

## Scientific notation and your calculator

NAME:

**Calculators often write numbers in scientific notation. This worksheet is designed to teach you how to interpret the calculator's notation.**

1. Fill in the table for the powers of ten by writing the decimal equivalent. Use commas where necessary. You may need to perform simple divisions by hand for the first four entries. To figure  $10^{12}$ , you may need to develop the pattern for  $10^3$ ,  $10^6$ , and  $10^9$  and extend it.

Number in exponent form	Number in decimal form
$10^{-12} = \frac{1}{10^{12}}$	
$10^{-9} = \frac{1}{10^9}$	
$10^{-6} = \frac{1}{10^6}$	
$10^{-3} = \frac{1}{10^3}$	
$10^3$	
$10^6$	
$10^9$	
$10^{12}$	

2. Scientific notation is an easy way to write really big numbers like 9,000,000,000,000. This can be thought of as  $9 * 1,000,000,000,000$ . Using the alternative way to write 1,000,000,000,000, how else could I write  $9 * 1,000,000,000,000$ ?

3. So we see that 9,000,000,000,000 could be concisely written as  $9 * 10^{12}$ . This is the idea behind scientific notation. This shorthand notation is quite convenient.

So really, any number can be written as “something times ten to some power”. To see the connection between the exponent of the ten and the number itself, complete the table.

Notice  $5 * 10^0$  is done for you; it will serve as a reference point. You may need to perform a simple division for the first one. (Remember your order of operations: evaluate the exponent before multiplying by the 5.)

Number in scientific notation form	Number in decimal form
$5 * 10^{-4} = \frac{5}{10^4}$	
$5 * 10^{-3} = \frac{5}{10^3}$	
$5 * 10^{-2} = \frac{5}{10^2}$	
$5 * 10^{-1} = \frac{5}{10^1}$	
$5 * 10^0$	<b>5.0</b>
$5 * 10^1$	
$5 * 10^2$	
$5 * 10^3$	
$5 * 10^4$	

4. Each number can be thought of as taking **5.0** and moving the decimal place so many places to either the left or the right. What is the connection between the exponent on the ten and how the decimal point moves?

5. Scientific notation lets us write any number as “some number (between 1 and 10) times ten raised to some power”. We could even have numbers like  $6.345 * 10^3$ . To translate this, we would move the decimal point over three places to the right to get 6345 or 6,345.

Practice translating between scientific notation and decimal forms in the table below. The numbers in the left column should always be in the form  $a * 10^n$  where  $a$  is a number between 1 and 10, not including 10. Notice the exponent  $n$  will always be an integer.

Number in scientific notation form	Number in decimal form
	.00000065
	8,500,000,000,000,000
	.0000000000000034
$5.4 * 10^{-8}$	
$8 * 10^7$	
$2.4 * 10^6$	
	.000689
$-9.478 * 10^{-5}$	
	-.00000000492
$-1.72 * 10^{12}$	

6. Our last task is to interpret how the calculator denotes scientific notation. Instead of writing  $2.4 * 10^6$ , the calculator writes 2.4E6. If you want to enter a number in scientific notation, you use the EE function. On the **TI86** or **TI85**, the EE function is the button directly above the 7 key. On the **TI83** or **TI82**, the EE function is the second function of the **comma** button, directly above the 7 key.

Let's say we want to find the value of  $\frac{3.4 * 10^9}{6.5 * 10^4}$ . Let's use the EE function on our calculators. We do not need to use parentheses because the calculator knows to evaluate the scientific notation first, before dividing. Simply put "3.4E9/6.5E4" into the calculator.

Did you get 52307.69?

(Note: We could have put in " $(3.4 * 10^9)/(6.5 * 10^4)$ " and gotten the same result. Notice how you need parentheses here.)

7. Often the calculator will use scientific notation. For instance, when we find roots via the Root / Zero function, it gives us the  $x$  value (which is what we want) but sometimes it also gives us something like  $y = 9.86E-32$ . Explain why this can be interpreted as 0.