

## KEY CONCEPT OVERVIEW

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In Topic B, students are introduced to **scientific notation**, which is a convenient way to write numbers that are very large or very small. Students learn to convert standard numbers to scientific notation and perform operations on numbers in many forms. Finally, students compare numbers written in various forms to put them in order or to determine which number has the greatest or least value.

After your child has completed Lesson 11, LEARN MORE by viewing a video called “Powers of Ten,” which demonstrates positive and negative powers of 10. Visit: [eurmath.link/powers-of-ten](http://eurmath.link/powers-of-ten).

You can expect to see homework that asks your child to do the following:

- Use the **order of magnitude** of a number to determine the next greatest **power of ten**, and put numbers in order according to their value. The larger the magnitude, the larger the number’s value.
- Solve real-life problems using numbers written in scientific notation.
- Convert numbers written in standard form to scientific notation, and vice versa. Represent those numbers on a calculator.
- Determine whether a number represented in scientific notation is very large or very small in value.
- Perform calculations on numbers represented in scientific notation.
- Change a given unit of measure to a different unit of measure.

## SAMPLE PROBLEMS (From Lessons 9 and 10)

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The table below shows the debt of the three most populous states and three least populous states.

State	Debt (in dollars)	Population (2012)
California	407,000,000,000	38,000,000
New York	337,000,000,000	19,000,000
Texas	276,000,000,000	26,000,000
North Dakota	4,000,000,000	690,000
Vermont	4,000,000,000	626,000
Wyoming	2,000,000,000	576,000

How much larger is the combined debt of the three most populous states than that of the three least populous states? Express your answer in scientific notation.

$$\begin{aligned}
 (1.02 \times 10^{12}) - (1 \times 10^{10}) &= (1.02 \times 10^2 \times 10^{10}) - (1 \times 10^{10}) \\
 &= (102 \times 10^{10}) - (1 \times 10^{10}) \\
 &= (102 - 1) \times 10^{10} \\
 &= 101 \times 10^{10} \\
 &= (1.01 \times 10^2) \times 10^{10} \\
 &= 1.01 \times 10^{12}
 \end{aligned}$$

**SAMPLE PROBLEMS** *(continued)*

Approximately how many times greater is the total population of California, New York, and Texas compared to the total population of North Dakota, Vermont, and Wyoming?

$$\begin{aligned}\frac{8.3 \times 10^7}{1.892 \times 10^6} &= \frac{8.3}{1.892} \times \frac{10^7}{10^6} \\ &\approx 4.39 \times 10 \\ &\approx 43.9\end{aligned}$$

***The combined population of California, New York, and Texas is about 43.9 times greater than the combined population of North Dakota, Vermont, and Wyoming.***

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at [GreatMinds.org](http://GreatMinds.org).

**HOW YOU CAN HELP AT HOME**

You can help at home in many ways. Here are just a few tips to help you get started:

- The idea of “how many times larger” comes up often in this topic. To determine “how many times larger,” you need to divide. For example, if the area of your living room is 330 square feet and the area of your bathroom is 110 square feet, you would need to divide 330 by 110 to determine that the living room is 3 times larger than the bathroom. Discuss with your child why “how many times larger” indicates the need to divide. Perform some of these calculations together, gathering ideas from real-life numbers such as sports statistics and merchandise prices.
- When you are in the grocery store, garage, or workroom, discuss with your child the different units of measure you encounter. This will help your child form stronger mental models of what an inch looks like and how many ounces are in a pound, for example. With this practice your child will become better prepared to answer questions about measurement units.

**TERMS**

**Order of magnitude:** The exponent of the power of 10 when a decimal is expressed in scientific notation. For example, in scientific notation, the decimal 192.7 is represented as  $1.927 \times 10^2$ , so its order of magnitude is 2 (the exponent in  $10^2$ ).

**Power of ten:** A term with the number 10 as its base. For example,  $10^3$  is a power of 10 that equals 1,000.

**Product:** The answer to a multiplication problem.

**Product of a decimal:** The result of multiplying any number and a decimal.

**Scientific notation:** The representation of a very large or very small number as the product of a decimal and a power of 10. The decimal must have a value greater than or equal to 1 and less than 10. For example,  $2.41 \times 10^5$  is in scientific notation, while  $24.1 \times 10^4$  is not because the decimal value, 24.1, is greater than 10. Scientific notation is used when the number is too big or too small to be conveniently written in standard form.