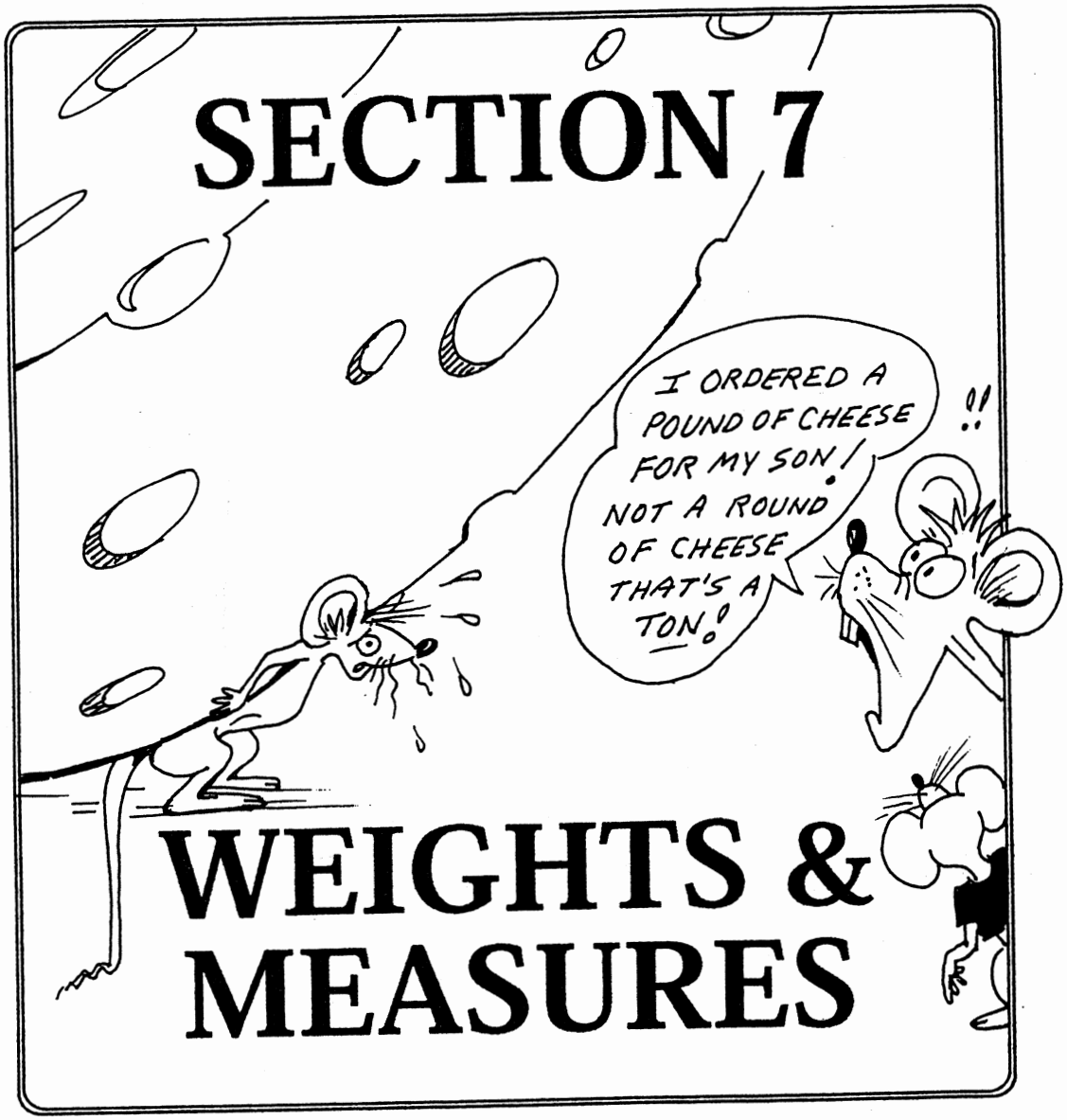
SECTION 7



WEIGHTS & MEASURES

textbook
PUBLISHERS
PO Box 910517
St George, UT 84791
1-435-238-7702

Principles of Weights and Measures

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Introduction to
"LENGTH" MEASUREMENTS

Several years ago, there was a movement throughout the U.S. to change our measuring system to the European "metric" system--that is, kilometers instead of miles, meters instead of yards, centimeters instead of inches, etc. While this method of measurement is preferred by some--and is even incorporated into some of our daily uses, most Americans seem to be more content to use the familiar "U.S. Customary System."

Today it is a matter of choice. The conventional "U.S. Customary System" is measured in units of "twelve." The Metric System is measured in units of "ten."

Whichever way you choose to measure, get out your ruler, yard-stick and the tape measure, and let's have some fun!

PRINCIPLE #1

THE STANDARD U.S. CUSTOMARY UNITS OF LENGTH ARE: INCH, FOOT, YARD AND MILE.

EXAMPLES

There are 12 inches in 1 foot.
There are 36 inches in a yard.
There are 3 feet in a yard.
There are 5,280 feet in a mile.
There are 1,760 yards in a mile.

Learning Exercise

Memorize the above customary lengths.
Figure out your own height in inches, feet and yards.
(Don't worry about the miles!--But try centimeters and meters!)

PRINCIPLE #2

ALL MEASUREMENTS INCLUDE A NUMBER AND A UNIT.

EXAMPLES

number	*unit*	*number*	*unit*
6	feet	70	kilometers
55	inches	10	centimeters
62	miles	4	meters

Learning Exercise

Using a ruler and a yardstick, measure ten lengths and write them down, showing the number and the unit.

PRINCIPLE #3

MEASUREMENTS OF LENGTH CAN BE ABBREVIATED.

EXAMPLES

U.S. CUSTOMARY SYSTEM

inches = in. or "
feet = ft or ‘
yard = yd
mile = mi

(Note that the abbreviation “in." for "inches" is the only one with a period after it. This is to keep it from being confused with the word "in".)

METRIC SYSTEM

Millimeter = mm (about 1/25 of an inch)
Centimeter = cm (about 2/5 of an inch)
Meter = m (slightly longer than a yard)
Kilometers = km (about 5/8 of a mile)

Learning Exercise

Write ten sentences using the above measurements, and write the measurements as abbreviations.

PRINCIPLE #4

MEASUREMENTS OF LENGTH CAN BE CONVERTED INTO SMALLER UNITS BY MULTIPLYING.

EXAMPLES

1. How many inches are there in three yards?

1 yd = 36 in.
36 in. x 3 yd = 108 inches in 3 yards.

2. How many feet are in 60 yards?

1 yd = 3 ft
3 ft x 60 yd = 180 feet in 60 yards

Learning Exercise

Convert ten length measurements from large units to small units.

PRINCIPLE #5

MEASUREMENTS OF LENGTH CAN BE CONVERTED INTO <u>LARGER</u> UNITS BY <u>DIVIDING</u>.

EXAMPLE

If you were 63 inches high, how many feet is that?

<u>Procedure</u>: 1 foot = 12 inches

12 in.) 63 in.

```
     5 R 3
12)63
   60
    3
```

Answer: 5 ft 3 in.

Learning Exercise

Convert ten length measurements from small units to large units.

Can you answer these questions?

(Try to remember without looking back!)

1. Convert the following:

   a. 30 in. = _____ft _____in b. 5 yd = _____in. c. 1 1/2 mi = _____ft

   d. 4 3/4 ft = _____in. e. 66 in. = _____yd f. 42 in. = _____ft _____in.

2. Add the following:

   a. 4 ft 4 in. + 1 ft 11 in. b. 3 yd 2 ft + 6 yd 2 ft c. 1 mi 4200 ft + 2 mi 3600 ft

3. Subtract the following:

   a. 3 5/8 yd – 1 3/4 yd b. 5 ft 3 in. – 2 ft 6 in. c. 9 yd 1 ft – 3 yd 2 ft

4. Multiply the following:

   a. 3 yd 2 ft x 4 b. 3 2/3 ft x 4 c. 4 yd 1 ft x 8

5. Divide the following:

   a. 4 ft 3 in. ÷ 3 b. 5 ft 4 in. ÷ 2 c. 12 1/2 in. ÷ 3

6. Solve the following:

   a. A roof is constructed with nine rafters each 8 ft 4 in. long. Find the total number of feet of material needed to build the rafters.

   b. Twenty-eight yards of material were used to make several dresses. How many feet of material were used?

Introduction to "WEIGHT" MEASUREMENTS

The "weight" of an object is determined by the pull of gravity which comes from the center of the earth upon that object. In this section, we'll be discussing the system of measuring the weight of things which scientists and mathematicians have developed. (You're gonna be so smart!!)

Interesting Scientific Info about "Weight"

(1) Objects on the moon weigh less than they do on earth because there is less gravity on the moon. Since there is not as much pull, objects tend to almost "float." (How would you like to do a few hand-springs on the moon and end up out in space?)

(2) The weight of an object --such as a solid rubber ball--can be altered without changing its shape or size! Put it in water and it weighs less. Also, the rubber ball will weigh more at the beach than it will on top of a high mountain. Do you know why? (Think about it!)

(3) Imagine what it would be like if we had no gravity! When the astronauts journey into space, scientists have had to figure out how the weightless astronauts can eat, move, and function without gravity. It is not as easy as you might think! The Creator placed just the right amount of "gravity" on the earth so that we wouldn't be too heavy to walk, yet our feet would stay on the ground every time we took a step.

Gravity is something we really take for granted.

In our study of math, gravity is measured in "units of weight".

PRINCIPLE #6

THE STANDARD U.S. CUSTOMARY UNITS OF WEIGHT ARE MEASURED IN OUNCES, POUNDS, AND TONS.

EXAMPLE

There are 16 ounces in a pound.
There are 2,000 pounds in a ton.

Learning Exercise

Find out how many "pounds" you weigh.
Write this measurement for future reference.

PRINCIPLE #7

WEIGHT MEASUREMENTS CAN BE ABBREVIATED.

U.S . CUSTOMARY SYSTEM

pound = lb
ounce = oz
ton = t

NOTE: In measurements of length, the abbreviations closely matched the complete words. In measurements of weight, the "pound" and "ounce" abbreviations are quite different from the orginal word. We discovered that "lb" stands for the Latin word "libra" which means "balance." A meaning for the abbreviation "oz" could not be found--but why don't you see if you could find out! Meanwhile, just remember the "Wizard of Oz" and abbreviate ounce as "oz".

METRIC SYSTEM

Kilogram = kg (about 2 $^{1}/_{5}$ pounds at sea-level)
metric ton = mt (1,000 kilograms, or 1 $^{1}/_{10}$ of a ton in the U.S. Customary System)

Learning Exercise

Write ten measurements, using their abbreviations.

PRINCIPLE #8

MEASUREMENTS OF WEIGHT CAN BE CONVERTED INTO SMALLER UNITS BY MULTIPLYING.

EXAMPLES

1. How many ounces are there in three pounds?

1 lb = 16 oz
16 oz x 3 lb = 48 ounces in 3 pounds.

2. How many pounds are in 5 ½ tons?

1 ton = 2,000 lbs
2,000 lb x 5 ½ tons = 11,000 pounds in 5 ½ tons

Learning Exercise

Convert ten weight measurements from large units to small units.

PRINCIPLE #9

MEASUREMENTS OF WEIGHT CAN BE CONVERTED INTO LARGER UNITS BY DIVIDING.

EXAMPLE

If your stack of textbooks weighs 195 ounces,
how many pounds is that? *(2,000 lbs of work to do!)*

Procedure:

16 oz)195 oz

$$\begin{array}{r} 12\text{ R }3 \\ 16\overline{)195} \\ \underline{16} \\ 35 \\ \underline{32} \\ 3 \end{array}$$

Answer: 12 lbs 3 oz

Learning Exercise

Convert ten weight measurements from small units to large units.

Can you answer these questions?

(Try to remember without looking back!)

1. Convert the following:

   a. 64 oz = ____lb b. 3200 lb = ____tons c. $2\frac{5}{8}$ lb = ____oz

   d. $1\frac{3}{10}$ tons = ____lb b. 85 oz = ____lb ____oz c. $\frac{4}{5}$ tons = ____lb

2. Add the following:

   a. 4 lb 7 oz + 3 lb 12 oz b. $6\frac{1}{2}$ oz + $2\frac{1}{2}$ oz c. 1 ton 800 lb + 3 tons 1600 lb

3. Subtract the following:

   a. 14 lb 5 oz – 8 lb 14 oz b. 3 tons 500 lb – 1 ton 800 lb c. $6\frac{3}{8}$ lb – $2\frac{5}{6}$ lb

4. Multiply the following:

   a. 3 lb 6 oz x 4 b. $4\frac{2}{3}$ lb x 3 c. 2 tons 700 lb x 5

5. Divide the following:

   a. 7 lb 14 oz ÷ 3 b. 3 lb 8 oz ÷ 2 c. 5 lb 12 oz ÷ 4

6. Solve the following:

   a. A 3-by-3-inch tile weighs 5 oz. Find the weight in pounds of a package of 144 tiles.

   b. A book weighing 1 lb 5 oz is mailed at the postage rate of $.12 per ounce. Find the cost of mailing the book.