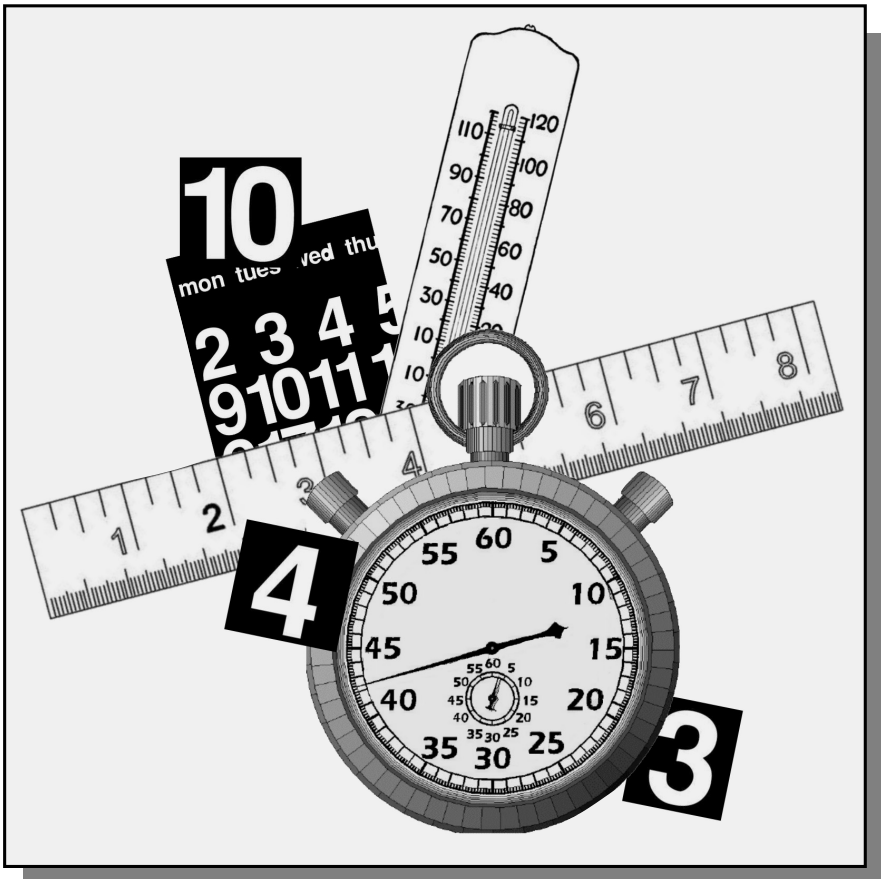
# *Basic Math Skills*




## *Chapter 5*

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"The study of Mathematics cannot be replaced by any other activity that will train and develop man's purely logical faculties to the same level of rationality."

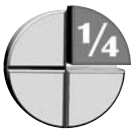
—C. O. Oakley






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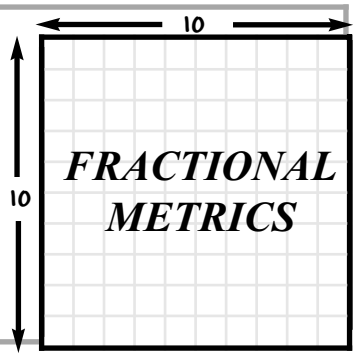
# Basic Math Skills




Lesson 1

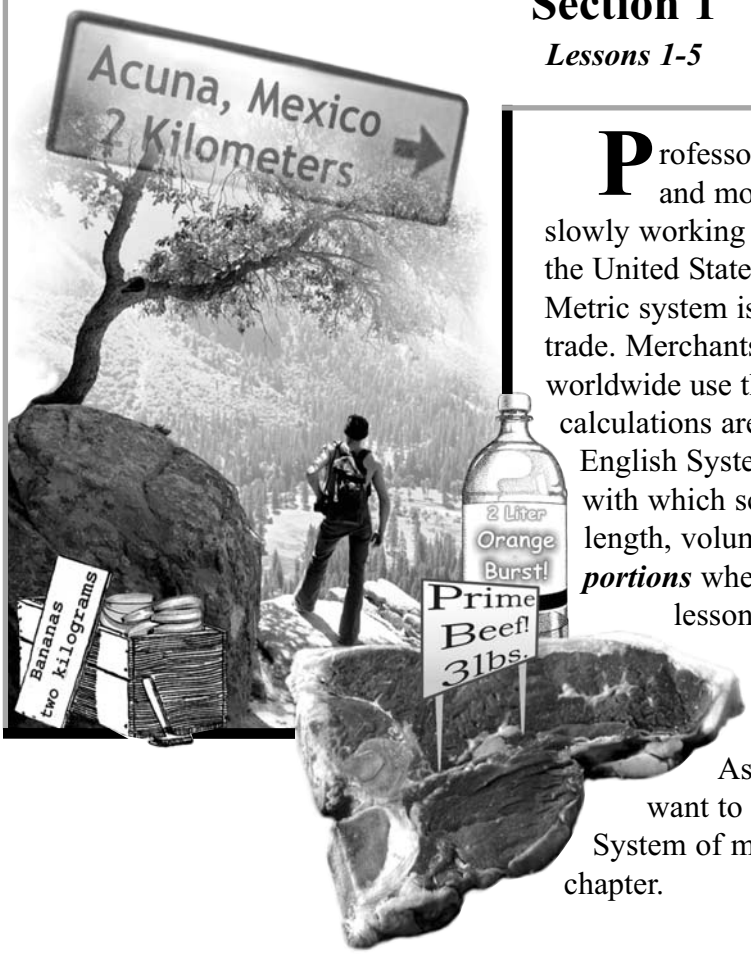
*Fractions*

# Chapter 5




## Section 1

***Lessons 1-5***






**Professor K**

Professor K has noticed that more and more, the Metric System is slowly working its way into ***commerce*** in the United States. The importance of the Metric system is evident in international trade. Merchants and scientists worldwide use the Metric System because calculations are easier in the Metric System than the English System. Also important is the relative ease with which scientists and businessmen can divide length, volume, and weight into very small ***portions*** when using the Metric System. In this lesson Professor K will show you how to work problems using fractions and especially decimals within the Metric System of measurement.

As with the English System, you may want to refer to the facts about the Metric System of measurement listed in the back of this chapter.

### VOLUME

In **Example Set 1**, Professor K will demonstrate that to get a clear, fractional representation of a unit of volume measurement, you must convert the measurement to another unit. Professor K will use a friend of his who ***emigrated*** to the United States from Mexico to help explain this process.




***Commerce:*** the manufacturing, buying, and selling of products
***Portions:*** parts of something; pieces
***Emigrated:*** moved from one region or country to another

**Example Set 1**

Roberto was planning a camping trip for his son, Rafael. Rafael had invited 15 boys to go on the camping trip. Roberto figured that each boy would drink two glasses of juice. Each glass could hold $\frac{1}{3}$ liter. Professor K helped Roberto calculate how many 2-liter bottles of juice Roberto needed to pick up at the grocery store as shown on the next page.



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**Step 1** Professor K first calculates how many milliliters are in a 2-liter bottle.
1 liter = 1,000 milliliters; therefore, 2 liters = 2 × 1,000 ml = 2,000 ml

**Step 2** Professor K must now calculate how many total liters of juice will be needed for the camping trip if each boy has two glasses of juice.

$$\frac{16 \text{ boys}}{1} \times \frac{1 \text{ liter}}{3 \text{ glasses}} \times \frac{2 \text{ glasses}}{1 \text{ boy}} = \frac{16 \text{ boys} \times 2 \text{ glasses} \times 1 \text{ liter}}{1 \text{ boy} \times 3 \text{ glasses} \times 1} =$$

$$\frac{16 \times 2 \times 1 \text{ liter}}{3} = \frac{32 \text{ liters}}{3} = 10\frac{2}{3} \text{ liters of juice needed}$$

Notice that the number of boys is *16* not 15, because Roberto's son must be included in the count. Roberto's son invited 15 boys plus himself, therefore the total is *16* boys.

**Step 3** Professor K must now make the final calculation to determine the number of 2-liter bottles that Roberto must purchase for the trip. Use the answer in Step 2, $10^2/_3$ liters, to calculate how many bottles are needed.

$$10\frac{2}{3} \text{ liters} = \frac{32}{3} \text{ liters; therefore, } \frac{32 \text{ liters}}{3} \div 2 \text{ liters} = \frac{32 \text{ liters}}{3} \times \frac{1 \text{ bottle}}{2 \text{ liters}} =$$

$$\frac{32 \text{ liters} \times 1 \text{ bottle}}{2 \text{ liters} \times 3} = \frac{32 \text{ bottles}}{2 \times 3} = \frac{32 \text{ bottles}}{6} = 5\frac{2}{6} \text{ bottles}$$

In Step 3, the *6* divides into *32* five times with a remainder of 2, yielding $5^2/_6$ bottles of juice needed for the trip. Roberto did not need to reduce the fraction to lowest terms. Since a fractional part of a bottle of juice is required for the trip, Roberto will be forced to buy another full bottle to meet the need. Therefore, Roberto will have to purchase 5 + 1 = 6 bottles for the camping trip.

## LENGTH

Professor K has seen families use the Metric System to measure and record quantities of liquid, the size of objects, and the weight and height of children. **Example Set 2** will show you how Professor K works problems that contain fractions in the Metric System when length is involved. Professor K uses his friend from Mexico to help explain the Metric System.

**Example Set 2**

For the camping trip, Roberto cut two walking staffs for Rafael and himself. Rafael's walking staff was only one-half as long as Roberto's staff. If Roberto's staff was *96.52* cm tall, use this information to determine the length of Rafael's staff.

**Step 1** Multiply the length of Roberto's staff times one-half.

$$96.52 \text{ cm} \times \frac{1}{2} = \frac{96.52 \text{ cm}}{1} \times \frac{1}{2} = \frac{96.52 \text{ cm} \times 1}{2} = \frac{96.52 \text{ cm}}{2}$$


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**Step 2**

Reduce the improper fraction from Step 1 to obtain the length of Rafael's staff in proper form. To reduce the fraction, divide *96.52* by *2*.

$$
\begin{array}{r}
48.26 \\
2\overline{)96.52} \\
-\,8\downarrow\phantom{.52} \\
\hline
16\phantom{.52} \\
-\,16\phantom{\downarrow} \\
\hline
00\,5 \\
\quad -\,4\downarrow \\
\hline
\quad\;\; 12 \\
\quad -\,12 \\
\hline
\end{array}
$$

Rafael's staff is 48.26 cm long.

## WEIGHT

Professor K reminds you that the basic unit of weight in the Metric System is the gram. A kilogram is 1,000 grams. The largest unit in the Metric System is the metric ton. One metric ton is equal to 1,000 kg.

Professor K demonstrates in **Example Set 3** how to find a fractional part of a metric weight.

**Example Set 3**

A Red Cross truck has a load capacity of 18.2 metric tons. On a trip to New York City from Texas with relief supplies for the Twin Towers disaster, the truck was at $^3/_4$ capacity. Professor K can use that information to determine how many metric tons of relief supplies the truck was hauling. Multiply *18.2* metric tons times $^3/_4$.

$$18.2\times\frac{3}{4}=\frac{18.2}{1}\times\frac{3}{4}=\frac{18.2\times3}{1\times4}=\frac{54.6}{4}$$

The improper fraction of metric tons must be reduced by dividing *54.6* by *4* to put the answer in proper metric form.

$$
\begin{array}{r}
13.65 \\
4\overline{)54.60} \\
-\,4\phantom{.60} \\
\hline
14\phantom{.60} \\
-\,12\phantom{.60} \\
\hline
\quad 2\,6 \\
\quad -\,2\,4 \\
\hline
\quad\;\; 20 \\
\quad -\,20 \\
\hline
\quad\;\; 0
\end{array}
$$

The truck was hauling 13.65 metric tons.

Demonstrate your ability to work with fractional measurements to Professor K by working the activities for this lesson.



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# LIFE PRINCIPLE



*"People who plan to succeed often do. People who do not plan usually do not succeed."*

—Ronald Johnson



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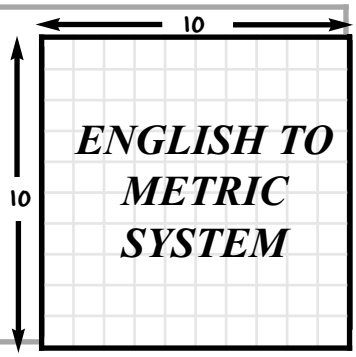
# Basic Math Skills



Lesson 2

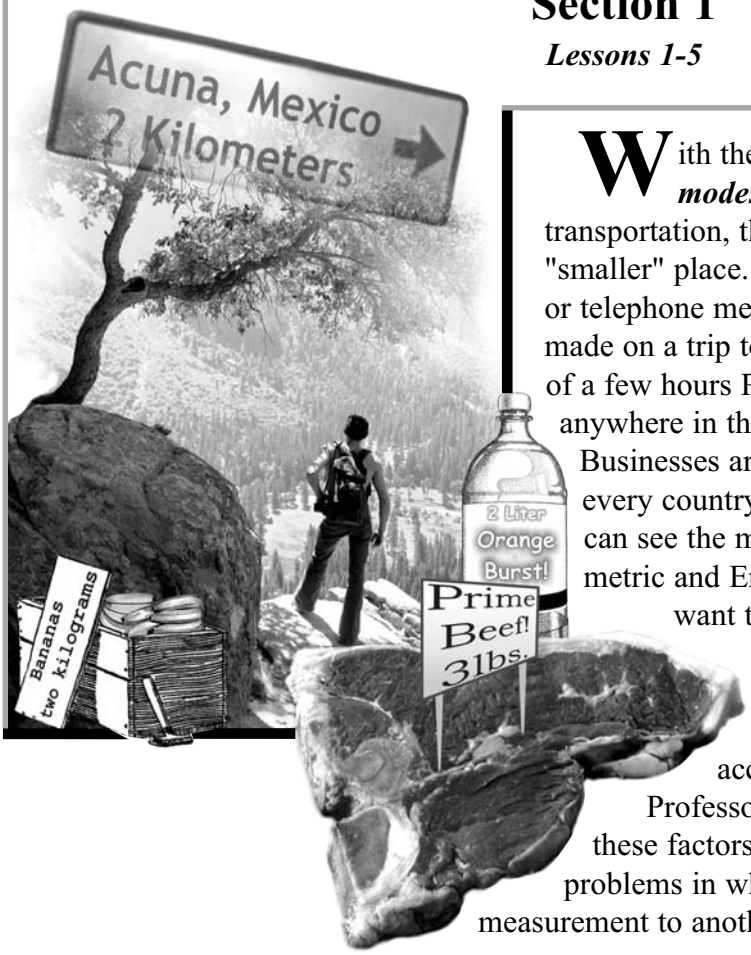
*Converting*

# Chapter 5




## Section 1

***Lessons 1-5***






**Professor K**

With the advent of better and faster ***modes*** of communication and transportation, the world is becoming a "smaller" place. Professor K can E-mail or telephone messages to friends that he made on a trip to Europe. In just a matter of a few hours Professor K can be almost anywhere in the world, thanks to jet airliners. Businesses are labeling products for sale in almost every country in the world. On most products you can see the measurement of the item given in both metric and English form. Sometimes you may want to convert metric numbers to English numbers or vice-versa. In this lesson Professor K will present the different ***conversion factors*** needed to accomplish this task for length. Professor K believes that memorization of these factors will benefit you in the working of problems in which converting from one system of measurement to another will be necessary.

### LENGTH

The basic unit of length in the Metric System is the meter. In the English System, the inch is the basic unit of length. **Table 2.1** shows some of the basic conversions for length from the English System to the Metric System of measurement and the Metric System to the English System of measurement that Professor K thinks are important. You should note that the decimals are not exact and are rounded off for ease of calculation for this lesson. In **Example Set 1** Professor K will show you how to use conversion factors to convert from one system to the other. Remember the principles you learned in the ***previous*** lessons about units dividing out (canceling). Professor K knows that those principles will be of great help to you in making conversions.

## VOCABULARY

***Modes:*** methods; ways of doing things
***Conversion factors:*** factors multiplied by another number for the purpose of converting from one unit to another
***Previous:*** in front of; one thing having occurred before another



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**Table 2.1**

| English to Metric | | Metric to English | |
|---|---|---|---|
| 1 inch | 2.54 cm | 1 centimeter | 0.3937 in. |
| 1 foot | 0.3048 meter | 1 meter | 39.37 in. |
| 1 yard | 0.9144 meter | 1 meter | 1.09 yds |
| 1 mile | 1.6 km | 1 kilometer | 0.6213 mile |

**Example Set 1**

**ENGLISH TO METRIC**



a) 5 in = ??? cm

Follow the steps as Professor K converts *inches* into *centimeters*. Professor K goes to **Table 2.1** and finds the conversion factor needed (1 in. = 2.54 cm).

$$\frac{5\text{ in}}{1}\times\frac{2.54\text{ cm}}{1\text{ in}}=\frac{5\ \cancel{\text{in}}\times 2.54\text{ cm}}{1\ \cancel{\text{in}}\times 1}=\frac{5\times 2.54\text{ cm}}{1}=\frac{12.7\text{ cm}}{1}=12.7\text{ cm}$$

b) Convert 4.5 miles to meters. (1 mile = 1.6 km) Remember, 1 km = 1000 m.

$$\frac{4.5\text{ mile}}{1}\times\frac{1.6\text{ km}}{1\text{ mile}}\times\frac{1000\text{ m}}{1\text{ km}}=\frac{4.5\ \cancel{\text{mile}}\times 1.6\ \cancel{\text{km}}\times 1000\text{ m}}{1\ \cancel{\text{mile}}\times 1\ \cancel{\text{km}}\times 1}=$$

$$\frac{4.5\times 1.6\times 1000\text{ m}}{1}=\frac{7.2\times 1000\text{ m}}{1}=7200\text{ m}$$

Notice in a) and b) how the conversion factors are placed (numerator and denominator) so the units you no longer need are divided out or canceled and the units you desire remain. Also, notice that as in b), sometimes you must convert within a measurement system to find the desired unit.

**METRIC TO ENGLISH**

c) Convert 3 km to miles. (1 km = .6213 miles)

$$\frac{3\text{ km}}{1}\times\frac{.6213\text{ miles}}{1\text{ km}}=\frac{3\ \cancel{\text{km}}\times .6213\text{ miles}}{1\ \cancel{\text{km}}\times 1}=\frac{3\times .6213\text{ miles}}{1\times 1}=$$

$$\frac{1.8639\text{ miles}}{1}=1.8639\text{ miles}$$



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**Example Set 2**

**ENGLISH TO METRIC**

a) 5 yds = ??? meters

Follow the steps to convert yards into meters. Go to **Table 2.1** and find the conversion factor needed (1 yd = .9144 m).

$$\frac{5\text{ yds}}{1}\times\frac{.9144\text{ m}}{1\text{ yd}}=\frac{5\text{ yds}\times.9144\text{ m}}{1\text{ yd}\times1}=\frac{5\times.9144\text{ m}}{1}=\frac{4.572\text{ m}}{1}=4.572\text{ m}$$

Notice in a) and b) how the conversion factors are placed (numerator and denominator) so the units you no longer need are divided out or cancelled, and the units you desire remain.

b) Convert 300 mm to yards. (1,000 mm = 1m and 1 meter = 1.09 yards)

$$\frac{300\text{ mm}}{1}\times\frac{1\text{ m}}{1000\text{ mm}}\times\frac{1.09\text{ yds}}{1\text{ m}}=\frac{300\text{ mm}\times1\text{ m}\times1.09\text{ yds}}{1000\text{ mm}\times1\text{ m}}=$$

$$\frac{300\times1\times1.09\text{ yds}}{1000\times1}=\frac{327\text{ yds}}{1000}=\frac{.327\text{ yds}}{1}=.327\text{ yds}$$

Show Professor K your understanding of conversion factors by working the activities for this lesson.

## LIFE PRINCIPLE



"Converting a bad life into a good life is worth the effort."

—Kermit Northcutt



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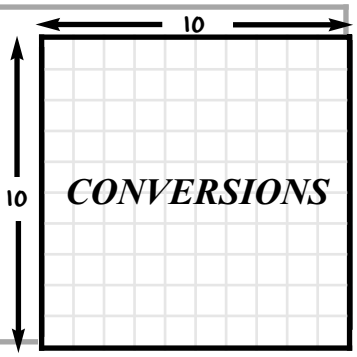
# Basic Math Skills



Lesson 3

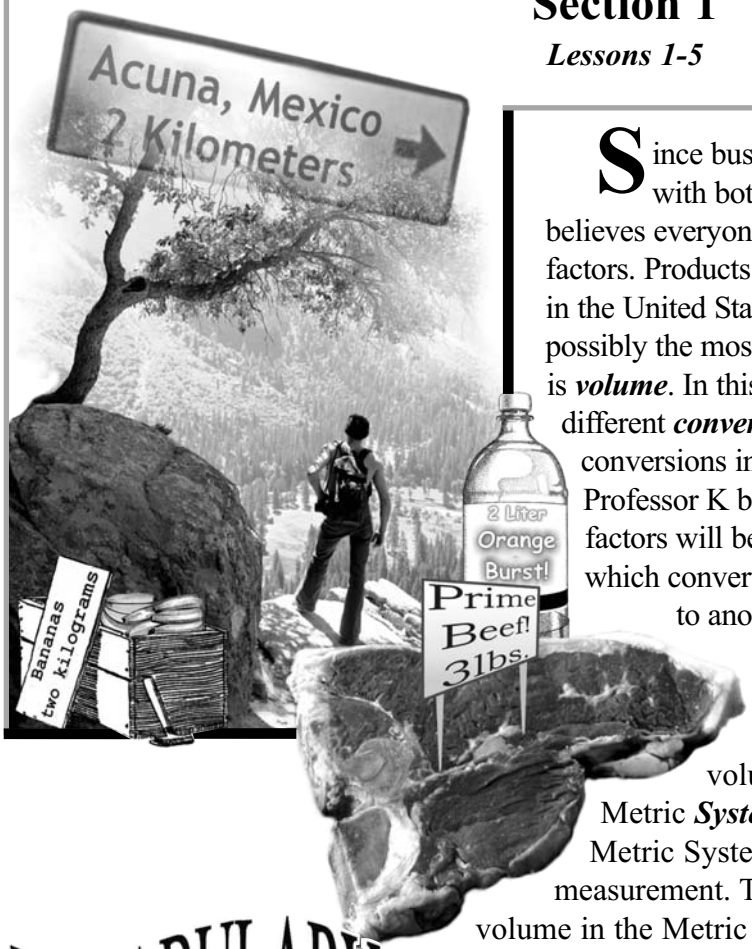
*Converting*

# Chapter 5




## Section 1

***Lessons 1-5***




Since businesses worldwide are labeling products with both English and metric units, Professor K believes everyone should be able to use conversion factors. Products from other countries fill store shelves in the United States. Professor K has noticed that possibly the most widely used measurement for products is ***volume***. In this lesson Professor K will present the different ***conversion factors*** needed to accomplish conversions involving volume measurements. Professor K believes that memorization of volume factors will benefit you in the working of problems in which converting from one system of measurement to another will be necessary.

### VOLUME

In **Table 3.1** Professor K shows some of the basic conversions for volume from the English System to the Metric ***System of measurement*** and from the Metric System to the English System of measurement. The *liter* is the basic unit for measuring volume in the Metric System. You should note that the decimals are not exact, but are rounded off for ease of calculation for this lesson. In **Example Sets 1 and 2** Professor K will show you how to use conversion factors to convert from one system to the other. Be sure to follow along with the steps that Professor K uses to work the problems.

### VOCABULARY

***Volume:*** the amount of space an object or substance occupies
***Conversion factors:*** factors multiplied by another number for the purpose of converting from one unit to another
***System of measurement:*** a standard for determining the length, weight, area, capacity or volume of something

**Table 3.1**

| English to Metric | | Metric to English | |
|---|---|---|---|
| 1 cubic inch | 16.39 cubic cm | 1 cubic cm | .061 cubic inch |
| 1 gallon | 3.785 liters | 1 cubic meter | 35.315 cubic feet |
| 1 cubic foot | 28.316 liters | 1 liter | 1.05 quarts |
| 1 quart | .946 liters | 1 liter | .264 gallon |



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**Example Set 1**

**ENGLISH TO METRIC**

a) This example demonstrates how to convert 2 cubic inches to cubic centimeters.

Follow the steps to convert 2 cubic inches into cubic centimeters. Go to **Table 3.1** and find the conversion factor needed (1 cubic in. = 16.39 cubic cm).

$$\frac{2 \text{ cubic inches}}{1} \times \frac{16.39 \text{ cubic cm}}{1 \text{ inch}} = \frac{2 \text{ cubic inches} \times 16.39 \text{ cubic cm}}{1 \text{ cubic inch} \times 1} =$$

$$\frac{2 \times 16.39 \text{ cubic cm}}{1 \times 1} = \frac{32.78 \text{ cubic cm}}{1} = 32.78 \text{ cubic cm}$$

b) Refer to Table 3.1 and convert 4.5 quarts to milliliters. (1 qt = .946 liters and 1 liter = 1000 ml)

$$\frac{4.5 \text{ quarts}}{1} \times \frac{.946 \text{ liters}}{1 \text{ quart}} \times \frac{1000 \text{ ml}}{1 \text{ liter}} = \frac{4.5 \text{ quarts} \times .946 \text{ liters} \times 1000 \text{ ml}}{1 \text{ quart} \times 1 \text{ liter} \times 1} =$$

$$\frac{4.5 \times .946 \times 1000 \text{ ml}}{1 \times 1 \times 1} = \frac{4.257 \times 1000 \text{ ml}}{1} = 4257 \text{ ml}$$

Notice in a) and b) how the conversion factors are placed (numerator and denominator) so the units you no longer need are divided out or cancelled, and the units you desire remain. Also, notice as in b), that sometimes you must convert within a measurement system to obtain the unit desired.



**METRIC TO ENGLISH**

c) Refer to Table 3.1 and convert 4 liters to quarts. (1 liter = 1.05 quarts)

$$\frac{4 \text{ liters}}{1} \times \frac{1.05 \text{ quarts}}{1 \text{ liter}} = \frac{4 \text{ liters} \times 1.05 \text{ quarts}}{1 \text{ liter} \times 1} = \frac{4 \times 1.05 \text{ quarts}}{1 \times 1} = \frac{4.2 \text{ quarts}}{1} = 4.2 \text{ quarts}$$

**Example Set 2**

**ENGLISH TO METRIC**

a) 5 gal = ??? liters

Follow the steps to convert gallons into liters. Professor K refers to **Table 3.1** and finds the conversion factor needed (1 gallon = 3.785 liters).

$$\frac{5 \text{ gallons}}{1} \times \frac{3.785 \text{ liters}}{1 \text{ gallon}} = \frac{5 \text{ gallons} \times 3.785 \text{ liters}}{1 \text{ gallon} \times 1} =$$

$$\frac{5 \times 3.785 \text{ liters}}{1 \times 1} = \frac{18.925 \text{ liters}}{1} = 18.925 \text{ liters}$$



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b) Refer to Table 3.1 and convert 3 cubic meters to cubic feet. (1 cubic meter = 35.315 cubic feet)

$$\frac{3 \text{ cubic meters}}{1} \times \frac{35.315 \text{ cubic feet}}{1 \text{ cubic meter}} = \frac{3 \cancel{\text{ cubic meters}} \times 35.315 \text{ cubic feet}}{1 \cancel{\text{ cubic meter}} \times 1} =$$

$$\frac{3 \times 35.315 \text{ cubic feet}}{1 \times 1} = \frac{105.945 \text{ cubic feet}}{1} = 105.945 \text{ cubic feet}$$

Test your knowledge of conversions between the Metric and English Systems of measurement by working the activities for this lesson.

## LIFE PRINCIPLE



**"Technology changes while human nature remains the same."**

—John Hudson Tiner



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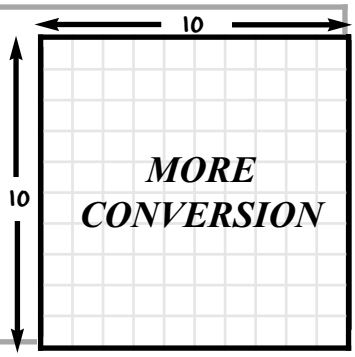
# Basic Math Skills



Lesson 4

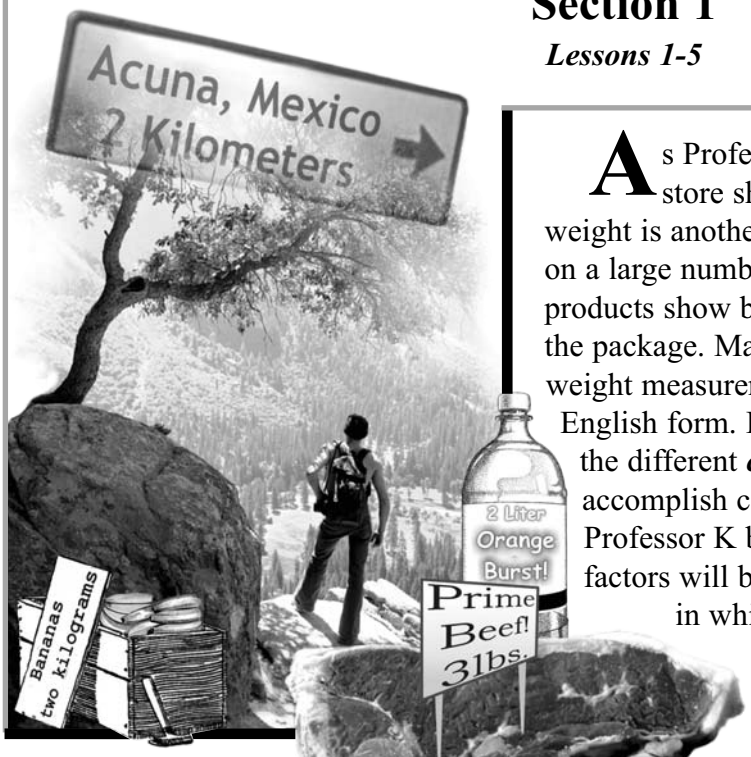
*Converting*

# Chapter 5




## Section 1

***Lessons 1-5***






**Professor K**

As Professor K looks at products on store shelves, he notices that weight is another measurement often found on a large number of products. Many products show both volume and ***weight*** on the package. Many products display weight measurement in both metric and English form. In this lesson Professor K will present the different ***conversion factors*** needed to accomplish conversions involving weight. Professor K believes that memorization of these factors will benefit you in the working of problems in which converting from one system of measurement to another will be necessary.

### WEIGHT

Professor K reminds you that the basic unit of weight is the ***gram*** in the Metric System, and the ounce in the English System. A kilogram is 1,000 grams. The largest unit in the Metric System is the metric ton. One metric ton is equal to 1,000 kilograms. Professor K presents a conversion chart for weight in **Table 4.1**. In **Example Set 1**, Professor K demonstrates converting English units of weight to metric units.

### VOCABULARY

***Weight:*** the specific quantity of mass or heaviness of a substance; due to the force of gravity on an object

***Conversion factors:*** factors multiplied by another number for the purpose of converting from one unit to another

***Gram:*** metric unit of mass or weight, equal to 15.432 grains on a metric scale

**Table 4.1**

| English to Metric | | Metric to English | |
|---|---|---|---|
| 1 ounce (oz) | 28.35 grams (g) | 1 gram (g) | .035 ounce (oz) |
| 1 pound (lb) | 454 grams (g) | 1 kilogram (kg) | 2.2 pounds (lb) |
| 1 ton (T) | 907.2 kilograms (kg) | 1 metric ton (mt) | 2200 pounds (lb) |



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**Example Set 1**

**ENGLISH TO METRIC**

a) This example demonstrates how to convert 3 oz to grams.

Follow the steps as Professor K converts 3 ounces into grams. Professor K goes to **Table 4.1** to find the conversion factor needed. (1 ounce = 28.35 grams)

$$\frac{3 \text{ ounces}}{1} \times \frac{28.35 \text{ grams}}{1 \text{ ounce}} = \frac{3 \cancel{\text{ ounces}} \times 28.35 \text{ grams}}{1 \cancel{\text{ ounce}} \times 1} =$$

$$\frac{3 \times 28.35 \text{ grams}}{1 \times 1} = \frac{85.05 \text{ grams}}{1} = 85.03 \text{ grams}$$

b) Convert 2.5 pounds to milligrams. Remember 1 pound = 454 grams and 1 gram = 1000 mg.

$$\frac{2.5 \text{ pounds}}{1} \times \frac{454 \text{ grams}}{1 \text{ pound}} \times \frac{1000 \text{ mg}}{1 \text{ gram}} = \frac{2.5 \cancel{\text{ pounds}} \times 454 \cancel{\text{ grams}} \times 1000 \text{ mg}}{1 \cancel{\text{ pound}} \times 1 \cancel{\text{ gram}} \times 1} =$$

$$\frac{2.5 \times 454 \times 1000 \text{ mg}}{1 \times 1 \times 1} = \frac{1135 \times 1000 \text{ mg}}{1} = 1{,}135{,}000 \text{ mg}$$

Professor K points out that in a) and b) the conversion factors are placed (numerator and denominator) so the units you no longer need are divided out and the units you desire remain. Also, notice as in b), that sometimes you must convert within a measurement system to obtain the unit desired.

**METRIC TO ENGLISH**

c) Convert 5 kg to pounds. (1 kg = 2.2 pounds)

$$\frac{5 \text{ kg}}{1} \times \frac{2.2 \text{ pounds}}{1 \text{ kg}} = \frac{5 \cancel{\text{ kg}} \times 2.2 \text{ pounds}}{1 \cancel{\text{ kg}} \times 1} = \frac{5 \times 2.2 \text{ pounds}}{1 \times 1} = \frac{11 \text{ pounds}}{1} = 11 \text{ pounds}$$

**Example Set 2**

**ENGLISH TO METRIC**

a) This example demonstrates how to convert 1 pound to grams.

Follow the steps as Professor K converts one pound into grams. Professor K goes to **Table 4.1** to find the conversion factor needed.

$$\frac{1 \text{ pound}}{1} \times \frac{16 \text{ ounces}}{1 \text{ pound}} \times \frac{28.35 \text{ grams}}{1 \text{ ounce}} = \frac{1 \cancel{\text{ pound}} \times 16 \cancel{\text{ ounces}} \times 28.35 \text{ grams}}{1 \cancel{\text{ pound}} \times 1 \cancel{\text{ ounce}} \times 1} =$$

$$\frac{1 \times 16 \times 28.35 \text{ grams}}{1 \times 1 \times 1} = \frac{453.6 \text{ grams}}{1} = 453.6 \text{ grams}$$



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**METRIC TO ENGLISH**

b) Convert 50 mg to oz (1 g = .035 oz).

$$\frac{50 \text{ mg}}{1} \times \frac{1 \text{ gram}}{1000 \text{ mg}} \times \frac{.035 \text{ ounces}}{1 \text{ gram}} = \frac{50 \cancel{\text{ mg}} \times 1 \cancel{\text{ gram}} \times .035 \text{ ounce}}{1000 \cancel{\text{ mg}} \times 1 \cancel{\text{ gram}} \times 1} = \frac{50 \times 1 \times .035 \text{ ounce}}{1000 \times 1 \times 1} =$$

$$\frac{1.75 \text{ ounces}}{1000 \times 1} = \frac{.00175 \text{ ounces}}{1} = .00175 \text{ ounces}$$

Professor K points out that in a) and b) the conversion factors are placed (numerator and denominator) so the units you no longer need are divided out and the units you desire remain. Also, notice as in b), sometimes you must convert within a measurement system to obtain the unit desired.

---

Show your understanding of conversions of weight by working the activities for this lesson.

# LIFE PRINCIPLE



"Weigh all your options before proceeding."

—Anonymous



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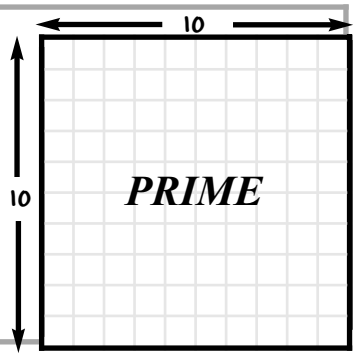

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Lesson 5

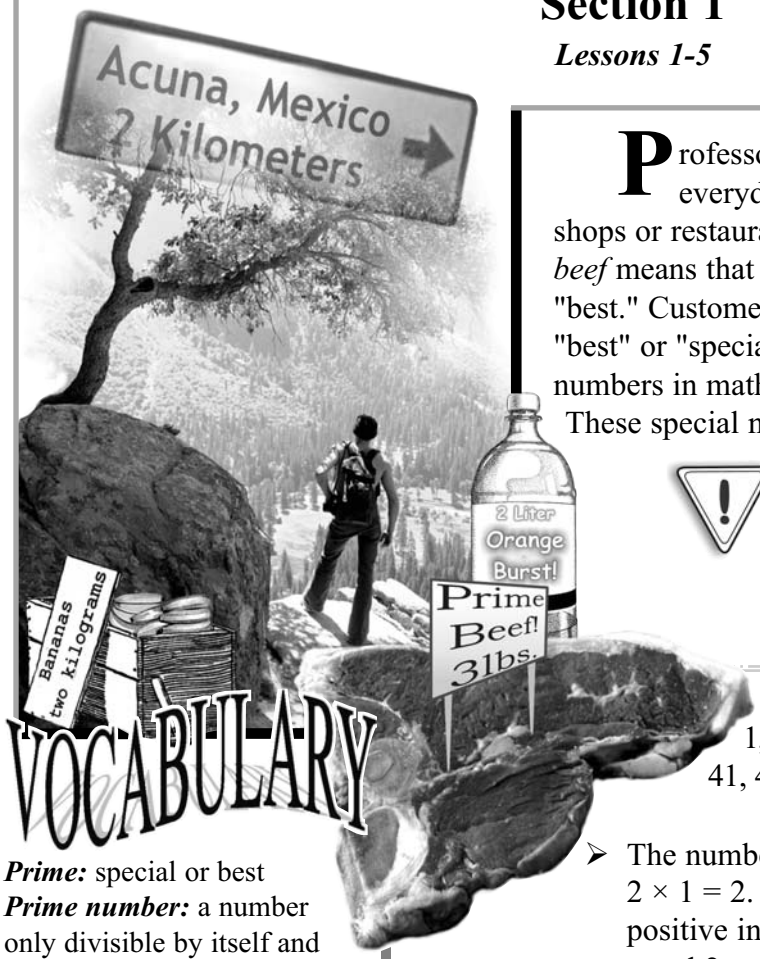
*Fundamentals*

# Chapter 5




## Section 1

***Lessons 1-5***




Professor K enjoys eating a good meal everyday. You probably have seen butcher shops or restaurants advertise, "***prime*** beef." *Prime beef* means that the meat is "really special" or the "best." Customers want to know that the meat is rated "best" or "special." Professor K knows that certain numbers in mathematics are also considered special. These special numbers are called ***prime numbers***.



**DEFINITION: PRIME NUMBER**

A prime number is a positive ***integer*** that has only two positive factors.

Here are the prime numbers 1-101:
1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 91, 97, 101.

- The number *2* is a prime number because $2 \times 1 = 2$. The numbers 2 and 1 are the only two positive integers that will multiply together to equal 2.
- The number *3* is a prime number because $3 \times 1 = 3$. The numbers 3 and 1 are the only two positive integers that will multiply together to equal 3.
- The number *4* is not a prime number because $1 \times 4 = 4$, or $2 \times 2 = 4$. There is more than one combination of positive integers that can multiply together to equal 4. The number 4 is considered a ***composite number***.

Professor K learned another way of understanding prime numbers by using the following ***analogy*** told by his grandfather. Professor K's grandfather explained that more than one road led to the ***grain elevator*** in the neighboring town.

### VOCABULARY

***Prime:*** special or best
***Prime number:*** a number only divisible by itself and one; a number whose only factors are itself and one
***Integer:*** the negative of the counting numbers, the counting numbers, and zero; …-3, -2, -1, 0, 1, 2, 3…
***Composite number:*** a number that is not prime; a number that has factors other than itself and one
***Analogy:*** a similarity of features between two things about which a comparison is formed



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When considering whether a number is a *prime number*, think about the story Professor K's grandfather told. If you can "get to" the product more than one way, then the number *is not* a prime number.

### Definition: Composite Number

A composite number is an integer, greater than the number 1, that is not a prime number.



- The number 4 is not a prime number and 4 > 1, therefore, the number 4 is a composite number.
- The number 8 is not a prime number because 1 × 8 = 8, or 2 × 4 = 8. The number 8 is also greater than 1. The number 8, therefore, is a composite number.
- Remember the story the old farmer told Professor K. If you can "get to" the product in more than one way, then the number is a composite number.

### Fundamental Theorem of Arithmetic

The Fundamental Theorem of Arithmetic states that every composite number has one and only one ***prime factorization***. The prime factors of a number in a list can be in any order.

30 = 2 • 3 • 5. The prime factors of 30 are 2, 3, 5; or 5, 3, 2; or 3, 2, 5; or 3, 5, 2.

Look at **Example Set 1** and follow Professor K's explanation of *prime factors*.

**Example Set 1**

Find all the prime factors of the following numbers.

a) 6, Prime factors: 2, 3

a) $2 \times 3 = 6$; *2* and *3* are prime numbers, therefore, *2* and *3* are all prime factors of *6*.

b) 8, Prime factors: 2, 2, 2

b) $2 \times 2 \times 2 = 8$, therefore *2*, *2*, and *2* are all the factors of 8. Since 2 is a prime number, *2*, *2*, and *2* are all prime factors of *8*.

c) 25, Prime factors: 5, 5

c) $5 \times 5 = 25$; therefore *5* and *5* are all the factors of *25*. Since *5* is a prime number, *5* and *5* are all prime factors of *25*.

d) 99, Prime factors: 3, 3, 11

d) $3 \times 3 \times 11 = 99$, therefore *3*, *3*, and *11* are all the factors of *99*. Since *11* and *3* are prime numbers, *3*, *3*, and *11* are all prime factors of *99*.

### VOCABULARY

***Grain elevator:*** a place where farmers take their harvested grain for sale and storage

***Prime factorization:*** finding all the prime factors of a number.



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Professor K points out that the numbers, *6*, *8*, *25*, and *99* in **Example Set 1** are composite numbers. These numbers are composed of several prime factors.

You are doing great!! After completing the activities for this lesson, ask your teacher for the Section One Quiz. A grade of 85% or better on all three section quizzes may exempt you from having to take the Chapter Test.

# LIFE PRINCIPLE



*"Man's nature is composed of good and bad. The nature he feeds the most is the most powerful."*

—American Indian Axiom



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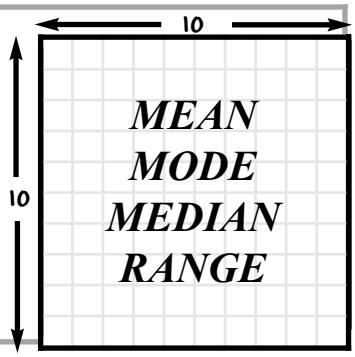
# Basic Math Skills




Lesson 6

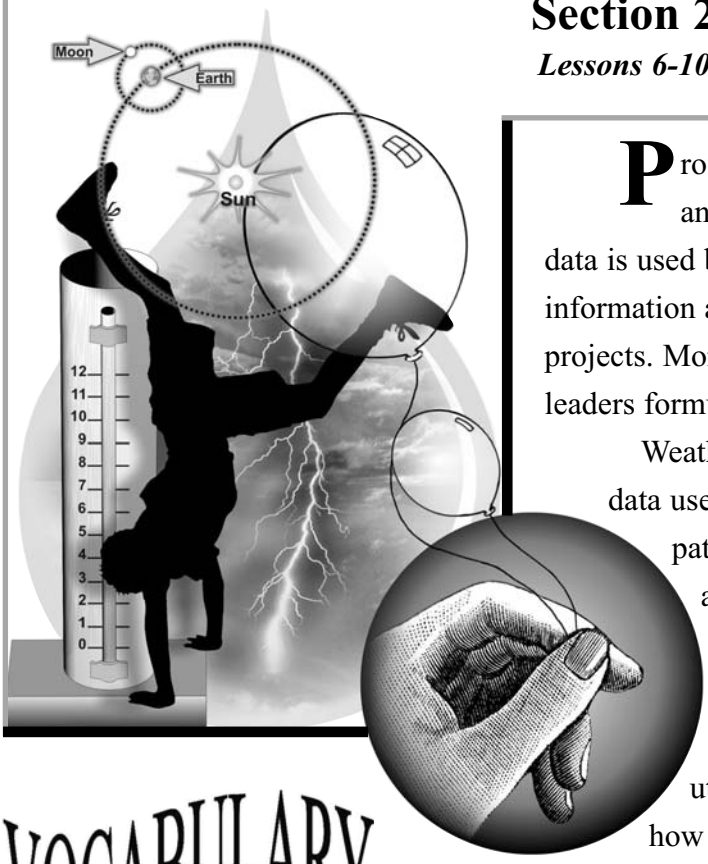
# Chapter 5

*Fundamentals*




## Section 2

***Lessons 6-10***




Professor K notices various types of data and statistics displayed in books. Some data is used by government agencies to reveal information about citizens or operational expenses for projects. Monitoring information helps governmental leaders formulate and pass laws.

Weather reports present another example of data used to show information about storm patterns. Meteorologists use data, such as average daily temperature and rainfall totals, from previous days and years, to predict weather conditions for the present and future. Weathermen also utilize a variation of the ***mode*** by counting how many temperatures were above 100° or below freezing during the summer or winter.

## VOCABULARY

***Mode:*** the number that occurs most often in a set of data
***Mean:*** average; also called the arithmetic mean
***Bimodal:*** a set or list of numbers with two modes
***Median:*** the middle set of numbers placed in numerical order
***Range:*** method of measuring the spread of data; subtract smallest data from largest data

### Definition: Mean

The ***mean*** is the average of a set of data. The mean is calculated by dividing the sum of all the data by the number of data.

In **Example Set 1**, Professor K demonstrates calculating the *mean* of a group of data. Follow the steps closely with Professor K so that you, too, can determine the mean of a set of data.

**Example Set 1**

The following example demonstrates how Professor K finds the mean of the following numbers:



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a) 3, 5, 2, 13, 5, 6, 10, 12

a) Given is a list of numbers.

**Step 1** $3 + 5 + 2 + 13 + 5 + 6 + 10 + 12 = 56$

To find the mean of the given set of numbers in a), Professor K must first obtain a total sum of all the numbers. (Step 1)

**Step 2** $\frac{56}{8} = 7$

Then divide the total (*56*) by the quantity of numbers (*8*) to obtain the mean or average (*7*). (Step 2)

b) 4, 1, 15, 25, 50, 7, 64, 2, 21

**Step 1** $4 + 1 + 15 + 25 + 50 + 7 + 64 + 2 + 21 = 189$

Notice the above list of nine numbers. (Step 1) Find the sum of all the numbers by simply adding the numbers.

**Step 2** $9\overline{)189}$ $\quad 21$

Divide the sum by *9* to obtain the mean, *21*.

c) 5, 3, 7, 8, 2

**Step 1** $\frac{5+3+7+8+2}{5} =$

Notice the above list of five numbers. Place the five numbers in the numerator and the *5* in the denominator. This shows a condensed method. (Step 1)

**Step 2** $\frac{25}{5} = 5$

The sum is then divided by *5*, obtaining a mean of *5*.

### DEFINITION: MODE

The mode is the number that occurs most in a set of data.



**Example Set 2** shows how Professor K determines the mode in a list or set of data.

**Example Set 2**

Find the mode.

a) 23, 45, 54, 63, 34, 23, 54, 33, 23

a) In this list of numbers, or data, *23* occurs three times. No other number occurs three times, therefore, *23* is the mode.

b) 4, 5, 2, 6, 7, 5, 3, 2, 5, 7, 2

b) In this list of numbers, *5* and *2* both occur three times, therefore, this list has two modes (*5* and *2*). This list of numbers is said to be ***bimodal***.

c) 12, 13, 35, 12, 64, 23, 12, 23, 78, 12

c) *12* is the mode, because *12* occurs four times.



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### Definition: Median

The ***median*** is the middle number in a list of numbers arranged in increasing numerical order.

**Example Set 3** shows how Professor K determines the median from a list of numbers.

**Example Set 3**

Find the median.
a) 4, 2, 56, 34, 99, 23, 45, 67, 76.

| | | |
|---|---|---|
| ***Step 1*** | 2, 4, 23, 34, 45, 56, 67, 76, 99 | This list of numbers must first be rearranged in increasing numerical order (Step 1). |
| ***Step 2*** | 2, 4, 23, 34, 45, 56, 67, 76, 99 | Since the list contains an *uneven* number of numbers, nine, the middle number will be the fifth number from the left. The median then is *45*. As many numbers exist to the left of *45* as to the right of *45* (Step 2). *2, 4, 23, 34,* ***45****, 56, 67, 76, 99* |

b) 5, 10, 4, 3, 15, 20

| | | |
|---|---|---|
| ***Step 1*** | 3, 4, 5, 10, 15, 20 | This list of numbers has an even number of items and must be rearranged in increasing numerical order (Step 1). |
| ***Step 2*** | $\frac{5+10}{2}=\frac{15}{2}=7\frac{1}{2}$ | Since this list contains an *even* number of items, the *median* occurs between the middle two numbers. To find the *median* Professor K must find the *mean* of the middle two numbers. (Step 2) $7\frac{1}{2}$ is the *median*. |



### Definition: Range

The ***range*** of a list of numbers is identified by calculating the spread of data. The simplest method to find the range is to subtract the smallest data from the largest data. The difference is called the range.

**Example Set 4** demonstrates how Professor K finds the range of a list of data.

**Example Set 4**

Find the range of the following data.
a) 3, 6, 5, 7, 9, 15

a) Professor K must determine which data has the smallest value, *3*, and which data has the largest value, *15*. Subtract the smallest data (3) from the largest data (15), 15 - 3 = 12. The range is 12.



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b) 45, 32, 13, 99, 35, 6, 2, 67, 78

b) Professor K must determine which data has the smallest value, *2*, and which data has the largest value, *99*. Subtract the smallest data (2) from the largest data (99). The range is 97.

---

You are learning so much about using numbers. Complete the activities for this lesson to further understand these concepts.

## LIFE PRINCIPLE



**"The greatest person is not found in the middle of the crowd. He stands apart."**

—Anonymous



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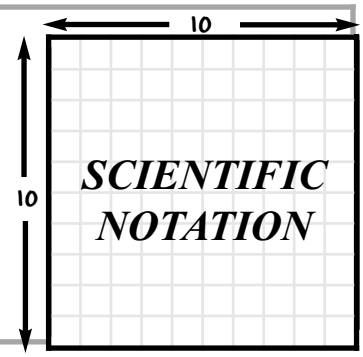
Lesson 7

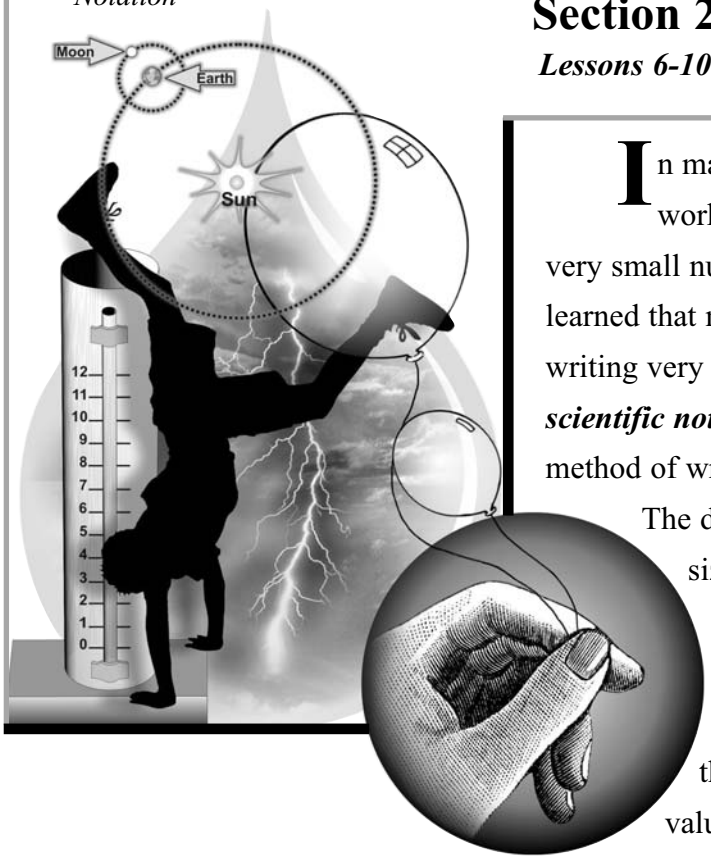
*Scientific Notation*

# Chapter 5

## Section 2

***Lessons 6-10***




In mathematics and science, writing and working problems involving very large or very small numbers are ***cumbersome***. Professor K learned that mathematicians devised a method of writing very large or very small numbers called ***scientific notation***. *Scientific notation* is a shorthand method of writing these numbers using ***powers of ten***.

The distances to planets from the Sun or the size of atoms are difficult to show as a "regular" number, but scientific notation simplifies calculations.

In **Table 7.1**, Professor K shows the different whole numbers and decimal values for some *powers of ten*.

**Table 7.1**

| Powers of ten | Number or decimal |
|---|---|
| $10^{-5}$ | $^{1}/_{100,000}$ or .00001 |
| $10^{-4}$ | $^{1}/_{10,000}$ or .0001 |
| $10^{-3}$ | $^{1}/_{1,000}$ or .001 |
| $10^{-2}$ | $^{1}/_{100}$ or .01 |
| $10^{-1}$ | $^{1}/_{10}$ or .1 |
| $10^{0}$ | 1 |
| $10^{1}$ | 10 |
| $10^{2}$ | 100 |
| $10^{3}$ | 1,000 |
| $10^{4}$ | 10,000 |
| $10^{5}$ | 100,000 |

## VOCABULARY

***Cumbersome:*** difficult to work with

***Scientific notation:*** a shorthand method for writing very large or very small numbers

***Powers of ten:*** the number 10, raised to various powers, usually used in place value and scientific notation



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Professor K encourages you to notice in **Table 7.1** that the value of the tens with positive exponents are found by performing the multiplication by ten the number of times determined by the exponent. Therefore,

$$10^1 = 10$$
$$10^2 = 10 \times 10 = 100$$
$$10^3 = 10 \times 10 \times 10 = 1000$$
$$10^4 = 10 \times 10 \times 10 \times 10 = 10{,}000$$
$$10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100{,}000$$

In **Table 7.1**, Professor K points out that ten raised to negative powers produces fractions with decimal equivalents. The negative sign in the exponent causes the power of ten to become the denominator of a unit fraction (a fraction with one in the numerator). The power of ten therefore, appears to have been flipped. Professor K thinks of a person standing on his head to illustrate this concept. This person's new position is the inverse (flipped upside down or opposite of the usual) of his usual stance. In mathematics the resulting number is called the *multiplicative inverse* of the original number. The inverse is multiplied the amount of times as indicated by the exponent. Therefore, Professor K shows these inverses as follows:

$$10^{-1} = {}^1/_{10} = .1$$
$$10^{-2} = {}^1/_{10} \times {}^1/_{10} = {}^1/_{100} = .01$$
$$10^{-3} = {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} = {}^1/_{1{,}000} = .001$$
$$10^{-4} = {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} = {}^1/_{10{,}000} = .0001$$
$$10^{-5} = {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} \times {}^1/_{10} = {}^1/_{100{,}000} = .00001$$

Another way Professor K expresses the process is: *ten is multiplied the given amount of times as determined by the exponent*, and then the product is placed in the denominator of a unit fraction (a fraction with a one in the numerator).



To put a number into scientific notation, move the decimal point from its original position in the number to the place where there is only one digit to the left of the decimal point (2789.6 becomes $2.7896 \times 10^?$). Write this resulting number and multiply it by the correct power of ten. The correct power of ten if determined by counting the number of places the decimal point was moved. For 2789.6 to become 2.7896, the decimal point is moved three places to the left, so the exponent on the power of ten is 3 ($2.7896 \times 10^3$). If the decimal point was moved to the left, the exponent on the power of ten will be positive. If the decimal was moved to the right, the exponent on the power of ten will be negative. For example, .0361 becomes $3.61 \times 10^{-2}$, because the decimal was moved two places to the right.

Look at **Example Set 1** to understand how Professor K changes numbers to scientific notation. Be sure to follow Professor K's explanation closely as he converts the numbers to scientific notation.

**Example Set 1**

Change the following numbers to scientific notation.

a) 6,000

$6{,}000 = 6 \times 1000 =$
$6 \times 10 \times 10 \times 10 = 6 \times 10^3$

a) The number is *6,000*. *6,000* can be expressed as *6* multiplied by *1,000* or *6* multiplied by *10* three times, or *6* times *10* cubed.



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b) .87563
$.87563 = 8.7563 \times {}^{1}/_{10} =$
$8.7563 \times 10^{-1}$

b) The number, *.87563* is equivalent to $8.7563 \times {}^{1}/_{10}$ or $8.7563 \times 10^{-1}$.

---

In **Example Set 1**, Professor K demonstrates an important rule of scientific notation.



**RULE 1**

The proper form for the answer to a problem given in scientific notation is: $A.00 \times 10^{n}$, where A is any digit 1, 2, 3, 4, 5, 6, 7, 8, 9 and *n* is zero or any positive or negative number.

In **Example Set 1** a), the $A = 6$. Professor K points out that a decimal point is understood to be to the right of the 6. In **Example Set 1** b), $A = 8$. A decimal point is necessary in this problem since other numbers remain to the right of the decimal point.
Professor K checks his answer by looking at the exponent of the *10*. Look at **Rule 2**.



**RULE 2**

**To check your work for accuracy:**

If the exponent is **positive**, move the decimal to the right the number of places equal to the value of the exponent and you should have the original number before you put it into scientific notation.

If the exponent is **negative**, move the decimal to the left the number of places equal to the numerical value of the exponent and you should have the original number before you put it into scientific notation.

**Example Set 2** shows the process of moving the decimal point to convert a number to scientific notation.

**Example Set 2**

Change the following numbers from standard numerical form into scientific notation form.

a) $546.43 \rightarrow 5.4643 \times 10^{2}$

a) The number *546.43* becomes $5.4643 \times 10^{2}$, because Professor K must move the decimal to the left so that the answer is in proper scientific notation form.

Check for accuracy:
$5.4643 \times 10^{2} =$
$5.4643 \times 100 = 546.43$

Checking to make sure he moved the decimal correctly; $10^{2}$ or *100* must multiply the answer. This operation moves the decimal back two places to the right and produces the original number. Therefore, the answer, $5.4643 \times 10^{2}$ is correct.

b) $.0395 \rightarrow 3.95 \times 10^{-2}$

b) The number, *.0395* becomes $3.95 \times 10^{-2}$ in proper scientific notation form.

Check
$3.95 \times 10^{-2} =$
$3.95 \times {}^{1}/_{100} =$
${}^{3.95}/_{100} = .0395$

The exponent is negative because to return to the original number the decimal must be moved two places to the left. The negative sign points the direction (left) that the decimal must be moved.

---



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Professor K wants you to notice in **Example Set 2**, that the "checking for accuracy" sections converts numbers in scientific notation back into regular numeric form to determine if the correct answer was obtained.

Work the activities for this lesson to demonstrate that you understand scientific notation.

## LIFE PRINCIPLE



**"Seek direction from one who has already been there."**

—Old Zulu saying



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# Chapter 5

**Lesson 8**

*Scientific Notation*

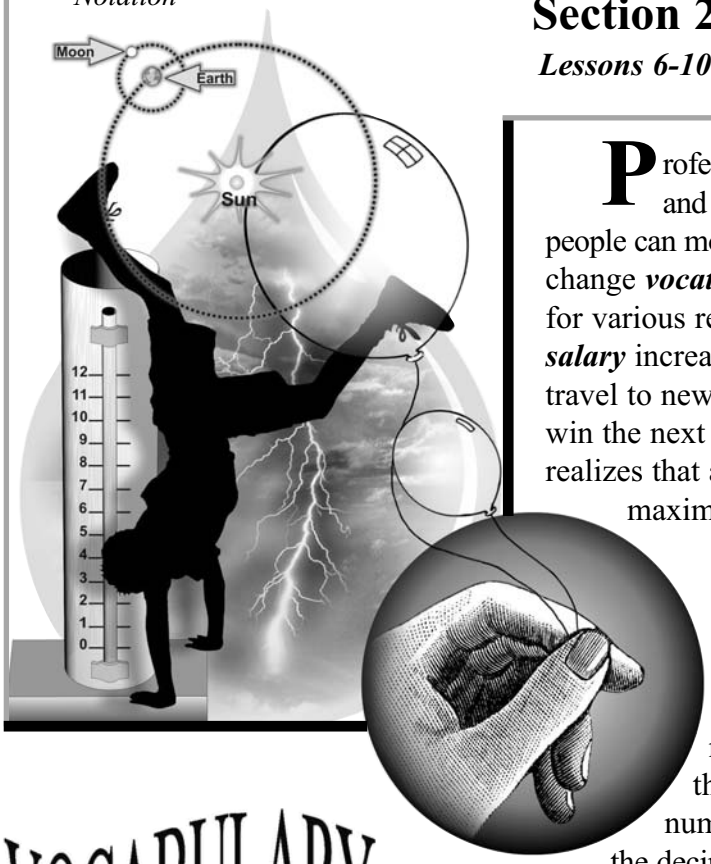
## Section 2

***Lessons 6-10***

10

10

***OPERATING SCIENTIFIC NOTATION***




Professor K has noticed in the lives of his family and friends, changes often must occur before people can move on to bigger responsibilities. Men change ***vocations*** and jobs and move to new places for various reasons, such as promotion and obtaining ***salary*** increases. Adventurous people are anxious to travel to new places, to climb the next mountain or win the next race. Without change, Professor K realizes that a person seldom produces at his maximum potential.

### ADDITION

Professor K points out that to add numbers written in scientific notation, the *powers of ten* must be equal. This often means that you must change the numbers to improper form and then add the ***numeric*** portion of the scientific number. This procedure is necessary to align the decimals properly for addition. **Example Set 1** demonstrates how Professor K adds numbers written in scientific notation. Be sure to read **Rule 1** to better understand the process of adding numbers written in scientific notation form.

## VOCABULARY

***Vocation:*** a particular occupation, business or profession; the type of work a person does to earn a living
***Salary:*** a certain, fixed amount of money a person earns for regular work or services; from the word *salt*; in ancient times some soldiers were paid in salt
***Numeric:*** refers to standard numbers

### RULE 1

The addition of numbers in scientific notation form is accomplished by following several steps.

- **Step 1** - The powers of ten must be equal. Adjust decimal points as needed.
- **Step 2** - Once the powers of ten are equal, simply add the numeric portions.
- **Step 3** - Make sure the final answer is in proper scientific notation form.



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**Example Set 1**

Add the following numbers. Write answers in proper form.

a) $54.3 \times 10^3 + 4.7 \times 10^3$

| | | |
|---|---|---|
| ***Step 1*** | $(54.3 + 4.7) \times 10^3$ | In this problem the *powers of ten* are *equal*, therefore, Professor K simply adds the numeric portions, leaving the powers of ten the same. (Step 1) |
| ***Step 2*** | $59 \times 10^3 = 59 \times 1{,}000 = 59{,}000$ | Next, Professor K can change $10^3$ to its numeric equivalent, *1000*, and multiply. (Step 2) |
| ***Step 3*** | $59{,}000 = 5.9 \times 10^4$ | Then Professor K must convert the answer to proper scientific notation form. (Step 3) |

b) $5.3218 \times 10^5 + 4.432 \times 10^4$

| | | |
|---|---|---|
| ***Step 1*** | $4.432 \times 10^4 = .4432 \times 10^5$ | In this problem the *powers of ten* are *unequal*, therefore, one of the powers must be changed. (Step 1) |
| ***Step 2*** | $5.3218 \times 10^5 + .4432 \times 10^5$ | Next, Professor K places the converted number in the addition problem. (Step 2) |
| ***Step 3*** | $(5.3218 + .4432) \times 10^5$ | Now that the powers of ten are equal, Professor K can add the numeric portions together. (Step 3) |
| ***Step 4*** | $5.7650 \times 10^5$ | Professor K notices that the answer is in proper scientific notation form, so no conversion is necessary. (Step 4) |

In the next part of this lesson, Professor K explains the subtraction of numbers written in scientific notation. Study this part carefully with Professor K to understand this mathematical operation. Begin by reading **Rule 2**.





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## RULE 2

The subtraction of numbers in scientific notation form is accomplished by following several steps.

- **Step 1** - The powers of ten must be equal. Adjust decimal points as needed.
- **Step 2** - Once the powers of ten are equal, simply subtract the numeric portions.
- **Step 3** - Make sure the final answer is in proper scientific notation form.

In **Example Set 2** Professor K demonstrates the subtraction of numbers written in scientific notation.

**Example Set 2**

Subtract the following. Professor K points out that answers must be placed in the proper form.

a) $532.5 \times 10^1 - 4.52 \times 10^2$

| | | |
|---|---|---|
| ***Step 1*** | $5325 = 53.25 \times 10^2$ | In this problem Professor K notices that the *powers of ten* are unequal. One of the powers must be changed. (Step 1) |
| ***Step 2*** | $53.25 \times 10^2 - 4.52 \times 10^2$ | Professor K places the converted number in the subtraction problem. (Step 2) |
| ***Step 3*** | $(53.25 - 4.52) \times 10^2$ | Professor K subtracts the numeric portions, keeping the power of ten the same. (Step 3) |
| ***Step 4*** | $48.73 \times 10^2$ | Professor K can convert this answer (Step 4) to its numeric equivalent and then to proper scientific notation form. (Step 5) |
| ***Step 5*** | $4873 = 4.873 \times 10^3$ | |

b) $98.345 \times 10^4 - 783.3 \times 10^3$

b) This problem contains numbers with unequal powers of ten. Professor K knows that one of the numbers must be changed. (Step 1)

| | | |
|---|---|---|
| ***Step 1*** | $783.3 \times 10^3 = 78.33 \times 10^4$ | Moving the decimal point one more place to the left adds one to the exponent on the power of ten. |
| ***Step 2*** | $98.345 \times 10^4 - 78.33 \times 10^4$ | Professor K places the converted number in the subtraction problem. (Step 2) |



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| | | |
|---|---|---|
| **Step 3** | $(98.345 - 78.33) \times 10^4$ | Professor K subtracts the numeric portions, keeping the power of ten the same. (Step 3) |
| **Step 4** | $20.015 \times 10^4$ | Professor K can convert this answer (Step 4) to its numeric equivalent and then to proper scientific notation form. (Step 5) |
| **Step 5** | $200150 = 2.0015 \times 10^5$ | |

You are making progress. Complete the activities to demonstrate your understanding of scientific notation.

## LIFE PRINCIPLE



**"A man has the power to make decisions that will change his life for the better."**

—Anonymous



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# Basic Math Skills



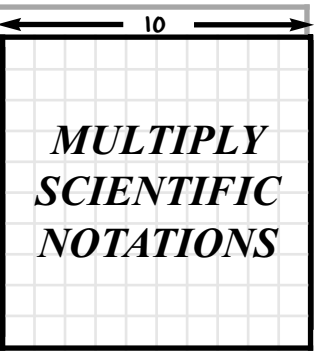

Lesson 9

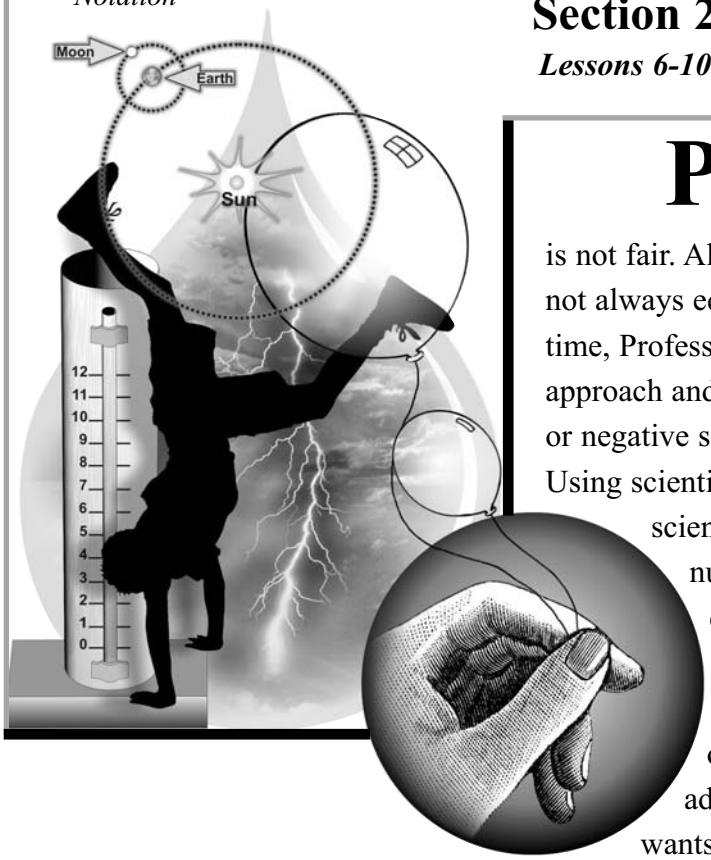
*Scientific Notation*

# Chapter 5

## Section 2

***Lessons 6-10***






**Professor K**

**P**rofessor K has noticed that some people believe that life is not fair. Although circumstances are not always equal for everyone all the time, Professor K believes with the right approach and attitude, you can turn bad or negative situations into positive opportunities. Using scientific notation is a means by which scientists and industrialists turn complex numbers into usable data for solving equations.

When multiplying numbers written in scientific notation, the powers of ten are not required to be equal as in addition and subtraction. Professor K wants you to study **Rule 1**.



**RULE 1**

When multiplying numbers in scientific notation form, the numeric portions are grouped and multiplied together and the ***exponents*** are added.

## VOCABULARY

***Exponent:*** a number, written in smaller script, placed after and upward from a given number to define the power to which the given number is to be raised, such as $10^4$

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

In **Example Sets 1 and 2**, Professor K demonstrates the multiplication of numbers written in scientific notation. Follow the steps that Professor K takes to perform this operation so that you too can multiply numbers in scientific notation form.

In **Example Set 1**, find the ***product*** of the following numbers (next page). Professor K writes the answers in proper form.



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**Example Set 1**

a) $(44.1 \times 10^4)(1.1 \times 10^3)$

| | | |
|---|---|---|
| ***Step 1*** | $(44.1 \times 1.1) \times 10^{4+3}$ | In this problem, the first step for Professor K is to group the numeric portions for multiplication and add the exponents (Step 1). |
| ***Step 2*** | $48.51 \times 10^7 = 48.51 \times 10{,}000{,}000$ | Professor K performs the multiplication of the numeric portions and the addition of the exponents. Professor K then changes the *power of ten* to its numeric equivalent and multiplies it by the numeric product (Step 2). |
| ***Step 3*** | $485{,}100{,}000 = 4.851 \times 10^8$ | Professor K converts the numeric answer into scientific notation (Step 3). |

b) $(32.1 \times 10^8)(2 \times 10^4)$

| | | |
|---|---|---|
| ***Step 1*** | $(32.1 \times 2) \times 10^{8+4} = 64.2 \times 10^{12}$ | Professor K notices that this problem is written in a little different form, but he follows the same process. Professor K groups the numeric portions for multiplication and adds the exponents. (Step 1). |
| ***Step 2*** | $64.2 \times 10^{12} = 64{,}200{,}000{,}000{,}000$ | Professor K converts the answer to its numeric equivalent (Step 2). |
| ***Step 3*** | $64{,}200{,}000{,}000{,}000 = 6.4 \times 10^{13}$ | Professor K now converts the numeric equivalent into scientific notation (Step 3). |

In **Example Set 2**, find the product of the following numbers. Professor K writes the answers in proper form.

**Example Set 2**

a) $(2.1 \times 10^2)(2.1 \times 10^3)$

| | | |
|---|---|---|
| ***Step 1*** | $(2.1 \times 2.1) \times 10^{2+3}$ | In this problem, the first step for Professor K is to group the numeric portions for multiplication and add the exponents (Step 1). |



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| | | |
|---|---|---|
| ***Step 2*** | $4.41\times 10^5$ | Professor K performs the multiplication of the numeric portions and the addition of the exponents (Step 2). |

b) $(25 \times 10^8)(3 \times 10^6)$

| | | |
|---|---|---|
| ***Step 1*** | $(25 \times 3) \times 10^{8+6} = 75 \times 10^{14}$ | Professor K notices that this problem is written in a little different form, but he follows the same process. Professor K groups the numeric portions for multiplication and adds the exponents (Step 1). |
| ***Step 2*** | $75 \times 10^{14} = 7{,}500{,}000{,}000{,}000{,}000$ | Professor K converts the answer to its numeric equivalent (Step 2). |
| ***Step 3*** | $750{,}000{,}000{,}000{,}000 = 7.5 \times 10^{15}$ | Professor K now converts the numeric equivalent into scientific notation (Step 3). |

Show Professor K you understand multiplying numbers written in scientific notation form by working the activities for this lesson.

## Life Principle



"When life gives you a handful of lemons, turn them into lemonade."

—Anonymous



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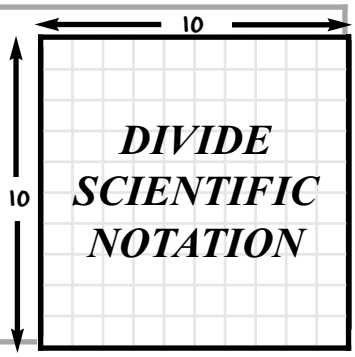
# Basic Math Skills




Lesson 10

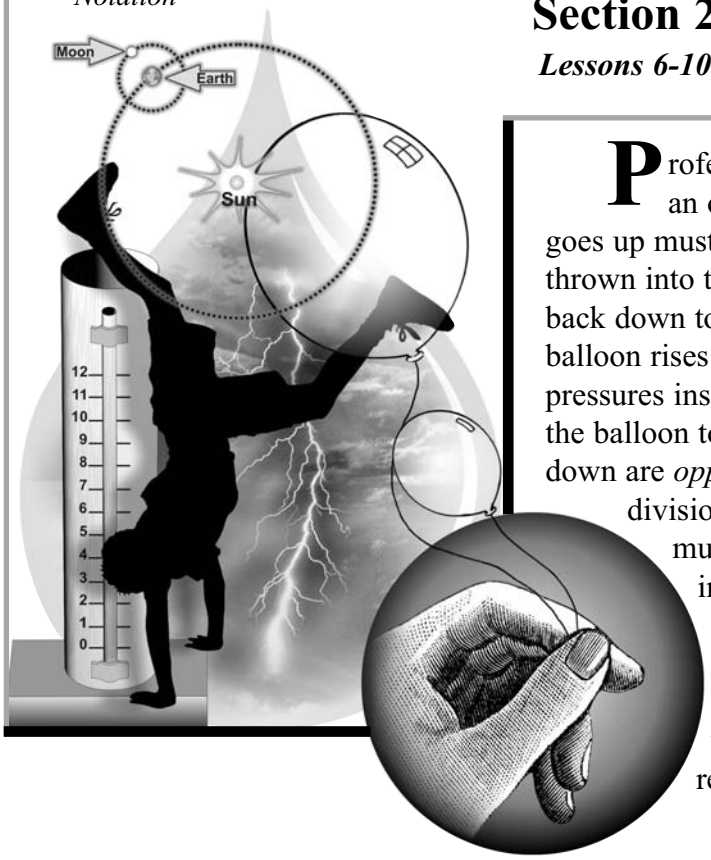
*Scientific Notation*

# Chapter 5




## Section 2

***Lessons 6-10***






Professor K once told his children an old axiom that stated, "What goes up must come down." If a ball is thrown into the air, gravity will pull it back down to Earth. A lighter than air balloon rises until it bursts or the pressures inside the balloon change enough to cause the balloon to return to Earth. Going up and coming down are *opposites*. As we learned in Chapter 1, division is the *opposite* operation from multiplication. Professor K will demonstrate in this lesson how to divide numbers in scientific notation form.

Professor K offers the diagram below to remind you of the positions of the *quotient*, *divisor*, and *dividend* in relation to the division symbol, the *tabletop*.

$$\text{divisor}\overline{)\,\text{dividend}}\ \text{quotient}$$

Study **Rule 1** so that you can follow Professor K's example of the division of numbers in scientific notation form.

### RULE 1

When dividing numbers in scientific notation form, the numeric portions are grouped and divided and the power of ten of the divisor is subtracted from the power of ten of the dividend.

$$(4 \times 10^4) \div (2 \times 10^2) = (4 \div 2) \times 10^{4-2} = 2 \times 10^2$$

$$\frac{7.5\times10^8}{5\times10^3} = (7.5 \div 5)\times10^{8-3} = 1.5\times10^5$$

## VOCABULARY

***Quotient:*** The answer to a division problem
***Dividend:*** the number being divided
***Divisor:*** the number of portions the dividend is divided into



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Remember from the previous lesson you studied the multiplication of numbers written in scientific notation form. The rule for multiplying such numbers states that you must add the exponents of the *factors of ten*. Notice in **Rule 1** that in division you must *subtract* the exponents. Professor K wants you to realize that since division is the *opposite* of multiplication, you must subtract the exponents instead of adding the exponents of the factors of ten. In **Example Set 1** Professor K demonstrates the division of numbers written in scientific notation. Follow the steps closely as Professor K works through the problem.

**Example Set 1**

Find the indicated quotient of the following. Be sure your answer is in the proper form.

a) $448 \div (2 \times 10^2)$

| | | |
|---|---|---|
| **Step 1** | $448 = 4.48 \times 10^2$ | In this division problem, *448* must be changed into scientific notation form (Step 1). |
| **Step 2** | $\frac{4.48\times10^2}{2\times10^2} = \frac{4.48}{2}\times10^{2-2}$ | Place this conversion in the numerator of a fraction with $2 \times 10^2$ as the denominator. (Remember, a fraction is another method to signify division.) Separate the numeric portion and subtract the powers of ten (Step 2). |
| **Step 3** | $2.24 \times 10^0 = 2.24 \times 1 = 2.24$ | Perform the division and subtraction. $^{4.48}/_{2} = 2.24$, and $10^0 = 1$, therefore $2.24 \times 10^0 = 2.24$ (Step 3). |

b) $(2.35 \times 10^3) \div (2.5 \times 10^{-1})$

| | | |
|---|---|---|
| **Step 1** | $\frac{2.35\times10^3}{2.5\times10^{-1}} = \frac{2.35}{2.5}\times10^{3-(-1)}$ | This problem is simplified in the same manner as the previous problem. Place the dividend in the numerator and the divisor in the denominator. Separate the numeric portion and subtract the powers of ten as shown (Step 1). |
| **Step 2** | $.94 \times 10^4 = 9.4 \times 10^3$ | Perform the indicated operations and convert to proper scientific notation form (Step 2). |

**Example Set 2**

Find the indicated quotient of the following. Be sure your answer is in the proper form.

a) $(25{,}000) \div (5 \times 10^3)$

| | | |
|---|---|---|
| **Step 1** | $25{,}000 = 2.5 \times 10^4$ | In this division problem, *25,000* must be changed into scientific notation form (Step 1). |



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**Step 2** $\frac{2.5\times10^{4}}{5\times10^{3}}=\frac{2.5}{5}\times10^{4-3}$

Place this conversion in the numerator of a fraction with $5 \times 10^{3}$ as the denominator. (Remember, a fraction is another method to signify division.) Separate the numeric portion and subtract the *powers of ten* (Step 2).

**Step 3** $.5 \times 10^{1} = .5 \times 10 = 5$

Perform the division and subtraction. $^{2.5}/_{5} = .5$, and $10^{1} = 10$; therefore $.5 \times 10^{1} = 5$ (Step 3).

---

Show Professor K you understand dividing numbers written in scientific notation form by working the activities for this lesson.

## Life Principle



"Strife causes division in the hearts of friends."

—Anonymous



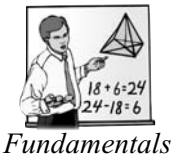
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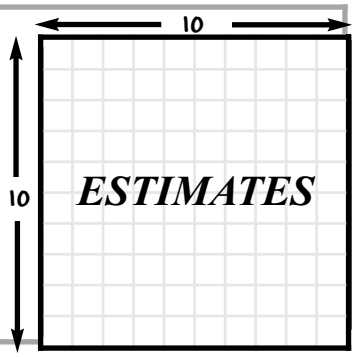
# Basic Math Skills




*Fundamentals*

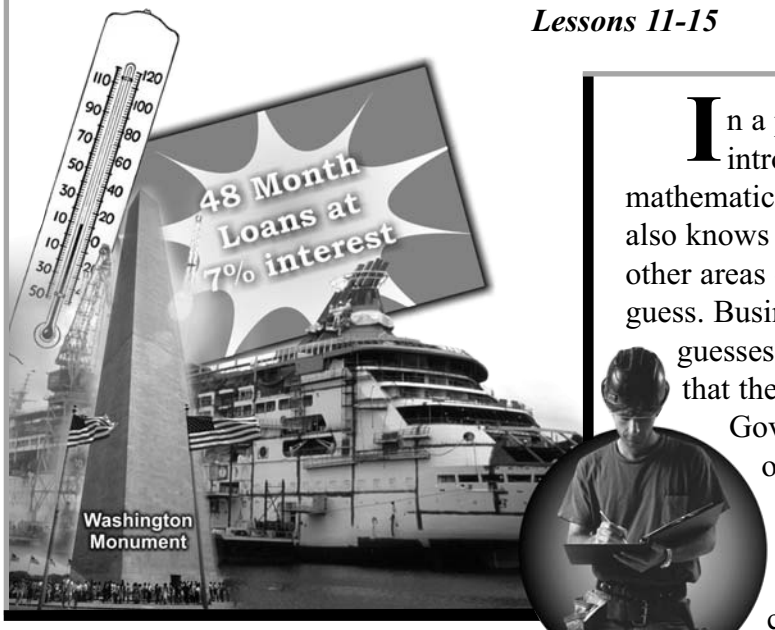
**Lesson 11**

# Chapter 5




## Section 3

***Lessons 11-15***

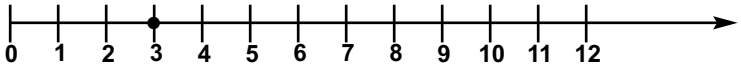



In a previous chapter, Professor K introduced you to the process in mathematics called ***estimation***. Professor K also knows that this process is important in other areas of life. An estimation is an educated guess. Business ***entrepreneurs*** make educated guesses as to the profitability of a product that they wish to produce and sell. Government leaders make laws based on estimations of the cost of government in the future, amount of crime, and population growth. Contractors estimate the cost of constructing houses, office buildings, roads and bridges. Estimations help a person get an idea of what an outcome will be.

Professor K will teach you how to make mathematical estimations based on your previous knowledge and facts given in the problem. Work through the examples with Professor K as he makes estimates based on the facts that are given in each problem.

### Example Set 1

Estimate the value of $\sqrt{3}$ and show the value on a number line. Professor K looks at the question and then recalls his prior knowledge. The number *3* is between *1* and *4* on the number line (below). The numbers *1* and *4* are the nearest number to *3* on each side of *3* that are perfect squares. Always look for the numbers that are perfect squares that are closest to the number being estimated.




## VOCABULARY

***Estimation:*** an educated guess
***Entrepreneur:*** a person who develops a business venture with the understanding that financial risk is involved



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Professor K realizes therefore, that the value of $\sqrt{3}$ must be between the value of $\sqrt{1}$ and the value of $\sqrt{4}$. Professor K now determines the value of $\sqrt{1}$ and $\sqrt{4}$. The square root of 1 is 1 ($\sqrt{1} = 1$) and the square root of 4 is 2 ($\sqrt{4} = 2$). Professor K has spread out the number line below so that you can see the fractional parts better. Also, the number *1* has been replaced with $\sqrt{1}$ and the number *2* with $\sqrt{4}$.




Professor K now considers the fact that *3* is closer to *4* than to *1*. This fact makes Professor K believe that the $\sqrt{3}$ would, therefore, be closer to the $\sqrt{4}$ than to the $\sqrt{1}$. The • on the number line above marks Professor K's estimate or guess as to the location on the number line of the value of the $\sqrt{3}$. That value is $7/4$ or $1\frac{3}{4}$. Professor K checks his estimate by squaring $7/4$.

Professor K's estimate that $\sqrt{3} = 7/4$ was a good guess because *3.0625* is very close to 3.

$$(\frac{7}{4})^2 = \frac{7}{4} \bullet \frac{7}{4} = \frac{7 \bullet 7}{4 \bullet 4} = \frac{79}{16} = 3.0625$$

Professor K reminds you that an estimate does not have to be exact, and usually it is not. Follow along with Professor K as he works another estimation problem for you.

---

**Example Set 2**

Estimate the sum of the following list of numbers: 345, 123, 450, 735 and 598. Professor K can make this estimation in his head quickly by rounding to the nearest *hundreds* place.

| | | |
|---|---|---|
| 345 → | 300 → | 3 |
| 123 → | 100 → | 1 |
| 450 → | 500 → | 5 |
| 735 → | 700 → | 7 |
| 598 → | 600 → | + 6 |
| | | 22 |



Professor K adds the digits in the *hundreds* place of the rounded numbers to obtain *22*. Therefore, Professor K estimates the sum of these numbers to be 2,200. To check the accuracy of his estimate Professor K added the original numbers together. The actual sum of the original numbers was 2,251. Professor K made a relatively accurate estimation by rounding to the *hundreds* place.

---

Professor K uses the process in **Example Set 2** to determine the accuracy of the final answer. Another way that Professor K makes estimations is to round to the place value to other than the largest place value. Look at **Example Set 3** as Professor K works through this concept.


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**Example Set 3**

Estimate the sum of the following numbers: 1,234 + 2,467 + 5,983. Professor K rounds these numbers to the *hundreds* place, not the *thousands* place. Afterward, Professor K adds these numbers.

$$\begin{array}{rr} 1{,}234 \longrightarrow & 1{,}200 \\ 2{,}467 \longrightarrow & 2{,}500 \\ 5{,}983 \longrightarrow & +\ 6{,}000 \\ & \hline 9{,}700 \end{array}$$

Professor K estimated the sum of *1,234*, *2,467* and *5,983* to be *9,700*. Professor K added the numbers together to check the accuracy of his estimation and obtained an answer of 9,684. Therefore, Professor K's estimate was very close to the actual sum.

---

Professor K points out that even though the numbers in **Example Set 3** were of larger value, the estimate was more accurate than in **Example Set 2** because more of the original digits were used in rounding to the final numbers.

Practice making estimations by working the activities for this lesson.

## LIFE PRINCIPLE



"It is a good thing to estimate the goodness of others."

—Anonymous



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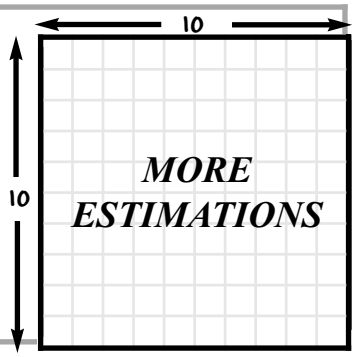
# Basic Math Skills




Lesson 12

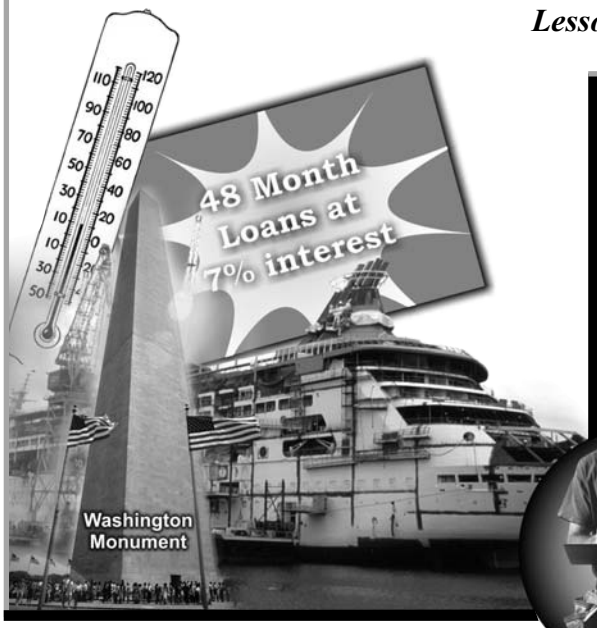
*Fundamentals*

# Chapter 5




## Section 3

***Lessons 11-15***




In the previous lesson Professor K showed you some ways to make ***estimations***. Professor K knows that estimations can be made in other ways as well. At a large gathering, such as for a political speech, news reporters simply look at the group to estimate the number of people in attendance.

When making estimates in mathematics, Professor K sometimes groups numbers to make the estimation easier to calculate.

Professor K will show you how to make mathematical estimations by grouping numbers. Work through the examples in this lesson with Professor K as he makes estimates by grouping numbers together.

**Example Set 1**

Estimate the sum of the following: 274, 193, 22, 410, 345 and 50.

$$\begin{array}{rr} \underline{274} & \\ \underline{193} & \rightarrow 100 \\ \underline{22} & \rightarrow 100 \\ \underline{410} & \\ \underline{345} & \rightarrow 100 \\ +\ \underline{50} & +\ \underline{\quad\quad} \\ 10 & 300 \end{array}$$

In this problem Professor K wants to estimate the sum of the numbers listed. To accomplish this, Professor K first adds the numbers in italics in the *hundreds* place to obtain the sum of *10*. Next, Professor K looks at the numbers in the *tens* and *ones* places and groups the numbers to add as close to *100* as possible. Professor K adds the ***grouping estimates*** together to obtain *300*. Looking at the sum of the *hundreds* column, *10*, and realizing that means ten 100s or $10 \times 100$, Professor K adds *1,000* to *300* to obtain an estimate of *1,300*.

$10 \times 100 = 1{,}000$

$1000 + 300 = 1{,}300$

## VOCABULARY

***Estimation:*** an educated guess
***Grouping estimates:*** estimates arrived at by putting numbers together to come as close to 100 as possible
***Precise:*** exact, carefully calculated



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Checking the accuracy of his estimate in **Example Set 1**, Professor K decided to add the numbers together. This will show you that this process is a valid method for making estimates. The actual sum of the numbers is 1,294, only a value of six from the estimate. Professor K reminds you that an estimate does not have to be ***precise***, and usually it is not; however, in **Example Set 1**, the estimate and the actual sum are very close.



Follow along with Professor K as he works another estimation problem for you in **Example Set 2**.

**Example Set 2**

Estimate the sum of the following list of numbers: 325, 283, 216, 380 and 305. Professor K can make this estimation in his head quickly by looking at the approximate average of groups of numbers, then multiply. The approximate *average* of 325 and 283 is 300. The approximate average of 216 and 380 is also 300. 305 is already near 300. Therefore, professor K counts the amount of numbers added (5) and multiplies that count by the average, 300 (shown below).

$$5 \times 300 = 1{,}500$$

Therefore, Professor K estimates the sum of these numbers to be *1,500*. Check the accuracy of Professor K's estimate by adding the original numbers together. The actual sum of the original numbers is 1,509. Professor K made a very accurate estimation again by calculating the average of groups and then multiplying.

---

Practice making more estimations by working the activities for this lesson.

# LIFE PRINCIPLE



*"Estimations of a person's worth are formed on the basis of appearance and behavior."*

—Nancy Johnson



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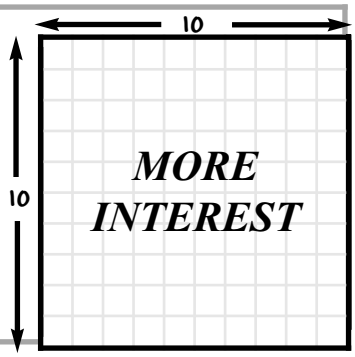
# Basic Math Skills




Lesson 13

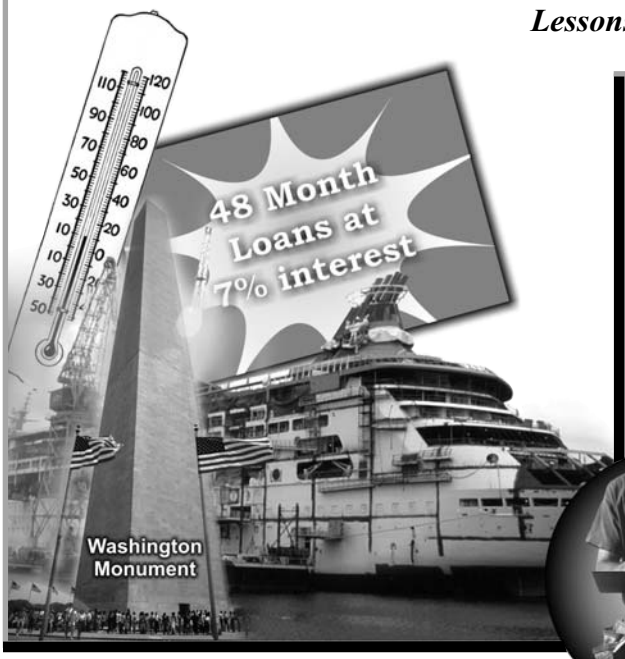
*Percent*

# Chapter 5




## Section 3

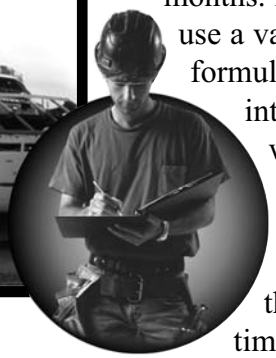
***Lessons 11-15***




Professor K once acquired a loan at the bank. The ***term*** of the loan required the loan to be repaid in two years. However, Professor K was able to pay the entire ***balance*** of the ***note*** in six months. Professor K had to use a variation of the simple interest formula to calculate the amount of interest he would owe when he went to the bank to ***pay off the loan***.



**Professor K**



In this lesson, Professor K will show you how to calculate the interest for fractional time periods. Look at **Example Set 1** as Professor K works a simple interest problem for you for a time period of six months.

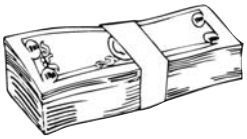


**Example Set 1**

Rachael borrowed $10,000.00 from the local bank for a year. The rate of interest was 6% per year. Rachael was able to repay the loan within six months. Professor K will show you how to calculate the amount of interest that Rachael owed when she repaid the loan.

***Step 1*** $I = prt$

In Step 1, Professor K writes the simple interest formula. (You may review this in Chapter 2, Lesson 15.)



## VOCABULARY

***Term:*** a period of time at which a loan is due and payable
***Balance:*** the amount of money remaining to be paid
***Note:*** a loan
***Pay off the loan:*** statement used to mean repayment of a loan in full



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**Step 2** $t = \frac{6\ months}{12\ months} = \frac{6}{12} = \frac{1}{2} = .5$

In Step 2, Professor K knows that the rate is calculated on a *per-year basis*. Since Rachael repaid the loan in six months, Professor K placed *6 months* in the numerator of a fraction with a denominator of *12 months* (1 year = 12 months). Professor K divides out the units (months) and then calculates the decimal equivalent of $^1/_2$, *.5*.

**Step 3**
$I = 10{,}000 \bullet .06 \bullet .5$
$I = 10{,}000 \bullet .03$
$I = 300$

In Step 3, Professor K places the principal of the loan, *$10,000.00*, the rate in decimal form (6% = *.06*) and the time (*.5*) into the simple interest formula. Professor K then performs the calculations to determine that $300.00 is the amount of interest that Rachael owed on her loan at the end of six months.

---

Look at **Example Set 2** as Professor K works another simple interest problem with a fractional time.

**Example Set 2**

John borrowed $20,000.00 from the local bank to start a computer programming business from his home. The rate of interest was 5% per year. John was able to repay the loan within eighteen months. Professor K will show you how to calculate the amount of interest that John owed when he repaid the loan.

**Step 1** $I = prt$

In Step 1, Professor K writes the simple interest formula.

**Step 2** $t = \frac{18\ months}{12\ months} = \frac{18}{12} = 1\frac{1}{2} = 1.5$

In Step 2, Professor K knows that the rate is calculated on a *per-year basis*. John repaid the loan in 18 months; Professor K placed *18 months* in the numerator of a fraction with a denominator of *12 months* (1 year = 12 months). Professor K divides out the units (months) and then calculates the decimal equivalent of $1^1/_2$, or *1.5*.


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**Step 3**

$I = 20{,}000 \bullet .05 \bullet 1.5$
$I = 20{,}000 \bullet .075$
$I = 1{,}500$

In Step 3, Professor K places the principal of the loan, *$20,000.00*, the *rate* in decimal form (5% = *.05*) and the *time* (*1.5*) into the simple interest formula. Professor K then performs the calculations to determine that *$1,500.00* is the amount of interest that John owed on his loan at the end of 18 months.

---

Work the activities for this lesson to acquaint yourself with interest problems.

# LIFE PRINCIPLE



**"Make sure you invest your life in a noble cause that will earn good interest."**

—Dr. Ronald Johnson



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# Chapter 5

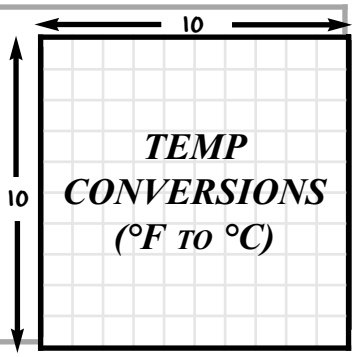
Lesson 14

*Converting*

## Section 3

***Lessons 11-15***






One of Professor K's children, Kevin, once attended a gathering that included students from all over the world. While talking with a student from ***Australia***, Kevin was asked what the weather was like where he lived. Kevin informed the student that, sometimes the temperature dropped to 14° ***Fahrenheit.*** The student from Australia asked Kevin if he could convert 14° Fahrenheit to °Celsius. Kevin converted 14° Fahrenheit to -10° Celsius.

## VOCABULARY

***Fahrenheit, °F:*** the unit of temperature in the English system with 180 equal divisions between the freezing (32°) and boiling (212°) points of water

***Australia:*** a country as well as a continent (approximately the size of the United States) between the South Pacific and Indian Oceans

***Degrees Celsius, °C:*** the normal unit of temperature in the Metric system with 100 equal divisions between the freezing (0°) and boiling (100°) points of water

### CONVERTING FAHRENHEIT TO CELSIUS

To convert Fahrenheit readings into Celsius, the formula $C = \frac{5}{9}(F - 32)$ is used, where $F$ is the temperature in degrees Fahrenheit, and $C$ is the temperature in ***degrees Celsius***.

Look at **Example Set 1** to see how Kevin converted 14° F to *degrees Celsius* for his Australian friend.

**Example Set 2**

| | | |
|---|---|---|
| ***Step 1*** | $C = \frac{5}{9}(F - 32)$ | Write the conversion formula to convert Fahrenheit into Celsius. |
| ***Step 2*** | $C = \frac{5}{9}(14 - 32)$ | Substitute 14° for the value of $F$ into the formula. |
| ***Step 3*** | $C = \frac{5}{9}(-18)$ | The calculation, *(14 - 32) = -18* is performed. *-18* replaces *(14 - 32)* in the formula. |



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| | | |
|---|---|---|
| **Step 4** | $C = \frac{5 \bullet (-18)}{9} = \frac{5 \bullet \cancel{9} \bullet (-2)}{\cancel{9}} = -10$ | The calculations are performed using the rules for multiplying and reducing fractions to determine that 14°F = -10°C. |

Look at **Example Set 2** as Professor K works another problem for converting a Fahrenheit temperature to degrees Celsius.

**Example Set 2**

Convert 113°F to degrees Celsius.

| | | |
|---|---|---|
| **Step 1** | $C = {}^{5}/_{9}(F - 32)$ | Write the conversion formula to convert °Fahrenheit into °Celsius. |
| **Step 2** | $C = {}^{5}/_{9}(113 - 32)$ | Substitute *113°* for the value of *F* into the formula. |
| **Step 3** | $C = {}^{5}/_{9}(81)$ | The calculation, *(113 - 32) = 81* is performed. The difference of *81* replaces *(113 - 32)* in the formula. |
| **Step 4** | $C = \frac{5 \bullet 81}{9} = \frac{5 \bullet 9 \bullet \cancel{9}}{\cancel{9}} = 5 \bullet 9 = 45$ | The calculations are performed using the rules for multiplying and reducing fractions to determine that 113°F = 45°C. |

Apply what you have learned about converting Fahrenheit units of temperature into Celsius units of temperature by working the activities for this lesson.

# LIFE PRINCIPLE



*"To have a friend, you must be a friend."*

—Hebrew Principle



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Converting

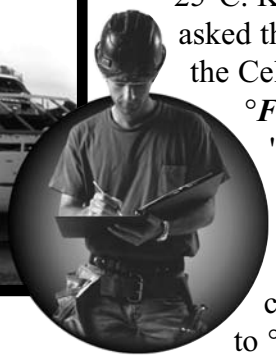
Lesson 15

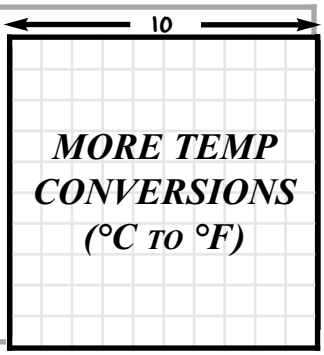
# Chapter 5

## Section 3

***Lessons 11-15***






Professor K's son, Kevin, commented to the student from Australia about the climate in the region where the student lived. Kevin's new friend stated that the temperature sometimes dropped as low as -25°C. Kevin smiled and asked the student to convert the Celsius temperature into °***Fahrenheit***. The student said, "Sure," and proceeded to do so.



Look at **Example Set 1** to see how the student from Australia performed the conversion from ***degrees Celsius*** to °Fahrenheit.

### CONVERT °CELSIUS TO °FAHRENHEIT

To convert °Celsius readings into °Fahrenheit, the formula $F = \frac{9}{5}C + 32$ is used, where $F$ is the temperature in degrees Fahrenheit, and $C$ is the temperature in degrees Celsius.

## VOCABULARY

***Fahrenheit, °F:*** the unit of temperature in the English system with 180 equal divisions between the freezing (32°) and boiling (212°) points of water

***Degree Celsius, °C:*** the normal unit of temperature in the metric system with 100 equal divisions between the freezing, 0°, and boiling, 100°, points of water

**Example Set 1**

Follow the steps as the Australian student converts -25°C to degrees Fahrenheit.

| | | |
|---|---|---|
| ***Step 1*** | $F = \frac{9}{5}C + 32$ | Write the conversion formula to convert °Celsius into °Fahrenheit. |
| ***Step 2*** | $F = \frac{9}{5}(-25) + 32$ | Substitute *-25* for the value of $C$ into the formula. |



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| | | |
|---|---|---|
| **Step 3** | $F = \frac{9 \bullet (-25)}{5} = \frac{9 \bullet \cancel{5} \bullet (-5)}{\cancel{5}} = 9 \bullet (-5) = -45$ | The multiplication is performed first, following the rule for multiplying and reducing fractions. |
| **Step 4** | $F$ = -45 + 32 = -13 | The answer from Step 3, which is *-45*, replaces $^9/_5$(*-25*) in the formula. |
| **Step 5** | -25°$C$ = -13°$F$ | The calculation is performed to determine that *-25°C = -13°F*. |

Look at **Example Set 2** as Professor K shows you how to convert another Celsius temperature into Fahrenheit.

**Example Set 2**

Follow the steps as Professor K converts 105°C to degrees Fahrenheit.

| | | |
|---|---|---|
| **Step 1** | $F = {}^9/_5C + 32$ | Write the conversion formula to convert °Celsius into °Fahrenheit. |
| **Step 2** | $F = {}^9/_5(105) + 32$ | Substitute *105°* for the value of $C$ into the formula. |
| **Step 3** | $F = \frac{9 \bullet 105}{5} = \frac{9 \bullet \cancel{5} \bullet 21}{\cancel{5}} = 9 \bullet 21 = 189$ | The multiplication is performed first, following the rule for multiplying and reducing fractions. |
| **Step 4** | $F$ = 189 + 32 = 221 | The answer from Step 3, which is *189*, replaces $^9/_5$(*105*) in the formula. |
| **Step 5** | 105°$C$ = 221°$F$ | The calculation is performed to determine that *105°C = 221°F*. |

Apply what you have learned about converting degrees Celsius to Fahrenheit by working the activities for this lesson.

## *Life Principle*



"A friend in need is a friend indeed."

—Pilgrim Axiom



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# *Basic Math Skills*

## Mathematics Charts

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***LENGTH - ENGLISH SYSTEM***

| | | |
|---|---|---|
| 12 inches | = | 1 foot |
| 3 feet | = | 1 yard |
| 5.5 yards | = | 1 rod |
| 320 rods | = | 1 mile |
| 1,760 yards | = | 1 mile |
| 5,280 feet | = | 1 mile |

***VOLUME - ENGLISH SYSTEM***

| | | |
|---|---|---|
| 1 tablespoon, Tbsp, T | = | 3 teaspoons, tsp |
| 1 cup, c | = | 16 tablespoons, Tbsp, T |
| 1 pint, pt | = | 2 cups, c |
| 1 quart, qt | = | 2 pints, pts |
| 1 gallon, gal | = | 4 quarts, qts |

***WEIGHT - ENGLISH SYSTEM***

| | | |
|---|---|---|
| 1 pound, lb | = | 16 ounces, oz |
| 1 hundredweight, cwt | = | 100 pounds, lbs |
| 1 ton | = | 20 hundredweight, cwt |
| 1 ton | = | 2000 pounds, lbs |

***LENGTH - METRIC SYSTEM***

| | | |
|---|---|---|
| 1 meter | = | 1,000 millimeters |
| 1 meter | = | 100 centimeters |
| 1 kilometer | = | 1,000 meters |
| 1 centimeter | = | 10 millimeters |

***VOLUME - METRIC SYSTEM***

| | | |
|---|---|---|
| 1 liter | = | 1,000 milliliters |
| 1 liter | = | 100 centiliters |
| 1 kiloliter | = | 1,000 liters |
| 1 centiliter | = | 10 milliliters |

***WEIGHT - METRIC SYSTEM***

| | | |
|---|---|---|
| 1 gram | = | 1,000 milligrams |
| 1 gram | = | 100 centigrams |
| 1 kilogram | = | 1,000 grams |
| 1 centigram | = | 10 milligrams |

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## *Mathematics Charts*

### *PERFECT SQUARES*

| | | | |
|---|---|---|---|
| $\sqrt{1}=1$ | $\sqrt{25}=5$ | $\sqrt{81}=9$ | $\sqrt{169}=13$ |
| $\sqrt{4}=2$ | $\sqrt{36}=6$ | $\sqrt{100}=10$ | $\sqrt{196}=14$ |
| $\sqrt{9}=3$ | $\sqrt{49}=7$ | $\sqrt{121}=11$ | $\sqrt{225}=15$ |
| $\sqrt{16}=4$ | $\sqrt{64}=8$ | $\sqrt{144}=12$ | $\sqrt{256}=16$ |

### *PERFECT CUBES*

| | | | |
|---|---|---|---|
| $\sqrt[3]{1}=1$ | $\sqrt[3]{-8}=-2$ | $\sqrt[3]{64}=4$ | $\sqrt[3]{-125}=-5$ |
| $\sqrt[3]{-1}=-1$ | $\sqrt[3]{27}=3$ | $\sqrt[3]{-64}=-4$ | $\sqrt[3]{216}=6$ |
| $\sqrt[3]{8}=2$ | $\sqrt[3]{-27}=-3$ | $\sqrt[3]{125}=5$ | $\sqrt[3]{-216}=-6$ |

$$P = \frac{\text{the number of elements in the set containing favorable outcomes}}{\text{the number of elements in the sample set}}$$

$$Midpoint = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

### *FORMULAS*

| Surface Area | Area | Volume | Perimeter/ Circumference | Others |
|---|---|---|---|---|
| **Sphere:** $A_s = 4\pi r^2$ | **Triangle:** $A = {}^1\!/_2 bh$ | **Sphere:** $V = {}^4\!/_3 \pi r^3$ | **Perimeter of a Rectangle:** $P = 2w + 2l$ | **Pythagorean Theorem:** $c^2 = a^2 + b^2$ |
| **Cylinder:** $A_s = 2\pi rh + 2\pi r^2$ | **Rectangle:** $A = l \times w$ | **Cone:** $V = {}^1\!/_3 \pi r^2 h$ | **Circumference of a Circle:** $C = 2\pi r$ or $C = \pi d$ | **Convert to Fahrenheit:** $F = {}^9\!/_5 C + 32$ |
| **Cube:** $A_s = 6s^2$ | **Circle:** $A = \pi r^2$ | **Rectangular Prism:** $V = l \times w \times h$ | | **Convert to Celsius:** $C = {}^5\!/_9 (F - 32)$ |
| **Lateral Surface Area of a Cone:** $A_{ls} = \pi rl$ | **Trapezoid:** $A = {}^1\!/_2 (b_1 + b_2)h$ | **Square Pyramid:** $V = ({}^1\!/_3) lwh$ | | **Distance:** $d = r \bullet t$ |
| | | **Triangular Prism:** $V = {}^1\!/_2 bhl$ | | **Slope:** $y = mx = b$ |
| | | **Cylinder:** $V = \pi r^2 h$ | | **Simple Interest:** $I = prt$ |

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***Mathematics Charts***

## *TIME CONVERSIONS*

1 week = 7 days
1 year = 12 months

## *CONVERSIONS*

| English to Metric | |
|---|---|
| 1 ounce (oz) | 28.35 grams (g) |
| 1 pound (lb) | 454 grams (g) |
| 1 ton (T) | 907.2 kilograms (kg) |

| Metric to English | |
|---|---|
| 1 gram (g) | .035 ounce (oz) |
| 1 kilogram (kg) | 2.2 pounds (lb) |
| 1 metric ton (mt) | 2200 pounds (lb) |

| English to Metric | |
|---|---|
| 1 cubic inch | 16.39 cubic cm |
| 1 gallon | 3.785 liters |
| 1 cubic foot | 28.316 liters |
| 1 quart | .946 liters |

| Metric to English | |
|---|---|
| 1 cubic cm | .061 cubic inch |
| 1 cubic meter | 35.315 cubic feet |
| 1 liter | 1.05 quarts |
| 1 liter | .264 gallon |

| English to Metric | |
|---|---|
| 1 inch | 2.54 cm |
| 1 foot | 0.3048 meter |
| 1 yard | 0.9144 meter |
| 1 mile | 1.6 km |

| Metric to English | |
|---|---|
| 1 centimeter | 0.3937 in. |
| 1 meter | 39.37 in. |
| 1 meter | 1.09 yds |
| 1 kilometer | 0.6213 mile |

## *AREA CONVERSIONS*

1 square centimeter = 0.155000 sq in.
1 square meter = 10.763910 sq ft
1 square inch = 645.16 sq mm
1 square foot = 0.09290304 sq meter
1 square yard = 0.836127 sq meter
1 square foot = 144 sq in.

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