

# Exponential Notation

## Cross-Curricular Focus: Mathematics

**Exponential notation** is one way to write a very large or very small number. The number is written as the product of either a decimal or an integer and as a power of 10. This works because of the way our base-10 place value system is set up. Each place value column is 10 times larger than the one before it as you move from right to left. When moving from left to right, each place value column is ten times smaller than the one before it. This “times 10” relationship between the columns lets us show numbers in exponential notation. The **base number** 10 is written as a regularly sized number. An **exponent** is a small number written up and to the right of the 10. The exponent tells how many place value columns are being shown.

The number 10 can be shown as  $1 \times 10^1$ . This is like saying  $1 \times 10$ . The number 100 can be shown as  $1 \times 10^2$ . This is like saying  $1 \times 10 \times 10$ . The number 1,000 can be shown as  $1 \times 10^3$ . This is like saying  $1 \times 10 \times 10 \times 10$ . The number 10,000 can be shown as  $1 \times 10^4$ . This is like saying  $1 \times 10 \times 10 \times 10 \times 10$ . For each place value column, add one more number to the exponent. So far, our multiplier has been 1. It can be another whole number, like 4. The number 4,000,000 can be shown in exponential notation as  $4 \times 10^6$ . This is a shorter way of saying  $4 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$ . The exponent matches the number of zeroes on the original number.

The multiplier can even be a decimal. Be careful when you change the number  $4.5 \times 10^4$  from exponential to **standard notation**. Standard notation is writing the number in regular number form. The number  $4.5 \times 10^4$  becomes not 450,000 but rather 45,000. There are only three zeros in the correct answer. The decimal point replaces one of the zeros.

Exponential notation allows us to write very large numbers in a short way. The more you use exponential notation, the more fun it will become.

Name: \_\_\_\_\_

Answer the following questions based on the reading passage. Don't forget to go back to the passage whenever necessary to find or confirm your answers.

1) How would you write 60,000 in exponential notation?

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2) When do you think it would make sense to write a number using exponential notation?

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3) How many zeros would you expect to see when writing the standard notation for the number  $9 \times 10^8$ ?

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4) What is the relationship between each of the place value columns?

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5) What is an exponent? \_\_\_\_\_

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Name: Key

Answer the following questions based on the reading passage. Don't forget to go back to the passage whenever necessary to find or confirm your answers.

**Actual wording of answers may vary.**

1) How would you write 60,000 in exponential notation?

**$6 \times 10^4$**

2) When do you think it would make sense to write a number using exponential notation?

**when a number is very long**

3) How many zeros would you expect to see when writing the standard notation for the number  $9 \times 10^8$ ?

**8**

4) What is the relationship between each of the place value columns?

**They have a difference of 10.**

5) What is an exponent? **The small number to the right of the base number that tells how many place value columns are being shown.**