals to scientific notation, and back to a decimal. Additionally, you will see more examples of how to multiply and divide numbers given in scientific notation.



[Video Link](#)

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