



Pre-Algebra Workbook Solutions

Scientific notation

POWERS OF 10

■ 1. If we multiply a number by a power of 10, we can count the number of zeroes to know how many spaces to move the _____ to the _____.

Solution:

decimal point, right

■ 2. Find the product.

$$450 \cdot 10^0$$

Solution:

$$450 \cdot 1$$

$$450$$

■ 3. Find the quotient.

$$6.4 \div 100$$



Solution:

0.064

■ 4. Find the product.

$$3.5 \times 10^4$$

Solution:

35,000

■ 5. Find the product.

$$1.8 \times 10^{-2}$$

Solution:

0.018

■ 6. Find the quotient.

$$420 \div 10^3$$



Solution:

0.42



SCIENTIFIC NOTATION

- 1. Scientific notation has 2 parts. The first part is the decimal number and the second part is the _____.

Solution:

power of 10

- 2. The decimal number of a number written in scientific notation must be between 1 and _____.

Solution:

10

- 3. Write the number in scientific notation.

0.000000056

Solution:



$$5.6 \times 10^{-8}$$

- 4. Write the number in scientific notation.

$$0.00000000000012$$

Solution:

$$1.2 \times 10^{-13}$$

- 5. Write number in expanded form.

$$7.2 \times 10^{12}$$

Solution:

$$7,200,000,000,000$$

- 6. Write number in expanded form.

$$4.9 \times 10^{-7}$$

Solution:



0.00000049



MULTIPLYING SCIENTIFIC NOTATION

- 1. Write the product $(3.1 \times 10^5)(5.5 \times 10^{-7})$ in scientific notation.

Solution:

Multiply the decimal numbers together, separately from the powers of 10.

$$(3.1 \times 5.5)(10^5 \times 10^{-7})$$

$$17.05 \times (10^5 \times 10^{-7})$$

To multiply the powers of 10, add the exponents.

$$17.05 \times 10^{5+(-7)}$$

$$17.05 \times 10^{5-7}$$

$$17.05 \times 10^{-2}$$

Proper scientific notation requires just one non-zero digit in front of the decimal point, which means we need to move the decimal point one place to the left. Therefore, we rewrite the expression as

$$1.705 \times 10^1 \times 10^{-2}$$

Now simplify the powers of 10 again.

$$1.705 \times 10^{1+(-2)}$$



$$1.705 \times 10^{1-2}$$

$$1.705 \times 10^{-1}$$

- 2. Write the product $(1.8 \times 10^4)(5.9 \times 10^6)$ in scientific notation.

Solution:

Multiply the decimal numbers together, separately from the powers of 10.

$$(1.8 \times 5.9)(10^4 \times 10^6)$$

$$10.62 \times (10^4 \times 10^6)$$

To multiply the powers of 10, add the exponents

$$10.62 \times 10^{4+6}$$

$$10.62 \times 10^{10}$$

Proper scientific notation requires just one non-zero digit in front of the decimal point, which means we need to move the decimal point one place to the left. Therefore, we rewrite the expression as

$$1.062 \times 10^1 \times 10^{10}$$

Now simplify the powers of 10 again.

$$1.062 \times 10^{1+10}$$



$$1.062 \times 10^{11}$$

- 3. Write the product $(8.8 \times 10^{-2})(7.85 \times 10^{-5})$ in scientific notation.

Solution:

Multiply the decimal numbers together, separately from the powers of 10.

$$(8.8 \times 7.85)(10^{-2} \times 10^{-5})$$

$$69.08 \times (10^{-2} \times 10^{-5})$$

To multiply the powers of 10, add the exponents.

$$69.08 \times 10^{-2+(-5)}$$

$$69.08 \times 10^{-2-5}$$

$$69.08 \times 10^{-7}$$

Proper scientific notation requires just one non-zero digit in front of the decimal point, which means we need to move the decimal point one place to the left. Therefore, we rewrite the expression as

$$6.908 \times 10^1 \times 10^{-7}$$

Now simplify the powers of 10 again.

$$6.908 \times 10^{1+(-7)}$$



$$6.908 \times 10^{1-7}$$

$$6.908 \times 10^{-6}$$

- 4. Write the product $(1.3 \times 10^3)(2.6 \times 10^{-4})$ in scientific notation.

Solution:

Multiply the decimal numbers together, separately from the powers of 10.

$$(1.3 \times 2.6)(10^3 \times 10^{-4})$$

$$3.38 \times (10^3 \times 10^{-4})$$

To multiply the powers of 10, add the exponents.

$$3.38 \times 10^{3+(-4)}$$

$$3.38 \times 10^{3-4}$$

$$3.38 \times 10^{-1}$$

- 5. If we're given 3.6×10^{-2} in scientific notation, will we get a smaller or larger number when we multiply it by a positive power of 10?

Solution:



Let's pretend we're multiplying by 10^3 . When we do, we get

$$3.6 \times 10^{-2} \times 10^3$$

$$3.6 \times 10^{-2+3}$$

$$3.6 \times 10^1$$

$$3.6 \times 10$$

$$36$$

This is a larger value than 3.6×10^{-2} , so we can say that multiplying by a positive power of 10 will give a larger number.

■ 6. Yvonne is asked to find the product of two numbers written in scientific notation:

$$(2.8 \times 10^4)(4.46 \times 10^{-6})$$

She solves the problem in three steps.

Step 1 $2.8 \times 4.46 = 12.488$

Step 2 $4 + (-6) = -2$

Step 3 12.488×10^{-2}

In what step did she make her mistake? What is the correct answer?



Solution:

She made her mistake in Step 3. She forgot to change the decimal back to a number between 1 and 10. She would get the correct answer in one more step:

$$1.2488 \times 10^1 \times 10^{-2}$$

$$1.2488 \times 10^{1+(-2)}$$

$$1.2488 \times 10^{1-2}$$

$$1.2488 \times 10^{-1}$$



DIVIDING SCIENTIFIC NOTATION

- 1. When we divide two numbers that have the same base, we _____ the exponents.

Solution:

subtract

- 2. Find the value of $(1.5 \times 10^8) \div (2.0 \times 10^{-3})$.

Solution:

Divide the decimal numbers, separately from the powers of 10.

$$\frac{1.5}{2.0} \times \frac{10^8}{10^{-3}}$$

$$0.75 \times \frac{10^8}{10^{-3}}$$

To divide the powers of 10, subtract the exponent in the denominator from the exponent in the numerator.

$$0.75 \times 10^{8-(-3)}$$



$$0.75 \times 10^{8+3}$$

$$0.75 \times 10^{11}$$

Proper scientific notation requires one non-zero digit in front of the decimal point, which means we need to move the decimal point one place to the right. Therefore, we rewrite the expression as

$$7.5 \times 10^{-1} \times 10^{11}$$

$$7.5 \times 10^{-1+11}$$

$$7.5 \times 10^{10}$$

■ 3. Find the value of $(6.75 \times 10^3) \div (1.5 \times 10^9)$.

Solution:

Divide the decimal numbers, separately from the powers of 10.

$$\frac{6.75}{1.5} \times \frac{10^3}{10^9}$$

$$4.5 \times \frac{10^3}{10^9}$$

To divide the powers of 10, subtract the exponent in the denominator from the exponent in the numerator.

$$4.5 \times 10^{3-9}$$



$$4.5 \times 10^{-6}$$

- 4. Find the value of $(2.75 \times 10^{10}) \div (8.0 \times 10^8)$.

Solution:

Divide the decimal numbers, separately from the powers of 10.

$$\frac{2.75}{8.0} \times \frac{10^{10}}{10^8}$$

$$0.34375 \times \frac{10^{10}}{10^8}$$

To divide the powers of 10, subtract the exponent in the denominator from the exponent in the numerator.

$$0.34375 \times 10^{10-8}$$

$$0.34375 \times 10^2$$

Proper scientific notation requires one non-zero digit in front of the decimal point, which means we need to move the decimal point one place to the right. Therefore, we rewrite the expression as

$$3.4375 \times 10^{-1} \times 10^2$$

$$3.4375 \times 10^{-1+2}$$

$$3.4375 \times 10^1$$



- 5. Find the value of $(7.5 \times 10^4) \div (1.5 \times 10^{-4})$.

Solution:

Divide the decimal numbers, separately from the powers of 10.

$$\frac{7.5}{1.5} \times \frac{10^4}{10^{-4}}$$

$$5 \times \frac{10^4}{10^{-4}}$$

To divide the powers of 10, subtract the exponent in the denominator from the exponent in the numerator.

$$5 \times 10^{4-(-4)}$$

$$5 \times 10^{4+4}$$

$$5 \times 10^8$$

$$5.0 \times 10^8$$

- 6. If we're given 5.75×10^6 in scientific notation and we divide it by a negative power of 10, will we get a larger or smaller result?



Solution:

Let's pretend we're dividing by 10^{-2} . When we do, we get

$$5.75 \times 10^{6-(-2)}$$

$$5.75 \times 10^{6+2}$$

$$5.75 \times 10^8$$

This is a larger value than 5.75×10^6 , so we can say that dividing by a negative power of 10 will give a larger number.



MULTIPLYING AND DIVIDING SCIENTIFIC NOTATION

- 1. Simplify the expression.

$$\frac{(4.5 \times 10^3)(1.4 \times 10^{-5})}{2.8 \times 10^{-1}}$$

Solution:

Simplify the numerator first by multiplying the scientific notation expressions.

$$\frac{(4.5 \times 1.4)(10^3 \times 10^{-5})}{2.8 \times 10^{-1}}$$

$$\frac{6.3 \times 10^{3+(-5)}}{2.8 \times 10^{-1}}$$

$$\frac{6.3 \times 10^{-2}}{2.8 \times 10^{-1}}$$

Now divide the scientific notation.

$$\frac{6.3}{2.8} \times \frac{10^{-2}}{10^{-1}}$$

$$2.25 \times 10^{-2-(-1)}$$

$$2.25 \times 10^{-1}$$



■ 2. Simplify the expression.

$$\frac{(7.6 \times 10^5)(1.1 \times 10^{-7})}{5.1 \times 10^{-3}}$$

Solution:

Simplify the numerator first by multiplying the scientific notation expressions.

$$\frac{(7.6 \times 1.1)(10^5 \times 10^{-7})}{5.1 \times 10^{-3}}$$

$$\frac{8.36 \times 10^{5+(-7)}}{5.1 \times 10^{-3}}$$

$$\frac{8.36 \times 10^{-2}}{5.1 \times 10^{-3}}$$

Now divide the scientific notation.

$$\frac{8.36}{5.1} \times \frac{10^{-2}}{10^{-3}}$$

$$1.639 \times 10^{-2-(-3)}$$

$$1.639 \times 10^1$$

■ 3. Simplify the expression.



$$\frac{(1.7 \times 10^{-3})(3.4 \times 10^{-4})}{(6.3 \times 10^{-3})(7.3 \times 10^{-2})}$$

Solution:

Simplify the numerator and denominator first by multiplying the scientific notation expressions.

$$\frac{(1.7 \times 3.4)(10^{-3} \times 10^{-4})}{(6.3 \times 7.3)(10^{-3} \times 10^{-2})}$$

$$\frac{5.78 \times 10^{-3+(-4)}}{45.99 \times 10^{-3+(-2)}}$$

$$\frac{5.78 \times 10^{-7}}{45.99 \times 10^{-5}}$$

Now divide the scientific notation.

$$\frac{5.78}{45.99} \times \frac{10^{-7}}{10^{-5}}$$

$$0.126 \times 10^{-7-(-5)}$$

$$0.126 \times 10^{-2}$$

Move the decimal point one place to the right to put the result in proper scientific notation.

$$1.26 \times 10^{-1} \times 10^{-2}$$

$$1.26 \times 10^{-1+(-2)}$$



$$1.26 \times 10^{-3}$$

■ 4. Simplify the expression.

$$\frac{(4.9 \times 10^4)(6.4 \times 10^{-4})}{(8.2 \times 10^{-3})(2 \times 10^3)}$$

Solution:

Simplify the numerator and denominator first by multiplying the scientific notation expressions.

$$\frac{(4.9 \times 6.4)(10^4 \times 10^{-4})}{(8.2 \times 2)(10^{-3} \times 10^3)}$$

$$\frac{31.36 \times 10^{4+(-4)}}{16.4 \times 10^{-3+3}}$$

$$\frac{31.36 \times 10^0}{16.4 \times 10^0}$$

Any non-zero value raised to the power of 0 is 1, so

$$\frac{31.36 \times 1}{16.4 \times 1}$$

$$\frac{31.36}{16.4}$$

$$1.912$$



■ 5. Simplify the expression.

$$\frac{(6.1 \times 10^6)(6.8 \times 10^{-4})}{(1.1 \times 10^{-5})(1.8 \times 10^5)}$$

Solution:

Simplify the numerator and denominator first by multiplying the scientific notation expressions.

$$\frac{(6.1 \times 6.8)(10^6 \times 10^{-4})}{(1.1 \times 1.8)(10^{-5} \times 10^5)}$$

$$\frac{41.48 \times 10^{6+(-4)}}{1.98 \times 10^{-5+5}}$$

$$\frac{41.48 \times 10^2}{1.98 \times 10^0}$$

Now divide the scientific notation.

$$\frac{41.48}{1.98} \times \frac{10^2}{10^0}$$

$$20.949 \times 10^{2-0}$$

$$20.949 \times 10^2$$

Move the decimal point one place to the left to put the result in proper scientific notation.



$$2.0949 \times 10^1 \times 10^2$$

$$2.0949 \times 10^{1+2}$$

$$2.0949 \times 10^3$$

■ 6. Danny and Deacon are working on finding the quotient below. Danny decides to multiply out the numerator and gets 10,000 for the powers of 10 portion. Then he divides it by 0.00061 to get 16,393,442.6 or 1.63934426×10^7 . Deacon decides he wants to divide, so he divides each number by 0.00061 and gets 819,672,131 and 32.78689852. Then he multiplies those numbers to get 2.68745×10^{10} . Why are the answers different? Who is correct?

$$\frac{(5 \times 10^5)(2 \times 10^{-2})}{6.1 \times 10^{-4}}$$

Solution:

Deacon is incorrect. He should have divided just one of the numbers and then multiplied the other number by that quotient.



ESTIMATING SCIENTIFIC NOTATION

- 1. Estimate the value of 3.65×10^{-5} .

Solution:

We'll round 3.65 up to the nearest whole number, 4, and then multiply that by 10^{-5} , or 0.00001.

$$4 \times 0.00001$$

$$0.00004$$

- 2. Use scientific notation to estimate the value $(5.75 \times 10^6)(2.34 \times 10^{-1})$.

Solution:

Round 5.75 to 6 and 2.34 to 2, then rewrite the expression as

$$(6 \times 10^6)(2 \times 10^{-1})$$

$$(6 \times 2)(10^6 \times 10^{-1})$$

$$12 \times 10^5$$



Rewrite the answer in proper scientific notation by moving the decimal point one place to the left.

$$1.2 \times 10^1 \times 10^5$$

$$1.2 \times 10^6$$

■ 3. Use scientific notation to estimate the value of $(2.456 \times 10^3)(1.67 \times 10^{-7})$.

Solution:

Round 2.456 to 2 and 1.67 to 2, then rewrite the expression as

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

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

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

■ 4. Use scientific notation to estimate the value of the expression.

$$\frac{7.152 \times 10^2}{2.91 \times 10^2}$$

Solution:



Round 7.152 to 7 and 2.91 to 3, then rewrite the expression as

$$\frac{7 \times 10^2}{3 \times 10^2}$$

$$\frac{7}{3} \times \frac{10^2}{10^2}$$

$$2.333 \times 1$$

$$2.333$$

■ 5. Use scientific notation to estimate the value of the expression.

$$\frac{(6.2 \times 10^6)(6.4 \times 10^{-3})}{(4.25 \times 10^{-2})(2.9 \times 10^{-3})}$$

Solution:

Round 6.2 to 6, 6.4 to 6, 4.25 to 4, and 2.9 to 3, then rewrite the expression as

$$\frac{(6 \times 10^6)(6 \times 10^{-3})}{(4 \times 10^{-2})(3 \times 10^{-3})}$$

$$\frac{(6 \times 6)(10^6 \times 10^{-3})}{(4 \times 3)(10^{-2} \times 10^{-3})}$$

$$\frac{36 \times 10^3}{12 \times 10^{-5}}$$



$$\frac{36}{12} \times \frac{10^3}{10^{-5}}$$

$$3 \times 10^8$$

- 6. Use scientific notation to estimate the value of the expression.

$$\frac{(1.7 \times 10^{-5})(2.6 \times 10^2)}{(3.334 \times 10^{-3})(2.5 \times 10^{-1})}$$

Solution:

Round 1.7 to 2, 2.6 to 3, 3.334 to 3, and 2.5 to 3, then rewrite the expression as

$$\frac{(2 \times 10^{-5})(3 \times 10^2)}{(3 \times 10^{-3})(3 \times 10^{-1})}$$

$$\frac{(2 \times 3)(10^{-5} \times 10^2)}{(3 \times 3)(10^{-3} \times 10^{-1})}$$

$$\frac{6 \times 10^{-3}}{9 \times 10^{-4}}$$

$$\frac{6}{9} \times \frac{10^{-3}}{10^{-4}}$$

$$0.6667 \times 10^1$$

$$6.6667$$



