

FLUENCY AND FLEXIBILITY

- *Fact Families with Decimals*
- *Scientific Notation*
- *reprinting numbers in many ways*
- *Proving factors and multiples*

Multiply this number by 10, 100, 1000.. What do you notice?

What about when you divide?

290

$$290 \times 10 = 2900$$

$$290 \div 10 = 29.0$$

$$\star 290 \times 100 = 29000$$

$$290 \div 100 = 2.90$$

$$290 \times 1000 = 290000$$

$$290 \div 1000 = 0.29$$

$$290 \times 100 = 29000$$

$$100 \times 290 = 29000$$

$$29000 \div 290 = 100$$

$$29000 \div 100 = 290$$

$$290 \div 100 = 2.90$$

$$290 \div 2.90 = 100$$

$$2.9 \times 100 = 290$$

$$100 \times 2.9 = 290$$

Multiply this number by 10, 100, 1000.. What do you notice?

What about when you divide?

3.15

$$3.15 \times 10 =$$

$$3.15 / 10 =$$

$$\star 3.15 \times 100 =$$

$$\star 3.15 / 100 =$$

$$3.15 \times 1000 =$$

$$3.15 / 1000 =$$

$$3.15 \times 100 = 315$$

$$100 \times 3.15 = 315$$

$$315 \div 100 = 3.15$$

$$315 \div 3.15 = 100$$

$$3.15 \div 100 = 0.0315$$

$$3.15 \div 0.0315 = 100$$

$$0.0315 \times 100 = 3.15$$

$$100 \times 0.0315 = 3.15$$

What ways can you express 1879 as a product of a decimal multiplied by 10, 100, 1000, 10,000, 100,000? How about a number multiplied by 0.1, 0.01, 0.001

$1879 =$

$1879 =$

$1879 =$

$1879 =$

$1879 =$

$1879 =$

$1879 =$

$1879 =$

Mooooove
me!!

why?)

Powers of Ten

Remember that the powers of 10 are as follows:

$$\begin{array}{l} 10^0 = 1 \\ 10^1 = 10 \\ 10^2 = 100 \\ 10^3 = 1000 \\ 10^4 = 10,000 \end{array} \qquad \begin{array}{l} 10^{-1} = 0.1 = \frac{1}{10} \\ 10^{-2} = 0.01 = \frac{1}{100} \\ 10^{-3} = 0.001 = \frac{1}{1000} \\ 10^{-4} = 0.0001 = \frac{1}{10000} \end{array}$$

...and so forth.

There are some important powers that we use often:

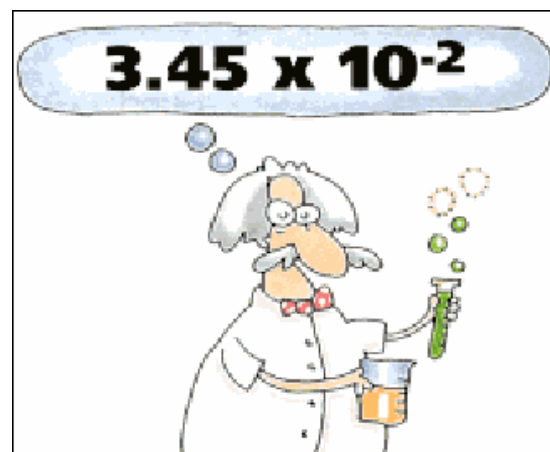
$$\begin{array}{l} 10^3 = 1000 = \text{one thousand} \\ 10^6 = 1,000,000 = \text{one million} \\ 10^9 = 1,000,000,000 = \text{one billion} \\ 10^{12} = 1,000,000,000,000 = \text{one trillion} \end{array} \qquad \begin{array}{l} 10^{-3} = 0.001 = \text{one thousandth} \\ 10^{-6} = 0.000\ 001 = \text{one millionth} \\ 10^{-9} = 0.000\ 000\ 001 = \text{one billionth} \\ 10^{-12} = 0.000\ 000\ 000\ 001 = \text{one trilli} \end{array}$$

4.2×10^{23}	\Rightarrow shift decimal point 23 places to the right	\Rightarrow 420,000,000,000,000,000,000,000.
4.2×10^5	\Rightarrow shift decimal point 5 places to the right	\Rightarrow 420,000.
4.2×10^3	\Rightarrow shift decimal point 3 places to the right	\Rightarrow 4200.
4.2×10^2	\Rightarrow shift decimal point 2 places to the right	\Rightarrow 420.
4.2×10^0	\Rightarrow shift decimal point no places to the right or left	\Rightarrow 4.2
4.2×10^{-1}	\Rightarrow shift decimal point 1 place to the left	\Rightarrow 0.42
4.2×10^{-2}	\Rightarrow shift decimal point 2 places to the left	\Rightarrow 0.042
4.2×10^{-3}	\Rightarrow shift decimal point 3 places to the left	\Rightarrow 0.0042
4.2×10^{-5}	\Rightarrow shift decimal point 5 places to the left	\Rightarrow 0.000 042
4.2×10^{-10}	\Rightarrow shift decimal point 10 places to the left	\Rightarrow 0.000 000 000 42

Here are some examples with more interesting numbers... watch how far the decimal point shifts to the right or left:

6.38×10^3 km	= 6380 km (radius of Earth)
6.214×10^{-1} mi	= 0.6214 mi (number of miles in one kilometer)
2.1×10^{-3} kg	= 0.0021 kg (mass of paper clip)
1.3×10^6 persons	= 1,300,000 persons (population of Hawaii)
3×10^8 persons	= 300,000,000 persons (population of the U.S.)
3.15576×10^7 s	= 31,557,600 s (number of seconds in a year)
2×10^{11} stars	= 200,000,000,000 stars (number of stars in our Galaxy)
$\$3.54 \times 10^{11}$	= \$354,000,000,000 (\$354 billion, annual U.S. deficit for fiscal year 2007)
$\$8.51 \times 10^{12}$	= \$8,510,000,000,000 (\$8.51 trillion, U.S. federal debt at end of fiscal year 2006)
1×10^{100}	= one "googol" (a 1 followed by 100 zeroes)

Converting Scientific Notation



Write this number as a product of a decimal and 10

$$\underline{2.1} \times 10 = 21$$

$$0.021 \times \underline{1000} = 21$$

$$3 \times 7 = 21$$

$$21 \div 1 = 21$$

SCIENTIFIC NOTATION

A number is written in **scientific notation** if it is of the form

$$c \times 10^n$$

where $1 \leq c < 10$ and n is an integer. *

an integer is a positive, negative whole number including zero

*

{... -3, -2, -1, 0, 1, 2, 3 ... }

Move the box to reveal the answer.

Sort the given values.

Written in proper
scientific notation

$$2.1203 \times 10^{-16}$$

$$6.09 \times 10^7$$

$$1.9 \times 10^{-22}$$

$$2.35 \times 10^5$$

$$3.214 \times 10^1$$

$$5 \times 10^{-9}$$



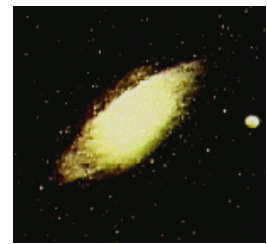
23

}

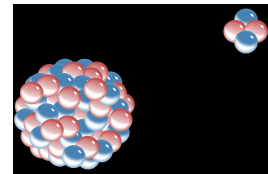
Not written in proper
scientific notation

The Andromeda Galaxy (the closest one to our Milky Way galaxy)

contains at least 200,000,000,000 stars.



On the other hand, the weight of an alpha particle, which is emitted in the radioactive decay of Plutonium-239, is 0.000,000,000,000,000,000,000,000,006,645 kilograms.



Scientific notation is used to write really big numbers.

decimal notation \longrightarrow scientific notation

Move the star to count the number of decimal places.

The amount of moves will give you the exponent value.

★ 123,000,000,000

1.23×10^{11}

$1.23 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

★ 45,000,000

4.5×10^7

★ 67,800,000,000,000

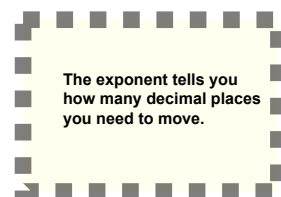
6.78×10^{13}

9×10^3

★ 9,000

Scientific notation is used to write really big numbers.

scientific notation \longrightarrow decimal notation



$$7.82 \times 10^3 \quad 7820 \star$$

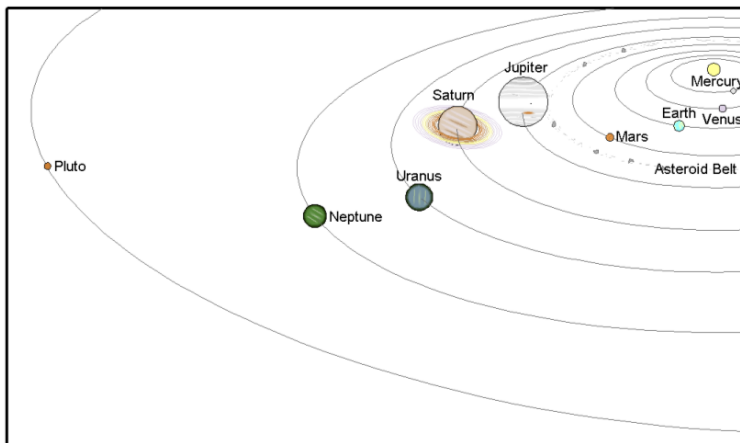
$$\star 3.04 \times 10^8 \quad 304000000$$

$$\star 5 \times 10^4 \quad 50000$$

$$\star 6.2103 \times 10^{10} \quad 62103000000$$

An example of a really big number.
Please write it in scientific notation.

As the planets orbit the sun, the closest Pluto gets to Earth is approximately 2,700,000,000 miles.



$$2.7 \times 10^9$$

An example of a really big number.
Please write it in scientific notation.

The speed of light in a vacuum is approximately
186,000 miles per second.

$$1.86 \times 10^5$$

Scientific notation is used to write really small numbers.

decimal notation • \longrightarrow *scientific notation*

0.000000034
★

3.4×10^{-8}

0.0000000005609
★

5.609×10^{-10}

0.000000000064
★

6.4×10^{-11}

0.007
★

7×10^{-3}

Scientific notation is used to write really small numbers.

scientific notation ●————→ *decimal notation*

$$4.8 \times 10^{-6}$$

★

$$1.2 \times 10^{-12}$$

★

$$9 \times 10^{-2}$$

★

$$7.1034 \times 10^{-5}$$

★

The exponent tells you
how many decimal places
you need to move.

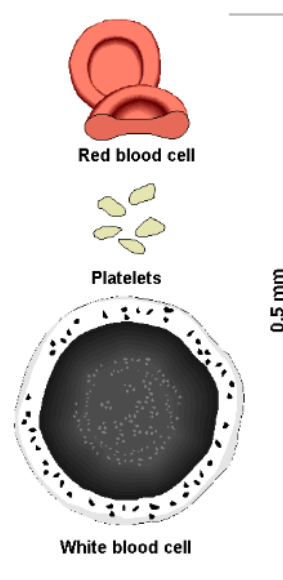
An example of a really small number.
Please write it in scientific notation.

Human fingernails grow at a rate of about 0.00286 inches per day. ★



An example of a really small number.
Please write it in scientific notation.

The thickness of a red blood cell is approximately 0.0003125
of an inch.



Extra Practice

Rewrite in decimal form.

1. 3.79×10^5

2. 2.5×10^{-2}

3. 8.44×10^1

4. 6.5393×10^4

5. 3.589×10^{-3}

6. 9.1187×10^0

7. 1.0056×10^{-5}

8. 7.2658746×10^8

Extra Practice

Rewrite in scientific notation.

7,960,000,000

0.007485

45.668

998.653

0.0000056388

63,000,000

0.0602

22,078,600

22,078,600

64.3

What other ways can you represent numbers? (use pictures and words as well as numbers)

24

123

84

50

150

180

63

1 230

14 000 000

Try proving the following using word and pictures but not numbers.

42 is a common multiple of 3 and 6

If we know that 3 and 4 both factors of a number then 12 must also be a factor.