

EXPONENTS, SQUARE ROOTS & SCIENTIFIC NOTATION



This sheet is designed as a review aid. If you have not previously studied this concept or after reviewing the contents you still don't pass you should enroll in the appropriate math class.

EXPONENTS:

Exponents are identified by a small number immediately following another number and raised to the top of the first number (5^4 - the 4 is an exponent). It indicates the number of times the first number should be multiplied by itself to get an answer.

The two most common exponents are square (2) and cube (3). Numbers with these exponents are usually referred to as squared or cubed respectively.

To find the area of a square, multiply the sides together. If the sides of a square are 3" each, the area of the square is 3×3 or 3^2 or 9 square inches.

To find the volume of a cube, multiply the length of one edge by itself 3 times. If the edge of a cube is 3", the volume would be $3 \times 3 \times 3$ or 3^3 or 27 cubic inches.

Other exponents are referred to as powers. 5^4 would be referred to as five to the fourth power, etc.

When an exponent is a positive number, the number to which it is attached is multiplied by itself the number of times indicated by the exponent:

5^4 would be calculated as $5 \times 5 \times 5 \times 5 = 625$

6^3 would be calculated as $6 \times 6 \times 6 = 216$

And so on . . .

When an exponent is a negative number you divide 1 by that number's exponential value:

5^{-4} would be $1/5^4 = 1/625 = .0016$

6^{-3} would be $1/6^3 = 1/216 = .0046296$ (.0046 rounded to 4 decimal places)

SQUARE ROOTS:

A square root is the opposite of a square. A square root symbol ($\sqrt{\quad}$) is essentially asking what number times itself will equal the number under the square root symbol.

$$\sqrt{25} = 5 \text{ because } 5 \times 5 = 25; \quad \sqrt{16} = 4 \text{ because } 4 \times 4 = 16$$

SCIENTIFIC NOTATION:

Scientific notation is used to work with extremely large or small numbers. By using scientific notation these extreme numbers can be brought into a manageable size. Scientific notation is expressed as a number times 10 to a positive or negative power.

42,000 can be expressed as 4.2×10^4 (stated as 4.2 times ten to the fourth power). It is $4.2 \times 10 \times 10 \times 10 \times 10$.

.00042 can be expressed as 4.2×10^{-4} (stated as 4.2 times ten to the negative fourth power).

To convert a number to scientific notation:

1. Move the decimal right or left until there is only one non-zero number to the left of the decimal
 43200 to 4.32
2. Write the new number times 10.
 4.32×10
3. Count the number of places the decimal moved and write that number as an exponent of 10.
 4.32×10^4
4. If the original number was smaller than 1, place a minus sign in front of the exponent.

Most expressions in scientific notation are rounded to 2 to 4 decimal places.

43290700 could be expressed as 4.33×10^7 or 4.329×10^7 .

Numbers expressed in scientific notation can be multiplied or divided more easily than when they are written in their long form.

To Multiply Numbers Written in Scientific Notation:

Sample - $(4.2 \times 10^3) \times (2.3 \times 10^2)$

1. Multiply the decimal numbers. $4.2 \times 2.3 = 9.66$
2. Add the exponents for 10 together. $3 + 2 = 5$
This is the new exponent for 10.
3. Combine the answers to form the complete answer. 9.66×10^5

To Divide Numbers written in Scientific Notation:

Sample - $(4.2 \times 10^3) \div (2.3 \times 10^2)$

1. Divide the decimal numbers. $4.2 \div 2.3 = 1.826$
2. Subtract the exponents of the bottom number from the exponents of the top number. $3 - 2 = 1$
This is the new exponent for 10.
3. Combine the answers to form the complete answer. 1.862×10^1
4. 10^1 is the same as 10. This answer can be written as: $1.862 \times 10 = 18.62$

To Add or Subtract Numbers Written in Scientific Notation:

Sample - $(4.2 \times 10^3) + (2.3 \times 10^2)$

1. Adjust decimal and associated exponent so that all the exponents are the same.
 $4.2 \times 10^3 = 42 \times 10^2$ The equation is now $(42 \times 10^2) + (2.3 \times 10^2)$
2. Add the decimals. $42 + 2.3 = 44.3$
3. Combine the answers to form the complete answer. 44.3×10^2
4. Adjust the decimal and exponent as needed to reflect true scientific notation. 4.43×10^3