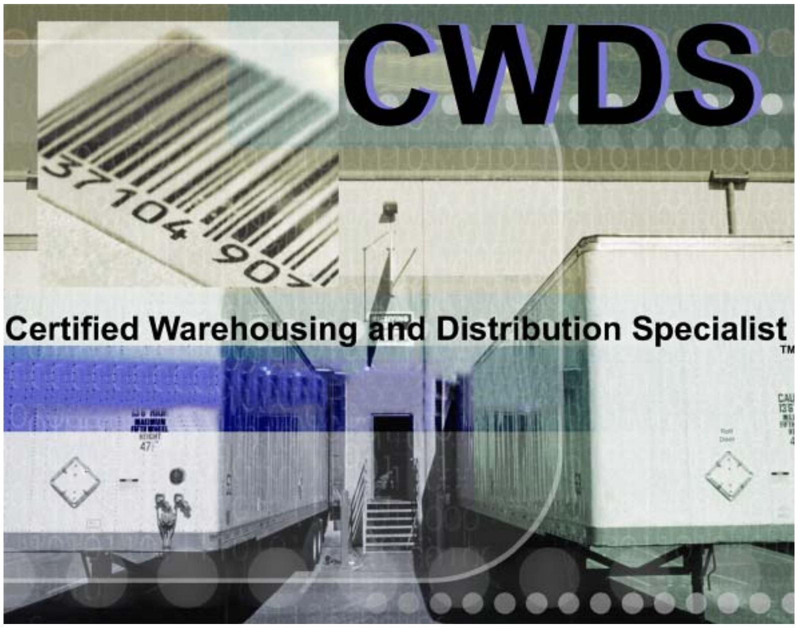

Math and Measurement

QUICKSTART®
TECHNICAL COLLEGE SYSTEM OF GEORGIA

Published August 2002
(G081502)

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Introduction

Overview

All jobs require some knowledge of mathematics. Warehousing and distribution are no different. From the receiving dock to the accounting office, working with numbers is important to every aspect of inventory management. Counting the items received, adding and deleting inventory, estimating the amount of space required to store merchandise, interpreting productivity charts, determining shipping costs, and (most importantly) calculating your paycheck all require math skills.

In this module we will review many of the concepts you have learned over the years (and possibly forgotten). We will also advance some concepts that may be new to you. Either way, you will see how each of these concepts is important to warehousing and distribution. Mastering these skills will make your job easier and make you a more valuable employee.

Objectives

The information, activities and practice provided during this unit will enable you to:

1. Perform mathematical computations using whole numbers, fractions, mixed numbers, decimals and percentages.
2. Perform conversions involving fractions, decimals and percentages.
3. Acquire familiarity with measurements of liquid, solid and distance in both English and metric.
4. Calculate an average.
5. Identify common angles.
6. Calculate the perimeter and area of an object.

Notes:

Reviewing the Basics

Whole Numbers

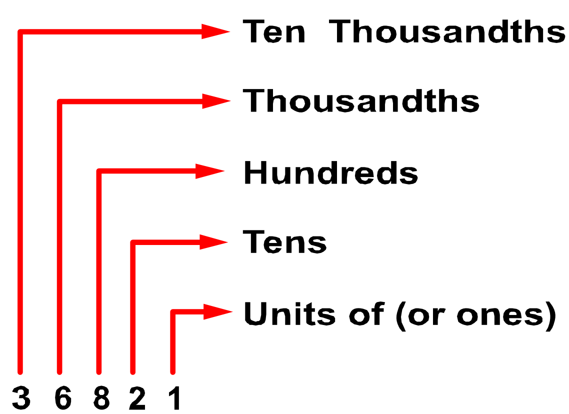
A whole number is a number that has no fractions.

Examples of whole numbers are 0, 5, 46, 132, 2879, and 36821.

While the digits 0 through 9 are included in all of these numbers, the numbers each mean something different because the digits are in different places. Each place has a different value.

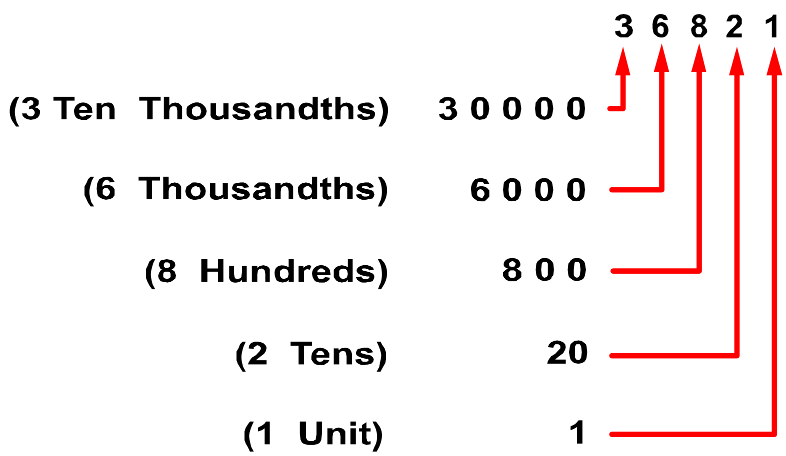
Place Values

The number 36821 has five different digits, each having a place value.



Place Value Example

In this example, there are 3 ten thousands, 6 thousands, 8 hundreds, 2 tens, and one unit.



Place Value Example 2

When they are combined (added), we have the number thirty-six thousand, eight hundred and twenty-one.

Adding Whole Numbers

Addition is the process of bringing together two or more numbers to make a larger number. The addition process is usually denoted by a plus (+) sign.

Adding single-digit numbers is easy. We all know that 4 + 2 = 6. We can do that in our heads.

Adding larger numbers becomes more difficult. To add 4352 and 217, most of us would have to use a calculator. Unfortunately, we don't always have a calculator handy so we must resort to pencil and paper.

Using this method, we must first align the numbers so that the units are in one column, the tens in one column, etc. We then add the columns beginning with the units column and moving left.

4 Add the Hundreds Column

$$\begin{array}{r} 4352 \\ +\ 217 \\ \hline 569 \end{array}$$

5 Add the Thousands Column

$$\begin{array}{r} 4352 \\ +\ 217 \\ \hline 4569 \end{array}$$

Carrying

The addition process is fairly simple until the total for a column exceeds 9. When that occurs, we must "carry" the excess to the next column.

1 Align & add the Units column

```
 6875
+ 348
-----
    3
```

2 Carry the "1" over to the Tens column

```
   1
 6875
+ 348
-----
    3
```

3 Add the Tens column

```
   1
 6875
+ 348
-----
   23
```

4 Carry the "1" over to the Hundreds column

```
  11
 6875
+ 348
-----
   23
```

5 Add the Hundreds column

```
  11
 6875
+ 348
-----
  223
```

6 Carry the "1" over to the Thousands column

```
 111
 6875
+ 348
-----
  223
```

7 Add the Thousands column

```
 111
 6875
+ 348
-----
 7223
```

Subtracting Whole Numbers

Subtraction is the process of finding the difference between two numbers. The subtraction process is usually denoted by a minus (–) sign.

Again, subtracting small numbers is simple. It is easy to determine that $6 - 2 = 4$. We give very little thought to it.

Subtracting larger numbers is a bit more involved. Subtracting 3412 from 8618 would require some thought. Without a calculator, we will again resort to pencil and paper.

The subtraction process begins by placing the smaller number below the larger one. Then, just as we did in addition, we align the numbers to the right so that the units are in one column, the tens in one column, etc. Starting in the units column and moving left, we subtract the bottom number from the top number.

1 $\begin{array}{r} 8\,6\,1\,8 \\ -\,\underline{3\,4\,1\,2} \end{array}$ Place smaller number under the larger number & align

2 $\begin{array}{r} 8\,6\,1\,8 \\ -\,\underline{3\,4\,1\,2} \\ 6 \end{array}$ Subtract the Units Column

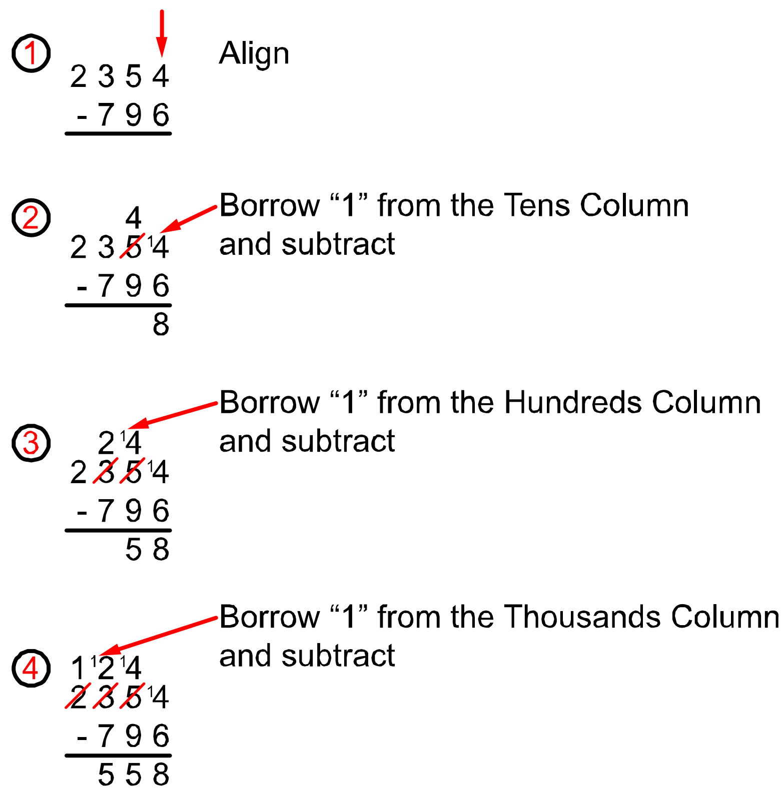
3 $\begin{array}{r} 8\,6\,1\,8 \\ -\,\underline{3\,4\,1\,2} \\ 0\,6 \end{array}$ Subtract the Tens Column

4 $\begin{array}{r} 8\,6\,1\,8 \\ -\,\underline{3\,4\,1\,2} \\ 2\,0\,6 \end{array}$ Subtract the Hundreds Column

5 $\begin{array}{r} 8\,6\,1\,8 \\ -\,\underline{3\,4\,1\,2} \\ 5\,2\,0\,6 \end{array}$ Subtract the Thousands Column

"Borrowing"

The subtraction process is fairly simple until a bottom digit in one of the columns is greater than the top digit in that column. When this occurs, we must "borrow" from the top digit in the next column.



"Borrowing" Across the Zero

Once it is understood, borrowing appears to be simple process until we attempt to borrow from zero. After all, you can't borrow from "nothing." When that occurs we must "borrow" across the zero.

1

$$\begin{array}{r} 6\;0\;0\;0 \\ -\;5\;4\;7 \\ \hline ? \end{array}$$

Align & Subtract Units Column

(Cannot subtract 7 from 0)

2

$$\begin{array}{l} 5 \\ \cancel{6}\,{}^{1}0\;0\;0 \\ \;\;-\;5\;4\;7 \\ \hline \end{array}$$

Borrow "1" from the Thousands Column and subtract

3

$$\begin{array}{l} 5\;9 \\ \cancel{6}\,{}^{1}\cancel{0}\,{}^{1}0\;0 \\ \;\;-\;5\;4\;7 \\ \hline \end{array}$$

Borrow "1" from the Hundreds Column and subtract

4

$$\begin{array}{l} 5\;9\;9 \\ \cancel{6}\,{}^{1}\cancel{0}\,{}^{1}\cancel{0}\,{}^{1}0 \\ \;\;-\;5\;4\;7 \\ \hline \end{array}$$

Borrow "1" from the Tens Column and subtract

5

$$\begin{array}{l} 5\;9\;9 \\ \cancel{6}\,{}^{1}\cancel{0}\,{}^{1}\cancel{0}\,{}^{1}0 \\ \;\;-\;5\;4\;7 \\ \hline 5\;4\;5\;3 \end{array}$$

Subtract as usual

Multiplying Whole Numbers

Multiplication is the process of adding a number to itself as many times as indicated by a second number. A "times" (×) sign denotes the multiplication process.

Multiplying 4 times 2 (4 × 2) is the same as adding 4 two times (4 + 4). They both equal 8.

Multiplying 6 times 7 (6 × 7) is the same as adding 6 seven times (6 + 6 + 6 + 6 + 6 + 6 + 6). They both equal 42.

Multiplication Table

Adding a long list of numbers is difficult. It is easier to use a multiplication table.

A multiplication table is a list of answers for multiplying any two numbers (in this case, 0 through 12).

	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	65	72	84	96	108	120	132	144

Multiplication Table

To use a multiplication table, simply locate the point where the two numbers being multiplied intersect.

Example

$6 \times 8 = ?$

Step 1: From the 6 in the left column, draw a line to the right.

Step 2: From the 8 in the top row, draw a line downward.

We see that the lines cross at 48. ($6 \times 8 = 48$.)

While the multiplication table makes it easy to multiply small numbers (less than 12), it is just as useful when multiplying larger numbers.

Note: Throughout this module you may use the multiplication table.

1 Align the two numbers

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline \end{array}$$

2 Multiply the units in the bottom number by the units in the top

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline 2 \end{array}$$

3 Multiply the units in the bottom number by the tens in the top

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline 42 \end{array}$$

4 Multiply the tens in the bottom number by the units in the top

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline 42 \\ 6 \end{array}$$

5 Multiply the tens in the bottom number by the tens in the top

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline 42 \\ 126 \end{array}$$

6

$$\begin{array}{r} 42 \\ \times\, 31 \\ \hline \left.\begin{array}{r} 42 \\ 126 \end{array}\right\} \text{Partial answers} \\ \hline 1302 \;\; \text{Add the partial answers} \end{array}$$

Carrying

Carrying when multiplying is very similar to carry when adding.

Note: Be sure that you multiply first then add the number being carried.

1

$$\begin{array}{r} 7\ 3 \\ \times\ 6\ 8 \\ \hline {}^{2}4 \end{array}$$

Multiply the units in the bottom number by the units in the top

Carry the "2" over to the Tens Column

2

$$\begin{array}{r} 7\ 3 \\ \times\ 6\ 8 \\ \hline 5\ 8\,{}^{2}4 \end{array}$$

Multiply the units in the bottom number by the tens in the top and add the "carry"

3

$$\begin{array}{r} 7\ 3 \\ \times\ 6\ 8 \\ \hline 5\ 8\ 4 \\ {}^{1}8\ \end{array}$$

Multiply the tens in the bottom number by the units in the top

Carry the "1" over to the Hundreds Column

4

$$\begin{array}{r} 7\ 3 \\ \times\ 6\ 8 \\ \hline 5\ 8\ 4 \\ 4\ 3\,{}^{1}8\ \end{array}$$

Multiply the tens in the bottom number by the tens in the top and add the "carry"

5

$$\begin{array}{r} 7\ 3 \\ \times\ 6\ 8 \\ \hline 5\ 8\ 4 \\ 4\ 3\,{}^{1}8\ \\ \hline 4\ 9\ 6\ 4 \end{array}$$

} Partial answers

Add the partial answers

Dividing Whole Numbers

Division is the process of finding out how many times one number is contained in another. The division process is usually denoted by either of two “divided by” signs: ÷ and /.

Most of us can quickly determine that there are 20 nickels in a dollar. In other words, 5 is contained in 100 twenty times. We did this by dividing 100 cents by 5 cents.

$$100 \div 5 = 20$$

The same division problem can be written in another way.

$$\begin{array}{r} 20 \\ 5\overline{)100} \end{array}$$

This method of writing division problems will be useful when we have larger numbers.

Dividing Small Numbers

The Multiplication Table is a handy tool to use when dividing smaller numbers.

Example

$48 \div 6 = ?$

Step 1: From the 6 in the left column, draw a line to the right until you reach the 48.

Step 2: From the 48, draw a line to the top row.

We see that the line stops at 8. ($48 \div 6 = 8$)

Dividing with a Remainder

The previous example had an answer that came out evenly…that is, without any amount remaining. Many division problems have a remainder.

The Multiplication Table is still a handy tool to use when dividing smaller numbers…with or without remainders.

Example

$58 \div 7 = ?$

Step 1: Using the Multiplication Table, find the 7 on the left-hand column.

Step 2: Follow the row to the right until you find a number as close as possible to 58 without going over 58. It should be 56.

Step 3: Go up the column until you find the number on the top row. It should be 8.

Step 4: Subtract 56 from 58 to determine the remainder of 2.

Completing the process, we see that $58 \div 7 = 8$ with a remainder of 2.

The answer may be written: 8 R 2.

Dividing Larger Numbers with Remainders

To divide larger numbers, we can still use the Multiplication Table but we must simplify the large number into smaller ones. To do this, it is easier to write the division problem in a different manner.

1
```
    ‾‾‾‾
 47)1534
```
Estimate how many times 47 goes into 153

2
```
       3
    ‾‾‾‾
 47)1534
    141
```
Multiply

3
```
       3
    ‾‾‾‾
 47)1534
    141
    ‾‾‾
     12
```
Subtract

4
```
       3
    ‾‾‾‾
 47)1534
    141
    ‾‾‾
     124
```
Bring down the 4

5
```
      32
    ‾‾‾‾
 47)1534
    141
    ‾‾‾
     124
      94
```
Estimate how many times 47 goes into 124

6
```
      32
    ‾‾‾‾
 47)1534
    141
    ‾‾‾
     124
      94
```
Multiply

7
```
      32
    ‾‾‾‾
 47)1534
    141
    ‾‾‾
     124
      94
     ‾‾‾
      30
```
Subtract

8 32 r 30 Final Answer with Remainder

Progress Check #1

1. Add the following:

   a. $57 + 48 = ?$

   b. $341 + 879 + 564 = ?$

   c. $4682 + 3579 + 1245 + 9753 = ?$

2. Subtract the following:

   a. $52 - 28 = ?$

   b. $457 - 398 = ?$

   c. $10000 - 2648 = ?$

3. Multiply the following:

   a. $4 \times 8 = ?$

   b. $66 \times 78 = ?$

   c. $253 \times 93 = ?$

4. Divide the following:

   a. $7\overline{)63}$ b. $23\overline{)322}$ c. $342\overline{)25341}$

5. The Receiving Department accepted 75 cases of "Birds of the World" alarm clocks. There are 24 clocks in each case. How many clocks were received?

6. Prior to this delivery, there were 30 cases already in the warehouse. What is the total number of clocks in the warehouse after receipt of the delivery?

7. The Shipping Department must ship an equal number of clocks to 15 stores. If all the clocks are to be shipped, how many cases must be shipped to each store?

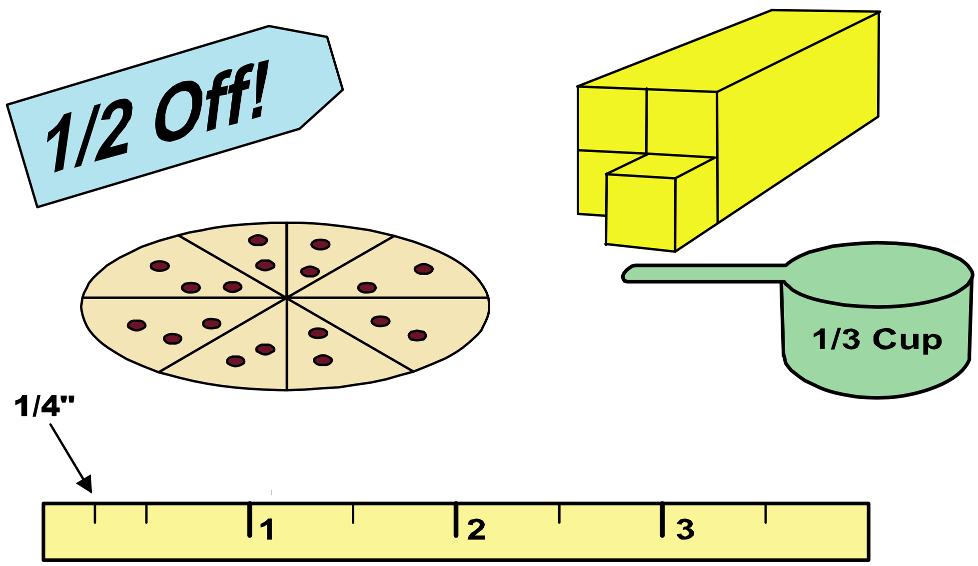
8. How many clocks will each store receive?

Notes:

Fractions

A fraction is a way of expressing a part of a whole.

We deal with fractions all of the time. Department stores have "half-off" sales. Recipes call for $^1/_3$ cup of sugar or $^1/_4$ pound of margarine. We travel $^4/_{10}$ of a mile to pick up a pizza cut into eight slices. (Each slice is $^1/_8$ of the whole pizza.) We measure $^1/_{16}$ of an inch on a ruler. The list is endless.



Examples of Fractions

There are two parts to a fraction. The top number and the bottom number.

The bottom number tells us the number of parts in the whole.

The top number tells us the number of parts we are talking about.

Proper Fractions

Examples:

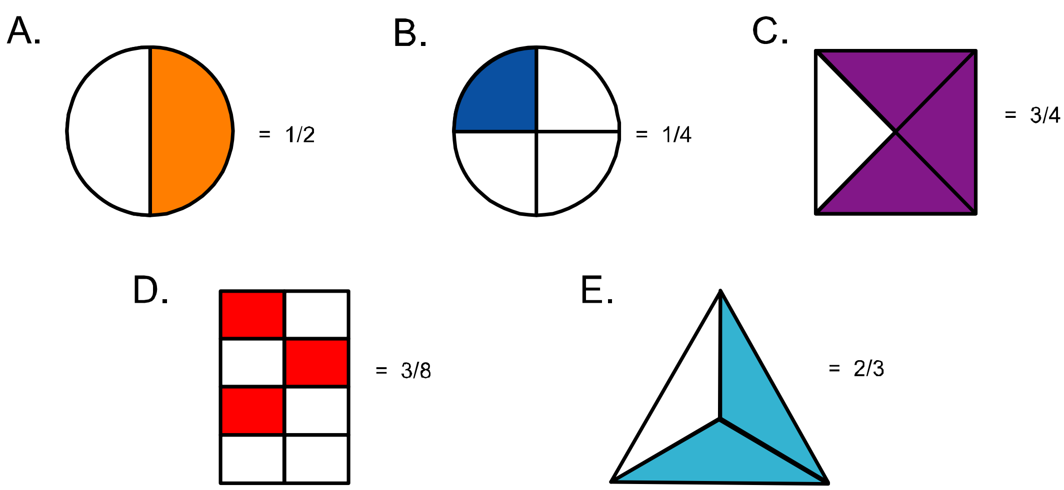
In illustration "A", the circle has two parts. One part is shaded. The fraction $^{1}/_{2}$ tells you how much of the circle is shaded.

In illustration "B", the circle has four parts. One part is shaded. The fraction $^{1}/_{4}$ tells you how much of the circle is shaded.

In illustration "C", the square has four parts. Three parts are shaded. The fraction $^{3}/_{4}$ tells you how much of the circle is shaded.

In illustration "D", the rectangle has eight parts. Three parts are shaded. The fraction $^{3}/_{8}$ tells you how much of the circle is shaded.

In illustration "E", the triangle has three parts. Two parts are shaded. The fraction $^{2}/_{3}$ tells you how much of the circle is shaded.



Fractions Shaded

These fractions are known as proper fractions because the top number is smaller than the bottom number.

Reducing Fractions

Sometimes fractions can be a bit too large to handle easily. When this occurs, we try to reduce the fraction to make it easier.

Reducing a fraction means to write the fraction using smaller numbers *without changing the fraction's value*.

Example #1

A recipe takes 6 eggs. That means we would need $^{6}/_{12}$ of a dozen of eggs. Six-twelfths is a bit cumbersome. Let's reduce the fraction by finding a number that divides into both the top and bottom numbers evenly. In this case, 6 will divide into both numbers.

$$\frac{6 \div 6}{12 \div 6} = \frac{1}{2}$$

After dividing both numbers by six, we have reduced the fraction to $^{1}/_{2}$ … a much easier fraction to handle. *Moreover, we have not changed its value.* Six eggs *are* half a dozen.

Example #2

A dollar is equal to one hundred pennies. A dime is equal to ten pennies. Therefore, a dime is $^{10}/_{100}$ of a dollar. Let's reduce the fraction. Ten will divide into both numbers.

$$\frac{10 \div 10}{100 \div 10} = \frac{1}{10}$$

As you can see, we have reduced $^{10}/_{100}$ to $^{1}/_{10}$, an easier number to handle, *without changing its value.* After all, a dime is one-tenth of a dollar.

Mixed Numbers

A mixed number is a combination of a whole number and a fraction.

2 $^1/_3$, 5 $^3/_4$, and 4 $^5/_6$ are examples of mixed numbers.

Mixed numbers can be converted to fractions by a simple process.

Example

Convert 4 $^2/_3$ to a fraction.

$$4\frac{2}{3} = \overset{1}{\frac{(4\times 3)+2}{3}} = \overset{2}{\frac{(12)+2}{3}} = \overset{3}{\frac{14}{3}}$$

Step 1: Multiply the bottom number (3) by the whole number (4).
$3 \times 4 = 12$

Step 2: Add the top number (2). $(2 + 12 = 14)$

Step 3: Write the sum over the bottom number: $^{14}/_3$.

Improper Fractions

As you saw in the previous example, there may be times when the top number of a fraction is equal to or larger than the bottom number. In those cases, the fractions are known as improper fractions.

$^{9}/_{8}$, $^{5}/_{4}$, and $^{6}/_{3}$ are examples of improper fractions.

An improper fraction can be converted into a whole or mixed number *without changing its value*.

Example #1

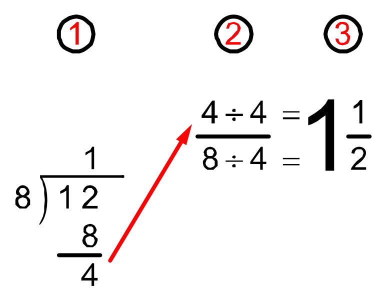
Convert $^{7}/_{7}$ to a whole number.

$^{7}/_{7}$ can be converted to a whole number by dividing the bottom number into the top number.

$$7 \div 7 = 1$$

Example #2

Convert $^{12}/_{8}$ into a mixed number.



Step 1: Divide the bottom number (8) into the top number (12).

Step 2: Write the remainder (4) over the bottom number (8).

Step 3: Reduce the fraction (4/8) to its lowest terms. (Divide both numbers by 4).

We see that $^{12}/_{8}$ equals $1\,^{1}/_{2}$.

Whole Numbers as Fractions

Any whole number can be written as an improper fraction with the bottom number as 1.

Examples:

$$5 = \frac{5}{1} \qquad 9 = \frac{9}{1} \qquad 12 = \frac{12}{1} \qquad 25 = \frac{25}{1}$$

Adding and Subtracting Fractions

The key to addition and subtraction of fractions is to make the bottom number the same on all of the fractions.

Like Fractions

If the bottom numbers are already the same, addition is easy. We simply add the top numbers and reduce if necessary.

Example

$^3/_4 + {}^1/_4 = ?$

1 2 3

$$\begin{array}{r} \frac{3}{4} \\ +\frac{1}{4} \\ \hline \frac{4}{4} \end{array} = 4 \div 4 = 1$$

Step 1: Add the top numbers. $(3 + 1 = 4)$

Step 2: Place the sum over the bottom number. $^4/_4$

Step 3: Reduce. (Divide the top number by the bottom number).
$4 \div 4 = 1$

We see that $^3/_4 + {}^1/_4 = 1$.

Unlike Fractions

If the bottom numbers are different, it's a little trickier to add. We must convert the fractions so that the bottom numbers are the same *without changing the value of the fractions.*

Example

$^1/_2 + {}^3/_8 = ?$

$$
\begin{array}{rcccc}
 & 1 & & 2 & & 3 \\
 & \frac{1}{2} & = & \frac{1\times 4}{2\times 4} & = & \frac{4}{8} \\
+ & \frac{1}{4} & = & \frac{3}{8} & = & \frac{3}{4} \\
\hline
 & & & & & \frac{7}{8}
\end{array}
$$

Step 1: Since 2 divides evenly into 8, we will use 8 as the bottom numbers on both fractions.

Step 2: Divide the 2 into the 8. $(8 \div 2 = 4)$

Step 3: Multiply the 1 by the 4. $(1 \times 4 = 4)$

Step 4: Place the 4 over 8. $^4/_8$

Note: We have converted $^1/_2$ to $^4/_8$ without changing the value of the fraction.

Step 5: Add the top numbers. $(4 + 3 = 7)$

Step 6: Place the sum (7) over 8.

We see that $^1/_2 + {}^3/_8 = {}^7/_8$.

Mixed Numbers

Adding or subtracting mixed numbers uses the same process.

Example

$2\,^5/_6 - 1\,^2/_3 = ?$

$$
\begin{array}{rcccc}
 & 1 & & 2 & & 3 \\
 & 2\frac{5}{6} & = & 2\frac{5}{6} & = & 2\frac{5}{6} \\
- & 1\frac{2}{3} & = & 1\frac{2\times 2}{3\times 2} & = & 1\frac{4}{6} \\
\hline
 & & & & & 1\frac{1}{6}
\end{array}
$$

Step 1: Since 3 divides evenly into 6, we will use 6 as the bottom numbers on both fractions.

Step 2: Divide the 3 into the 6. $(6 \div 3 = 2)$

Step 3: Multiply the bottom 3 by 2. $(3 \times 2 = 6)$

Step 4: Multiply the top 2 by 2. $(2 \times 2 = 4)$

Step 4: Place the 4 over the 6.

Step 5: Now that the bottom numbers of the fractions are the same, we simply subtract the top numbers. $(5 - 4 = 1)$

Step 6: Subtract the whole numbers. $(2 - 1 = 1)$

We see that $2\,^5/_6 - 1\,^2/_3$ equals $1\,^1/_6$.

Borrowing

There may be times when you need to subtract mixed numbers such as when the bottom fraction is larger than the top fraction. To resolve this situation, we borrow from the whole number.

We do this by converting part of the whole number into a fraction.

Example

$3\,{}^{1}/_{4} - 2\,{}^{3}/_{4} = ?$

$$\begin{array}{ccccccccc} 1 & & 2 & & & & 3 & 4 & 5 \\ 3\frac{1}{4} & = & 2\frac{4}{4} & + & \frac{4}{4} & = & 2\frac{5}{4} & & \\ -2\frac{3}{4} & = & 2\frac{3}{4} & & & = & 2\frac{3}{4} & & \\ \hline & & & & & & \frac{2\div 2}{4\div 2} & = & \frac{1}{2} \end{array}$$

Since ${}^{3}/_{4}$ is larger than ${}^{1}/_{4}$, we must borrow from the 3.

Step 1: Subtract 1 from the top whole number 3. $(3 - 1 = 2)$

Step 2: Convert the 1 into fourths. $(1 = {}^{4}/_{4})$

Step 3: Add the ${}^{4}/_{4}$ to the ${}^{1}/_{4}$. $({}^{4}/_{4} + {}^{1}/_{4} = {}^{5}/_{4})$

Step 4: Subtract the whole numbers. $(2 - 2 = 0)$

Step 5: Subtract the fractions. $({}^{5}/_{4} - {}^{3}/_{4} = {}^{2}/_{4})$

Step 6: Reduce the fraction. ${}^{2}/_{4} = {}^{1}/_{2}$

Multiplying Fractions

Multiplying fractions means finding part of a fraction (e.g. one-half of one-tenth). Therefore, the answer will be smaller than both of the two fractions you multiplied.

In the example above, one-half of one-tenth is one-twentieth. One-twentieth is smaller than both one-half and one-tenth.

Multiplying fractions is a simple process of multiplying the top numbers, then multiplying the bottom numbers.

Examples:

1 2 3

a. $$\frac{1}{3} \times \frac{2}{5} = \frac{1 \times 2}{3 \times 5} = \frac{2}{15}$$

b. $$\frac{3}{4} \times \frac{5}{9} = \frac{3 \times 5}{4 \times 9} = \frac{15}{36}$$

c. $$\frac{1}{2} \times \frac{4}{7} = \frac{1 \times 4}{2 \times 7} = \frac{4}{14} = \frac{2}{7}$$

Multiplying Mixed Numbers

Multiplying mixed numbers is almost as easy. To multiply mixed numbers we must change the mixed numbers to improper fractions. Then we follow the same process as multiplying fractions.

Example

$4\,^2/_3 \times 3\,^1/_6 = ?$

1 2 3 4 5 6

$$4\frac{2}{3} \times 3\frac{1}{6} = \frac{14}{3} \times \frac{19}{6} = \frac{14 \times 19}{3 \times 6} = \frac{266}{18} = 14\frac{14}{18} = 14\frac{7}{9}$$

Dividing Fractions

Dividing fractions is slightly more difficult. When dividing by a fraction, we must invert the fraction and then multiply.

Example #1

${}^{6}/_{6} \div {}^{3}/_{8} = ?$

1

$$\frac{5}{6} \div \frac{3}{8} =$$

2

Invert

$$\frac{5}{6} \div \frac{8}{3} =$$

Multiply

3 4 5 6 7

$$\frac{5}{6} \times \frac{8}{3} = \frac{5 \times 8}{6 \times 3} = \frac{40}{18} = 2\frac{4}{18} = 2\frac{2}{9}$$

Dividing Mixed Numbers

Dividing mixed numbers requires converting the mixed numbers to improper fractions then inverting and multiplying.

Example #2

$3\,{}^{2}/_{3} \div 1\,{}^{4}/_{5} = ?$

1 2

$$3\frac{2}{3} \div 1\frac{4}{5} = \frac{11}{3} \div \frac{9}{5} =$$

3

Invert

$$\frac{11}{3} \div \frac{5}{9} =$$

Multiply

4 5 6 7

$$\frac{11}{3} \times \frac{5}{9} = \frac{11 \times 5}{3 \times 9} = \frac{55}{27} = 2\frac{1}{27}$$

Progress Check # 2

1. Reduce the following fractions to their lowest terms:

   a. $\frac{6}{8}$ b. $\frac{5}{10}$ c. $\frac{3}{9}$ d. $\frac{15}{45}$

2. Convert the following mixed numbers to fractions:

   a. $1\frac{5}{6}$ b. $3\frac{7}{8}$ c. $4\frac{1}{2}$ d. $5\frac{3}{4}$

3. Convert the following improper fractions to mixed numbers:

   a. $\frac{13}{7}$ b. $\frac{8}{3}$ c. $\frac{27}{12}$ d. $\frac{37}{4}$

4. Add the following fractions:

   a. $\begin{array}{r} \frac{5}{8} \\ + \frac{2}{8} \\ \hline \end{array}$ b. $\begin{array}{r} \frac{7}{16} \\ + \frac{9}{16} \\ \hline \end{array}$ c. $\begin{array}{r} \frac{5}{6} \\ + \frac{1}{2} \\ \hline \end{array}$ d. $\begin{array}{r} \frac{4}{12} \\ + \frac{2}{3} \\ \hline \end{array}$

5. Subtract the following fractions:

   a. $\begin{array}{r} \frac{11}{32} \\ - \frac{6}{32} \\ \hline \end{array}$ b. $\begin{array}{r} \frac{7}{8} \\ - \frac{1}{8} \\ \hline \end{array}$ c. $\begin{array}{r} \frac{3}{4} \\ - \frac{1}{3} \\ \hline \end{array}$ d. $\begin{array}{r} \frac{3}{5} \\ - \frac{3}{15} \\ \hline \end{array}$

6. Add the following mixed numbers:

a. $$\begin{array}{r} 1\frac{1}{8} \\ +4\frac{2}{8} \\ \hline \end{array}$$ b. $$\begin{array}{r} 2\frac{1}{3} \\ +5\frac{1}{15} \\ \hline \end{array}$$ c. $$\begin{array}{r} 3\frac{7}{8} \\ +3\frac{7}{8} \\ \hline \end{array}$$ d. $$\begin{array}{r} 6\frac{13}{27} \\ +7\frac{5}{9} \\ \hline \end{array}$$

7. Subtract the following mixed numbers:

a. $$\begin{array}{r} 2\frac{2}{8} \\ -1\frac{1}{8} \\ \hline \end{array}$$ b. $$\begin{array}{r} 3\frac{1}{4} \\ -1\frac{3}{12} \\ \hline \end{array}$$ c. $$\begin{array}{r} 4\frac{1}{6} \\ -2\frac{5}{6} \\ \hline \end{array}$$ d. $$\begin{array}{r} 5\frac{13}{35} \\ -3\frac{3}{7} \\ \hline \end{array}$$

8. Multiply the following fractions:

a. $\frac{4}{5} \times \frac{3}{8}$ b. $\frac{4}{9} \times \frac{2}{3}$ c. $\frac{1}{6} \times \frac{1}{4}$

9. Multiply the following mixed numbers:

a. $2\frac{1}{8} \times 1\frac{2}{3}$ b. $3\frac{2}{3} \times 5\frac{1}{6}$

10. Divide the following fractions:

a. $\frac{1}{3} \div \frac{1}{3}$ b. $\frac{3}{5} \div \frac{2}{3}$

11. Divide the following mixed numbers:

a. $1\frac{1}{2} \div 2\frac{1}{3}$ b. $4\frac{2}{9} \div 2\frac{1}{8}$

12. During the annual inventory it was learned that there were several partial cases of unsold books. You have been directed to consolidate all of the books into one shipment for donation to charity. You must calculate how many total cases the charity will receive. Below are the quantities by book title:

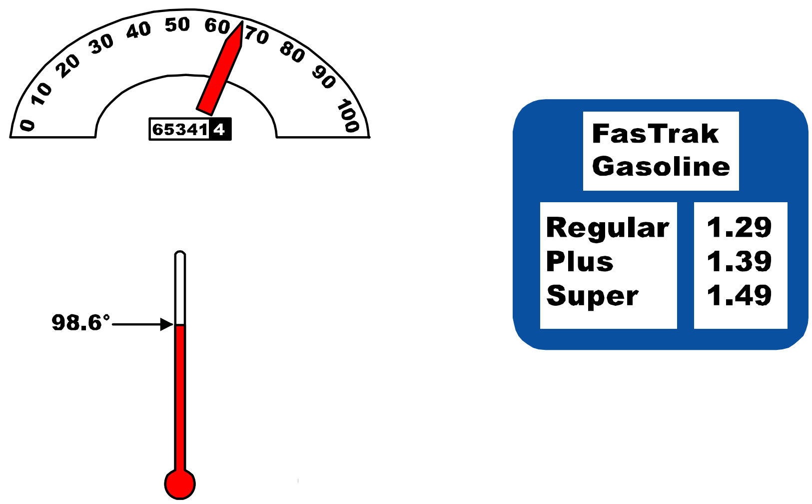
Title 1:	$2\frac{1}{2}$	cases
Title 2:	$3\frac{3}{4}$	cases
Title 3:	$4\frac{2}{3}$	cases
Title 4:	$1\frac{1}{6}$	cases
Title 5:	3	cases
Total:		cases

Notes:

Decimals

Just as with fractions, we work with decimal numbers everyday without realizing it. A body temperature of 98.6 is considered normal. We pay $1.29 for a gallon of gasoline. We traveled 12.4 miles to work.

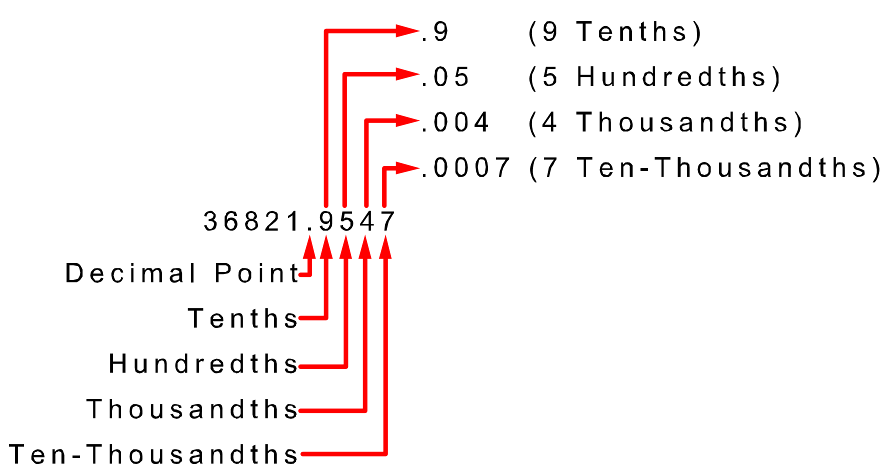
Numbers like 98.6, 1.29 and 12.4 are decimals.



Examples of Decimals

Like whole numbers, each digit of a decimal has a place value.

We use the decimal point to separate the whole number from the decimal number.



Reading Decimals

Decimals with Zeros

We can easily recognize whole numbers with added zeros, but decimals with added zeros can sometimes cause confusion.

The whole number 25 could be written as 025 or 0025. We quickly realize that the zeros are unnecessary. All three numbers (25, 025, and 0025) mean the same. Adding extra zeros to the left of a whole number does not change the number's value.

The decimal .25 could be written as .250 or .2500. Like before, the extra zeros are unnecessary. All three decimals (.25, .250, and .2500) mean the same. Adding extra zeros to the right of a decimal does not change the decimal's value.

However, adding zeros to the right of a whole number does change its value. 25, 250 and 2500 are very different numbers.

Similarly, adding zeros between the decimal point and the decimal number changes its value. .25, .025, and .0025 are very different decimals.

Note: If there is no whole number, a zero is sometimes added to the left of the decimal point to clarify the decimal. (.85 = 0.85)

Sorting Decimals

At first glance, it is often difficult to recognize which decimal is larger or smaller. Some thought and a little practice will help you when comparing decimals.

The easiest method to compare decimals is to give each of the decimals the same number of decimal places by adding zeros to the right.

Remember: Adding extra zeros to the right of a decimal does not change the decimal's value.

Initially, .6, .065, .605, and .06 would be difficult to sort.

Adding zeros to give each decimal the same number of places solves the problem.

.600, .065, .605, and .060 are much easier to sort.

Sorting from the smallest to the largest: .060, .065, .600, and .605

Adding Decimals

Adding decimals is just as easy as adding whole numbers. The key to this process is to align the decimal points.

Examples:

1

$$\begin{array}{r} .457 \\ +\,.86 \\ \hline \end{array}$$

Align the decimal points

2

$$\begin{array}{r} .457 \\ +\,.86 \\ \hline 1\ \ 317 \end{array}$$

Add as with whole numbers

3

$$\begin{array}{r} .457 \\ +\,.86 \\ \hline 1.317 \end{array}$$

Bring down the decimal point

Subtracting Decimals

Aligning the decimal points is also critical when subtracting decimals. It is sometimes helpful to add zeros to the right of one of the numbers to give both numbers the same numbers of decimal places.

Remember: Adding extra zeros to the right of a decimal does not change the decimal's value.

1 Align the decimal points

$$\begin{array}{r} 4.3 \\ -\,2.859 \\ \hline \end{array}$$

2 Insert zeros to give both numbers the same amount of places

$$\begin{array}{r} 4.300 \\ -\,2.859 \\ \hline \end{array}$$

3 Subtract as with whole numbers

Bring down the decimal point

$$\begin{array}{r} 4.300 \\ -\,2.859 \\ \hline 1.441 \end{array}$$

Multiplying Decimals

Multiplying decimals is very similar to multiplying whole numbers. With decimals, we must be sure to keep track of the number of decimal places.

Example:

1

$$\begin{array}{r} 5.47 \\ \times\ \ .3 \\ \hline \end{array}$$

Align to the right

2

$$\begin{array}{r} 5.47 \\ \times\ \ .3 \\ \hline 1641 \end{array}$$

Multiply as with whole numbers

3

$$\begin{array}{r} 5.47 \\ \times\ \ .3 \\ \hline 1641 \end{array}$$

2 decimal places
1 decimal places
Count the total number of decimal places (3)

4

$$\begin{array}{r} 5.47 \\ \times\ \ .3 \\ \hline 1.641 \end{array}$$

Count the same number of decimal places (3) from the right and insert the decimal point

Dividing Decimals

Just as with multiplication, the process of dividing decimals is similar to that of whole numbers. As a matter of fact, to make things easier, we will change one of the numbers to a whole number by moving the decimal points on both numbers.

Example:

1 .25)40.5

2 25.)40.5 Move the decimal all the way to the right

3 25.)40 50. Move the decimal the same number of places (2)

4 25.)4050. Bring the decimal point up

5 Divide as with whole numbers

```
       1 62.
25.)40 50.
    25
    15 5
    15 0
       50
       50
        0
```

Converting Fractions to Decimals

Fractions are often difficult to handle. Sometimes it is easier to change the fraction into a decimal. To change a fraction into a decimal, simply divide the bottom number into the top number.

Example #1

What is the decimal equivalent of $^1/_2$?

1 $\frac{1}{2}$

2 $2\overline{)1}$ Rewrite the problem

3 $2\overline{)1.}$ Add the decimal point

4 $\begin{array}{r} . \\ 2\overline{)1.} \end{array}$ Bring the decimal point up

5 $\begin{array}{r} .5 \\ 2\overline{)1.0} \\ \underline{1\ 0} \\ 0 \end{array}$ Divide as with whole numbers

Example #2

What is the decimal equivalent of $^3/_{16}$?

1. $$\frac{3}{16}$$

2. $16\overline{)3}$ Rewrite the problem

3. $16\overline{)3.}$ Add the decimal point

4. $$\begin{array}{r} . \\ 16\overline{)3.0000} \end{array}$$ Bring the decimal point up

5. Divide as with whole numbers
Add as many zeros as is necessary

$$\begin{array}{r}
.1875 \\
16\overline{)3.0000} \\
\underline{1\ 6} \\
1\ 40 \\
\underline{1\ 28} \\
120 \\
\underline{112} \\
80 \\
\underline{80} \\
0
\end{array}$$

Example #3

What is the decimal equivalent of $^{25}/_{100}$?

1. $\dfrac{25}{100}$

2. $100\overline{)25}$ — Rewrite the problem

3. $100\overline{)25.}$ — Add the decimal point

4. $100\overline{)25.}$ with the point above: $\overset{.}{}$ — Bring the decimal point up

5. Divide as with whole numbers
   Add as many zeros as is necessary

$$\begin{array}{r}
.25 \\
100\overline{)25.00} \\
\underline{200} \\
500 \\
\underline{500} \\
0
\end{array}$$

The following is a conversion chart of the most common fractions.

Fraction to Decimal Coversion					
1/32					0.03125
2/32	1/16				0.0625
3/32					0.09375
4/32	2/16	1/8			0.125
5/32					0.15625
6/32	3/16				0.1875
7/32					0.21875
8/32	4/16	2/8	1/4		0.25
9/32					0.28125
10/32	5/16				0.3125
11/32					0.34375
12/32	6/16	3/8			0.375
13/32					0.40625
14/32	7/16				0.4375
15/32					0.46875
16/32	8/16	4/8	2/4	1/2	0.5
17/32					0.53125
18/32	9/16				0.5625
19/32					0.59375
20/32	10/16	5/8			0.625
21/32					0.65625
22/32	11/16				0.6875
23/32					0.71875
24/32	12/16	6/8	3/4		0.75
25/32					0.78125
26/32	13/16				0.8125
27/32					0.84375
28/32	14/16	7/8			0.875
29/32					0.90625
30/32	15/16				0.9375
31/32					0.96875
32/32	16/16	8/8	4/4	2/2	1.0

Conversion Chart

Progress Check #3

1. Put the following decimals in order from smallest to largest:

    a. .031, .31, .301, and .0031

    b. 0.2, .207, .027, and .27

2. Add the following decimals:

    a. $.45 + .528 + .3$

    b. $.8 + .37 + 1.366$

3. Subtract the following decimals:

    a. $.56 - .379$

    b. $1.3 - .299$

4. Multiply the following decimals:

    a. 2.54×5.3

    b. $.741 \times .44$

5. Divide the following decimals:

   a. 4.24 ÷ 1.06

   b. 20.215 ÷ .05

6. Convert the following fractions to decimals:

   a. $^{1}/_{4}$

   b. $^{3}/_{8}$

7. Your company pays independent truckers 32 cents for each mile traveled. The truckers each traveled different distances (see below). What is the total amount of money your company will pay these truckers?

   Trucker A: 354.6 miles

   Trucker B: 753.9 miles

   Trucker C: 1,321.4 miles

   Trucker D: 448.1 miles

8. You worked 46 hours this week. Anything over 40 hours is paid at time-and-a-half (1.5 × pay). Your regular hourly pay is 11.50 per hour. What was your gross income (before taxes) this week?

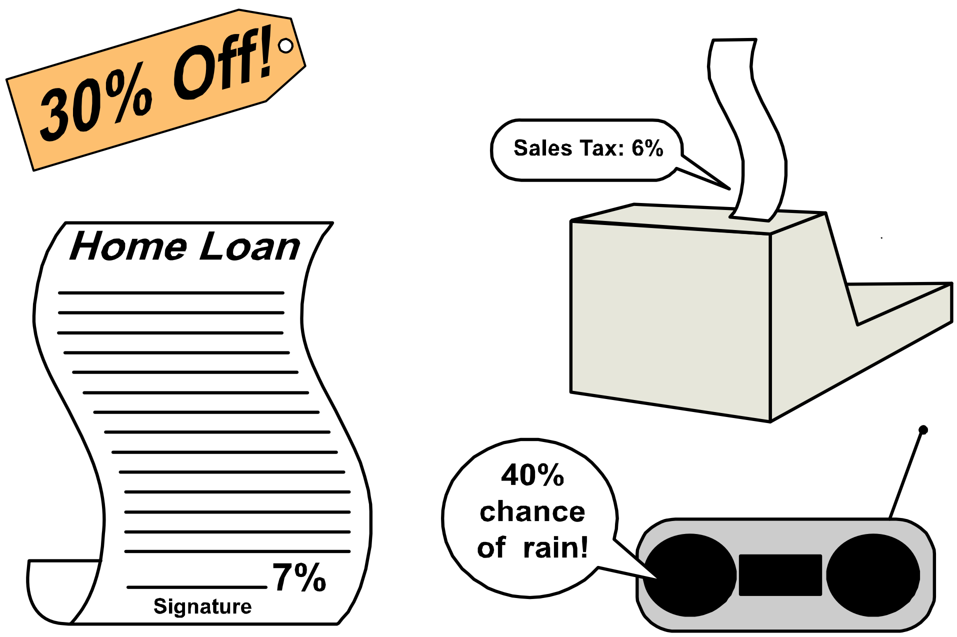
Notes:

Percents

Just as fractions and decimals are everywhere, so are percents. Percents are another way of describing part of a whole. In the case of percents, the whole is divided into 100 equal parts.

A store that advertises "30% off!" is telling us that prices will be reduced 30 cents for every dollar.

A loan that offers 7% interest charges $7 for every $100 borrowed.



Examples of Percents

Converting Percents to Fractions and Decimals

Since percents are based on 100 parts, changing percents to fractions involves placing the percent over 100.

Dividing the top number by 100 converts the fraction to a decimal.

Note: 100% is equal to the whole, 200% is two times the whole, etc.

$$50\% = \frac{50}{100} = .50$$

$$75\% = \frac{75}{100} = .75$$

$$100\% = \frac{100}{100} = 1.00$$

$$140\% = \frac{140}{100} = 1.40$$

Converting Fractions and Decimals to Percents

Previously, we saw how to convert a fraction to a decimal. We simply divided the top number by the bottom number. We will use this same method to convert a fraction to a percent. Then we will convert the decimal to a percent by multiplying it by 100. (After all, percents are based on 100.)

$$\frac{1}{4} = .25 \times 100 = 25\%$$

$$\frac{3}{8} = .375 \times 100 = 37.50\%$$

$$\frac{2}{3} \approx 0.667 \times 100 = 66.7\%$$

$$\frac{7}{16} = 0.4375 \times 100 = 43.75\%$$

$$\frac{1}{20} = 0.05 \times 100 = 5\%$$

Working with Percents

Solving problems with percents is a matter of multiplication or division.

Examples:

a.	30%	of	\$175	is	?	
	.30	of	\$175	is	?	Convert the percent to a decimal
	.30	X	\$175	=	\$52.50	Multiply
b.	45%	of	\$342	is	?	
	0.45	of	\$342	is	?	Convert the percent to a decimal
	0.45	X	\$342	=	\$153.90	Multiply

c. What percent of 34 is 17?

?%	of	34	is	17	Write the problem
?%	=	$\frac{17}{34}$			Rewrite the problem
?%	=	.50			Convert fraction to a decimal
?%	=	0.5	X	100	Convert decimal to percent
?%	=	50%			

d. What percent of 500 is 25?

?%	of	500	is	25	Write the problem
?%	=	$\frac{25}{500}$			Rewrite the problem
?%	=	.05			Convert fraction to a decimal
?%	=	.05	X	100	Convert decimal to percent
?%	=	5%			

Progress Check #4

1. Convert the following percents to fractions:

   a. 35% _____

   b. 6% _____

   c. 21.9% _____

2. Convert the following percents to decimals:

   a. 68% _____

   b. 3.3% _____

   c. 119% _____

3. Convert the following fractions to percents:

   a. $^{3}/_{4}$ _____

   b. $^{2}/_{5}$ _____

   c. $^{21}/_{50}$ _____

4. Convert the following decimals to percents:

   a. .89 _____

   b. .08 _____

   c. .576 _____

5. Seven and one-half percent of your pay is taken for Social Security. If your gross pay is $386, how much money do you contribute to your social security account?

6. Your lift truck operators loaded 159 pallets onto trucks. Fifty-three of the pallets contained birdseed. What percent of the pallets had birdseed?

Measurements

There are many times when we must ensure that the product we are storing or shipping meets space requirements. Measurements are often taken to ensure the product will fit into a carton, on a rack or onto a trailer. As a warehouse team member, you may be responsible for taking these measurements.

There are two measurement systems in use throughout the United States and the world – the standard or "American" measuring system and the metric system.

We will cover both.

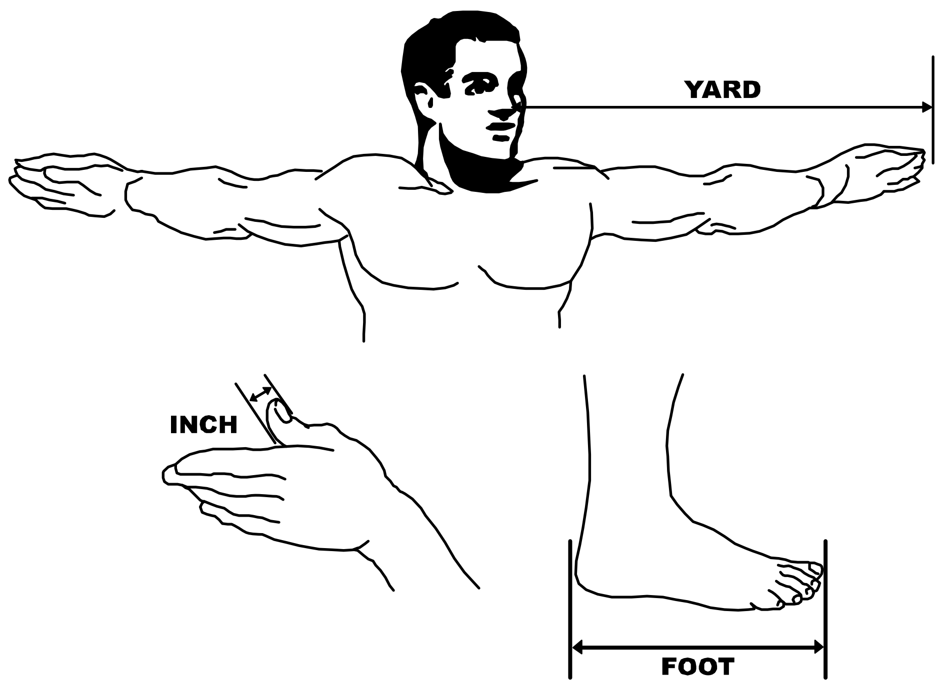
Linear Measurements

Because warehouse personnel are not required to measure much more than a few feet, we will only focus on three units of measuring distance in each system – the inch, the foot and the yard in the standard system, and the millimeter, centimeter and meter in the metric system.

Standard System

The standard system has unusual origins. Centuries ago, the units of measurements were based on rather dubious "standards." An inch was the width of a thumb. A foot was the length of a foot from the heel to the tip of the big toe. A yard was the distance from the tip of the nose to the tip of the middle finger.

It is easy to see that there are great inconsistencies between one person's thumb and another's. There are even greater differences between the size of our feet! And which way should we turn our head (and nose) when measuring a yard?



Standards

These "standards" may have been sufficient three hundred years ago, but they certainly are not adequate in the 21st century.

The standard system has evolved from those primitive measurements to scientifically accurate standards. An inch has been standardized as equal to the wavelength of light given off by Krypton 86 gas. It is an absolute standard that never changes.

The abbreviation for an inch is "*in*."

One inch is often written as *1*".

A foot is twelve times an inch. That is, there are twelve inches in a foot.

1 foot = 12 inches.

The abbreviation for a foot is "*ft*."

One foot is often written as *1*'.

A yard is three times a foot. That is, there are three feet in a yard.

1 yard = 3 feet

The abbreviation for a yard is "*yd*."

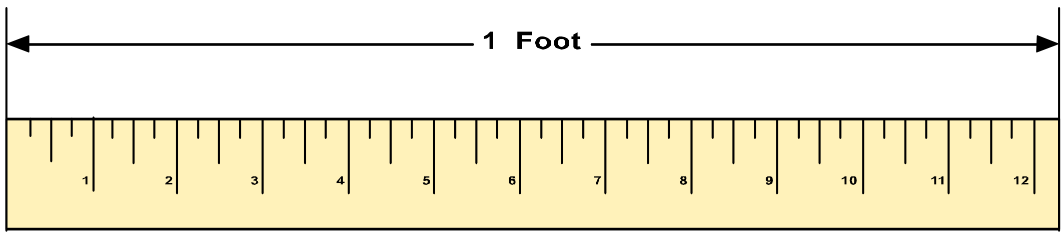
Since there are twelve inches in a foot, there must be 36 inches in a yard. (3 × 12" = 36")

12 inches	= 1 foot
3 feet	= 1 yard
36 inches	= 1 yard

Rulers, Yardsticks and Tape Measures

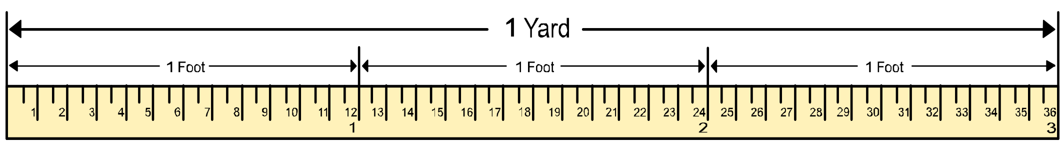
When measuring small distances we commonly use rulers, yardsticks or tape measures.

A ruler, sometimes referred to as a "foot rule" or "straightedge", is one foot long. It is useful when measuring distances less than twelve inches.



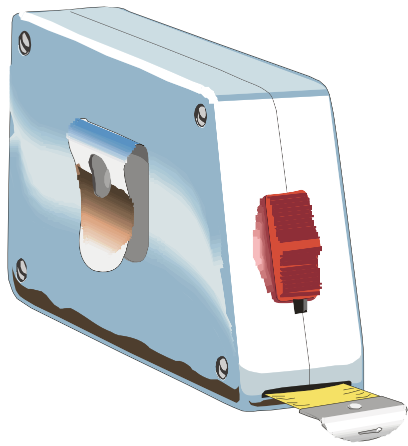
Ruler

A yardstick is one yard long. It is three times the length of a ruler. It is useful when measuring distances less than 36 inches.



Yardstick

Tape measures come in a variety of sizes (16', 20', etc.). Because a tape measure is retractable and flexible, it may be extended a small amount or its entire length. A tape measure is useful when measuring distances from a few inches to several feet. It is convenient to carry or store.



Tape Measure

Rulers, yardsticks and tape measures are marked at each inch. Yardsticks and tape measures also have markings at each foot.

- A ruler is divided into twelve inches.
- A yardstick is divided into 36 inches.

Although tape measures come in different sizes, they are also divided into inches and feet along their entire length.

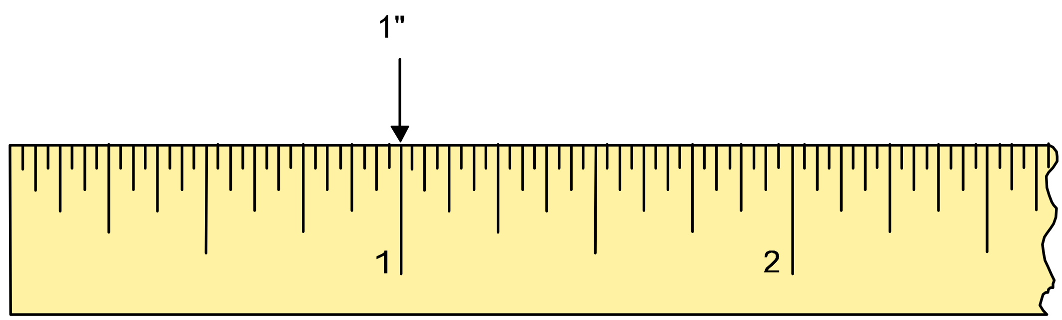
Smaller Measurements

In today's era of mass production, a foot and an inch are rather large measurements. Therefore, the inch has been divided into smaller parts.

Graduations

On each of these measuring tools, there are several difference-sized markings. The longest of these "graduations" marks a full inch. The first inch mark is one inch from the left end of the ruler.

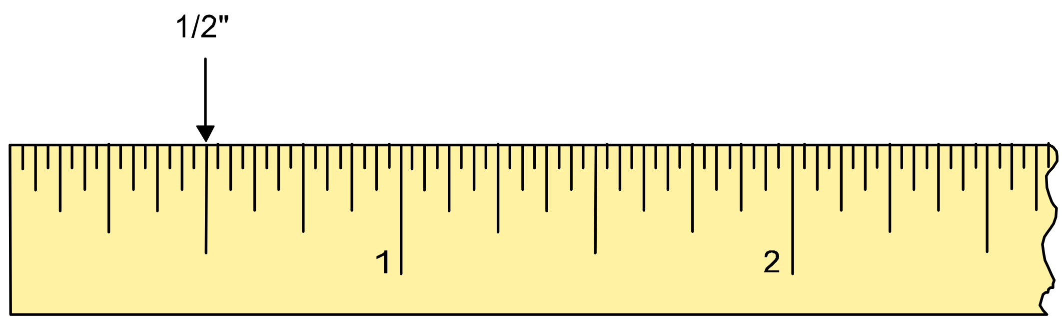
There is a mark for every inch along the ruler, yardstick or tape measure. The marks are numbered in sequence (i.e. 1, 2, 3, 4, etc.).



When linear measurements are taken, they often fall between the inch markings. If we look more closely at a ruler, yardstick or tape measure, we can see that there are many graduations of different sizes between each inch mark.

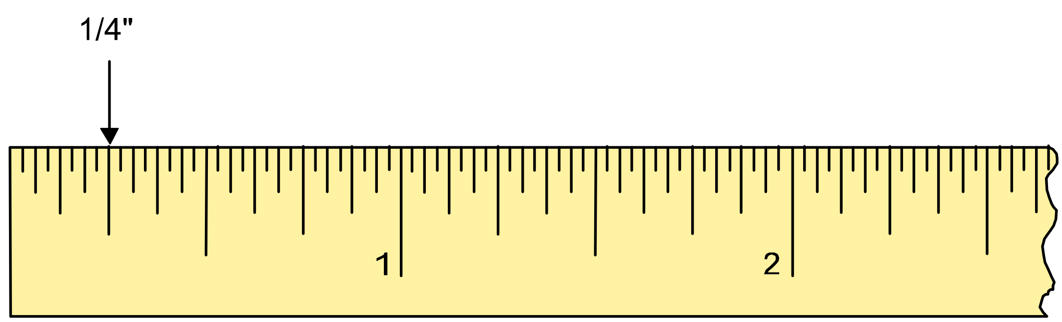
These markings help us divide an inch into parts or fractions.

The second longest graduation marks the halfway point between each inch. It represents one-half inch. The first half-inch mark is one-half of an inch from the left end of the ruler.



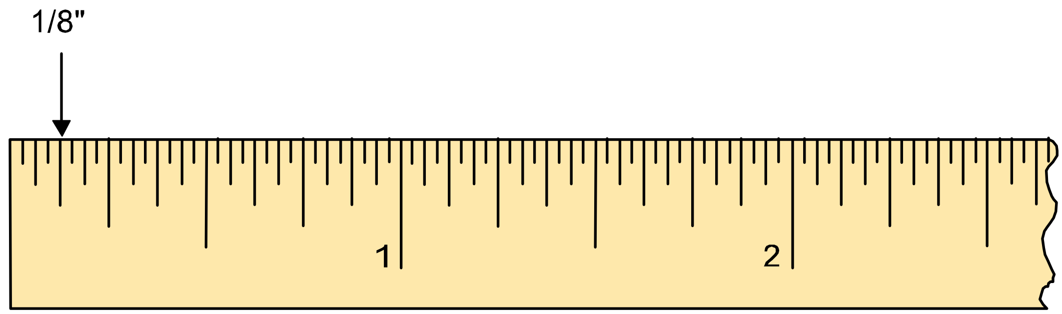
One-half inch is written as a fraction: $^1/_2$".

The next longest graduation marks each one-fourth inch or one-quarter inch. The first quarter-inch mark is one-fourth of an inch from the left end of the ruler.



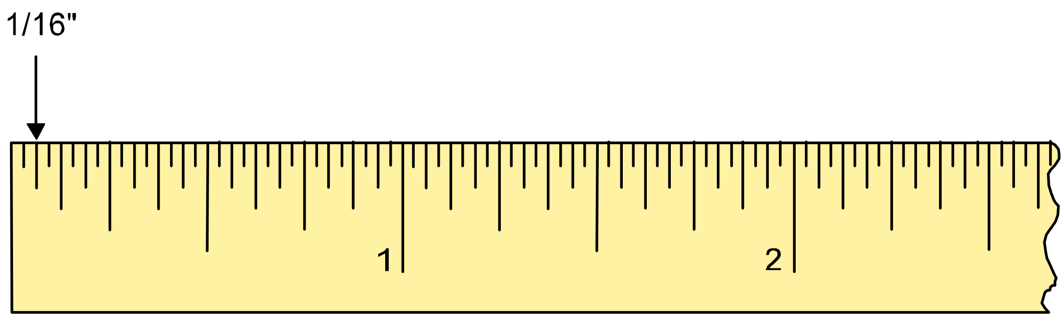
One-fourth inch is written as a fraction: $^1/_4$".

The next longest graduation marks each one-eighth inch. The first eighth-inch mark is one-eighth of an inch from the left end of the ruler.



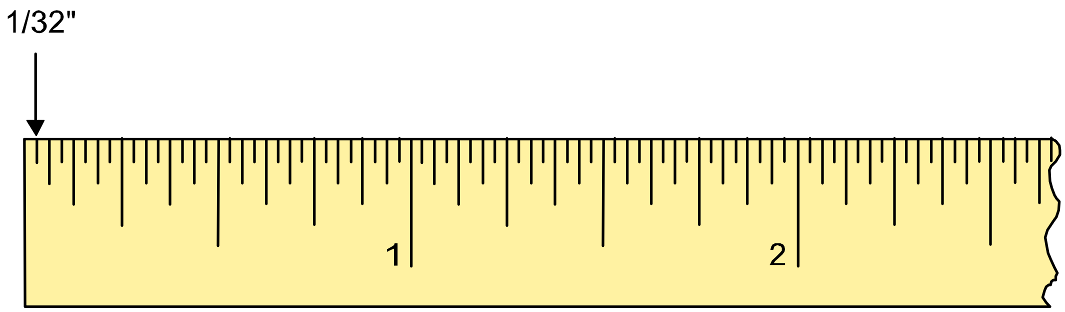
One-eighth inch is written as a fraction: $^1/_8$".

The next longest graduation marks each one-sixteenth inch. The first sixteenth-inch mark is one-sixteenth of an inch from the left end of the ruler.



One-sixteenth inch is written as a fraction: $^1/_{16}$".

The next longest graduation represents each one thirty-seconds inch. The first thirty-seconds of an inch mark is one thirty-seconds of an inch from the left end of the ruler.



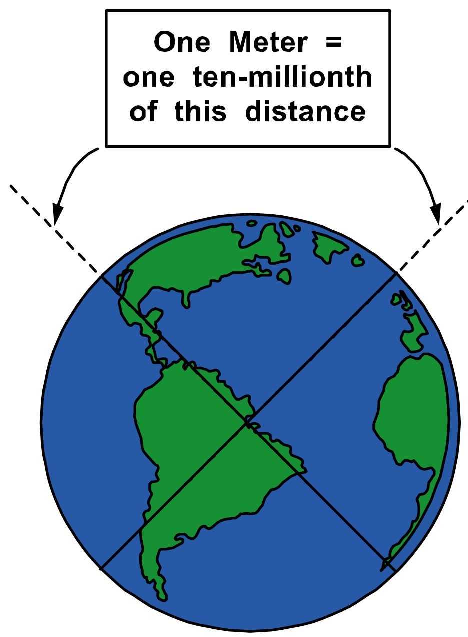
One thirty-seconds inch is written as a fraction: $^{1}/_{32}$".

Only precision rulers go much smaller than $^{1}/_{32}$".

If a measurement exceeds an inch, we simply look at the whole-inch to the immediate left and then add the fraction.

Metric System

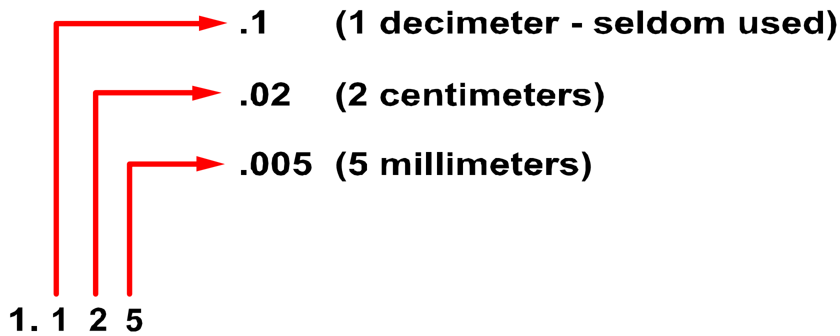
The metric system has a much more scientific origin. In 1790, at the request of the French Parliament, the French Academy of Sciences proposed a measuring system based on one unit of measurement…the meter. A meter was determined to be one-ten millionth of the distance from the North Pole to the equator.



Earth

The French adopted the metric system in 1795, but the rest of the world was slow to follow. In 1875, the Treaty of the Meter, establishing the meter as an international standard, was signed by 17 nations, including the United States. One hundred years after that, in 1975, the U.S. Congress passed a law which encouraged the *voluntary* conversion to the metric system. A quarter of a century later, the United States has made some progress towards adopting the meter as its universal standard.

The meter is used as the basis for most other measurements in the metric system (liquid measures, weight, etc.)



Metric Place Value

The abbreviation for a meter is "*m*".

A meter contains 100 centimeters. (Note: "centi" means hundredths.)

The abbreviation for a centimeter is "*cm*".

A meter also contains 1000 millimeters. (Note: "milli" means thousandths.)

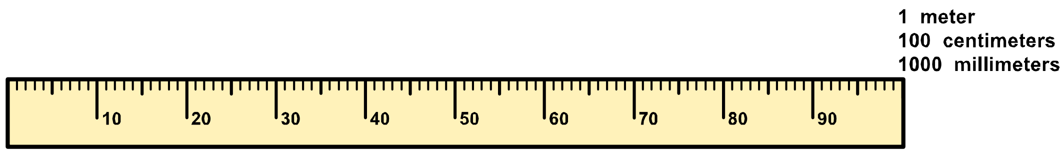
The abbreviation for a millimeter is "*mm*".

Since there are 1000 millimeters in a meter and 100 centimeters in a meter, there must be 10 millimeters in a centimeter (1000 ÷ 100 = 10).

1 meter	= 100 centimeters
1 meter	= 1000 millimeters
1 centimeter	= 10 millimeters
1 centimeter	= .01 meter
1 millimeter	= .001 meter

Meter Measuring Stick

A meter measuring stick is one meter long. It has 1000 marks indicating each millimeter. There are larger graduation marks for each centimeter as well as every five and ten centimeters.



Meter Stick

Progress Check # 5

1. Using a standard ruler, measure the lines below:

   a.

   b.

   c.

2. Using a metric ruler, measure the same lines:

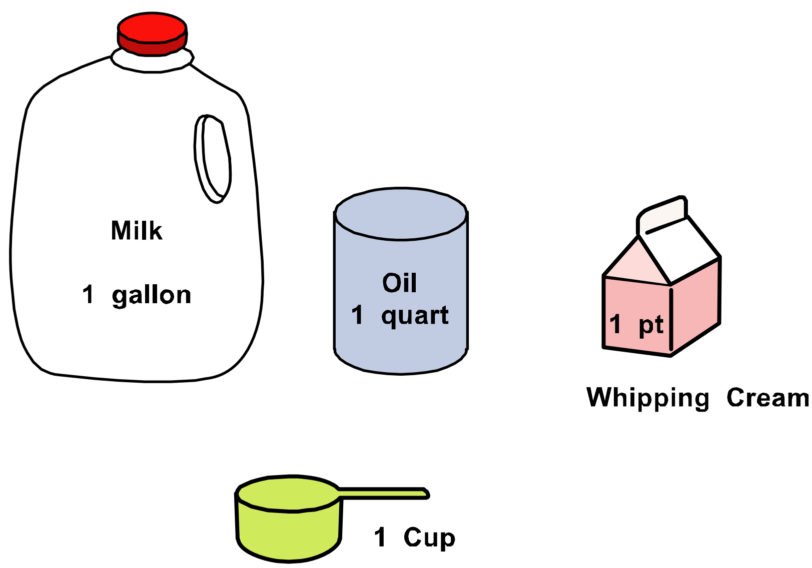
3. Using a yardstick or tape measure, measure the length, width and height of your desk.

4. Using a meter measuring stick or tape measure, measure the length, width and height of your desk.

Liquid Measures

Standard System

Measuring liquid volume (or capacity) using the standard system is quite awkward. Of uncertain origin, the gallon (from "galleon" or vessel) is the basic measure of liquid volume. A gallon is divided into four quarts (or "quarters"). The quart contains two pints (possibly from the "paint" mark dividing a quart container in half). A pint has two cups and a cup has 8 ounces.



Examples of Liquid Standards

Not very scientific, but we are stuck with it.

The abbreviation for gallon is "*gal*."

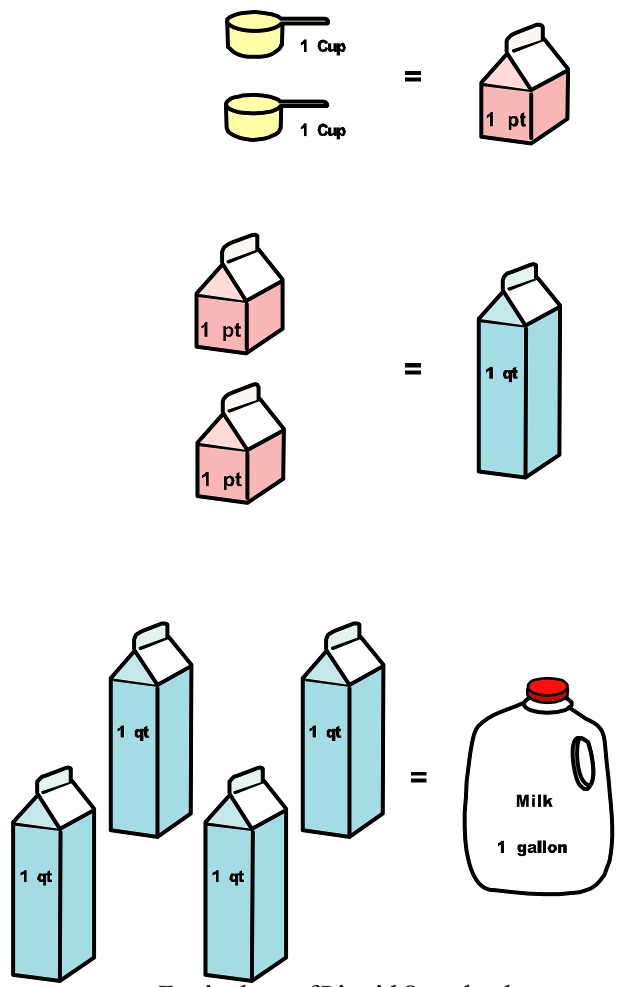
The abbreviation for quart is "*qt*."

The abbreviation for pint is "*pt*."

The abbreviation for ounce is "*oz*."

There is no standard abbreviation for cup.

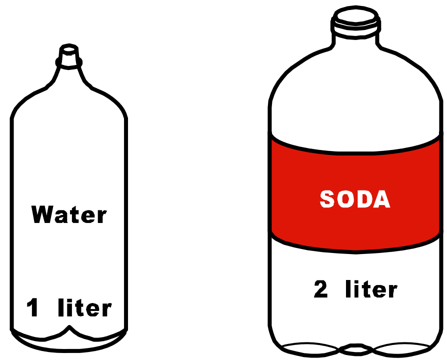
			1 cup	= 8 ounces
		1 pint	= 2 cups	= 16 ounces
	1 quart	= 2 pints	= 4 cups	= 32 ounces
1 gallon	= 4 quarts	= 8 pints	= 16 cups	= 128 ounces



Equivalents of Liquid Standards

Metric System

On the other hand, measuring liquid volume using the metric system is quite simple. Based on the meter, the basic unit of liquid measurement is the liter. A liter is equal to 1,000 cubic centimeters.



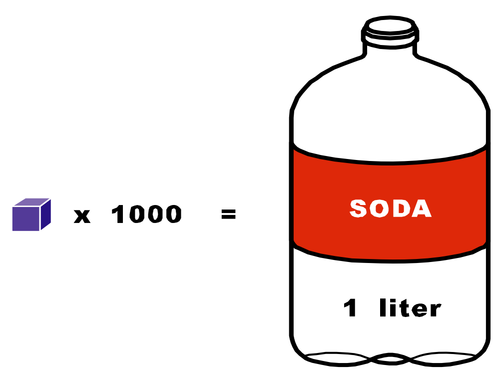
Examples of Liquid Metrics

A milliliter is one-thousandth of a liter. Therefore, a cubic centimeter is equal to a milliliter.

1 liter = 1000 cu cm

1 liter = 1000 milliliters

1 cu cm = 1 milliliter



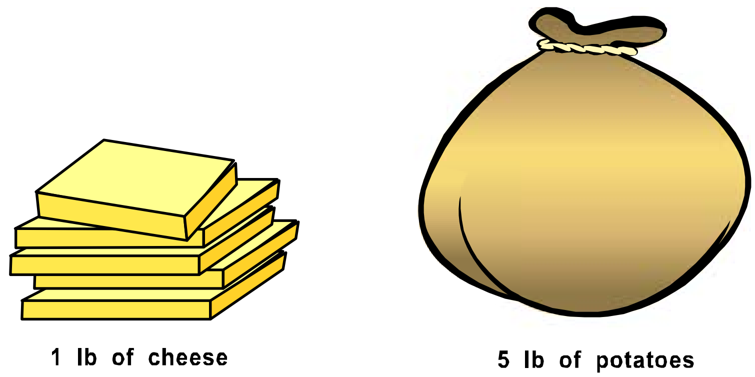
Equivalents of Liquid Metrics

Weights

Standard System

The basic unit of weight in the standard system is the pound (from the Latin "pundus" meaning "weight"). There are sixteen ounces in a pound.

The abbreviation for pound is "*lb*" (from the Latin "libra" meaning scales).



Examples of Weight

There are two thousand pounds in a ton.

The abbreviation for ton is "*T*".

1 pound	= 16 ounces
1 ton	= 2000 pounds

Metric System

Again, based on the meter, the basic unit of weight in the metric system is the gram. A gram is equal to the weight of one cubic centimeter of water.

A kilogram is one thousand grams. One kilogram (or "kilo") is equal to the weight of a liter (1,000 cubic centimeters) of water.

The abbreviation for grams is "*g*".

The abbreviation for kilogram is "*kg*".

1 gram	=	1 cu cm of water
1 kilogram	=	1000 grams

Progress Check # 6

1. One of our buyers made a purchase of five 55-gallon drums of hummingbird nectar. In order to save money, the purchasing manager has asked the warehouse personnel to fill the nectar containers for sale. Assuming no spillage, how many pint-sized containers can we fill?

2. The warehouse has mistakenly received 52,000 bags of grass seed instead of birdseed. Each bag weighs 4 ounces. The transportation manager needs to know how many tons of birdseed he must ship back to the vendor. How many tons are there?

3. Because of the previous error and in order to meet customer demands, the warehouse manager has decided to use the 400 kg of bulk birdseed that is stored in the warehouse. How many bags of birdseed will we be able to fill (assuming no losses) if each bag contains 250 g of birdseed?

Notes:

Graphs

Graphs provide a visual representation of numbers. They allow us to quickly see changes, compare numbers to each other, or compare part of something to the whole thing.

Graphs help to simplify complicated sets of numbers.

Managers often use graphs to better understand what is happening to the company (productivity, efficiency, costs, etc.). Employees often receive graphs of their investments in their retirement accounts. The news media sometimes uses graphs to show how much money our government is spending.

There are three basic types of graphs: Pie, Bar and Line.

Pie Graph

Pie graphs (or circle graphs) allow us to compare parts of a whole. The circle represents the whole thing…100% of whatever "it" might be: the number of employees, the total budget, all of the inventory, etc.

The slices of the pie graph represent parts (percentages) of the whole…the number of managers, the money spent on forklift repair, the quantity of inventory requiring refrigeration.

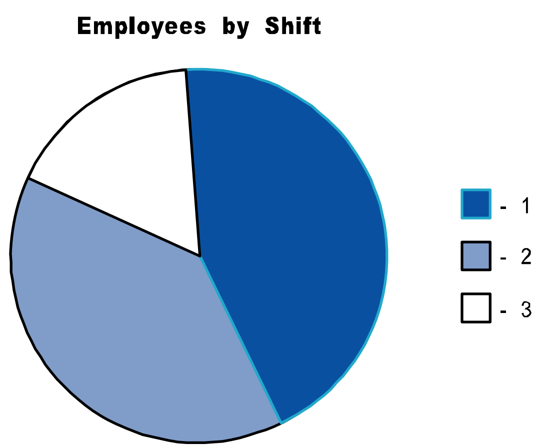
To develop a pie chart, determine the overall total. Then calculate what percentage of the total each part is.

Example

The warehouse operates three shifts. The chart below indicates how many employees are on each shift.

From the pie graph we can easily see that the first shift has more employees than second or third shift, but second and third shift combined have more employees than first.

Shift	#of Employees	%
1st	224	47.6%
2nd	182	38.6%
3rd	65	13.8%
Total	471	100%



Pie Graph

Bar Charts

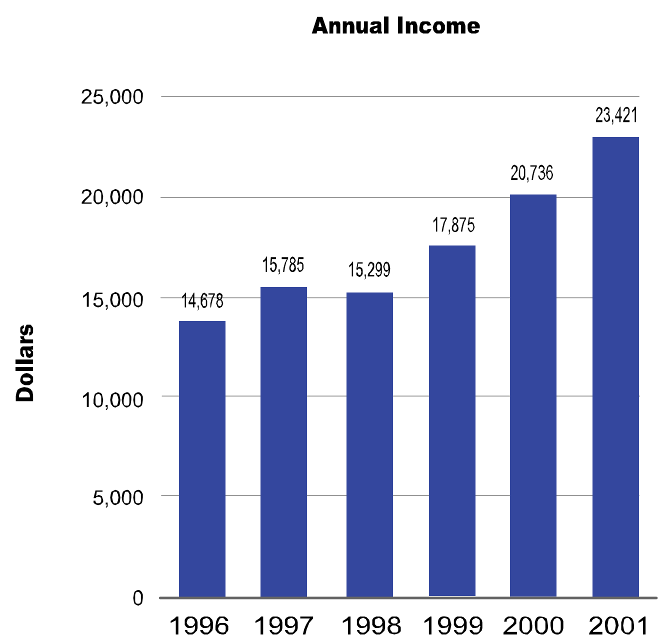
To compare one number against others, bar charts are used. Bar graphs are sometimes called column graphs. No calculations are required since the raw numbers are used.

Example

Annual income over a six-year period.

From the bar graph, we can see that 1998 was this person's smallest annual income, while 2001 was the largest.

Year	Income
1996	14,678
1997	15,785
1998	15,299
1998	17,875
2000	20,736
2001	23,421



Bar Graph

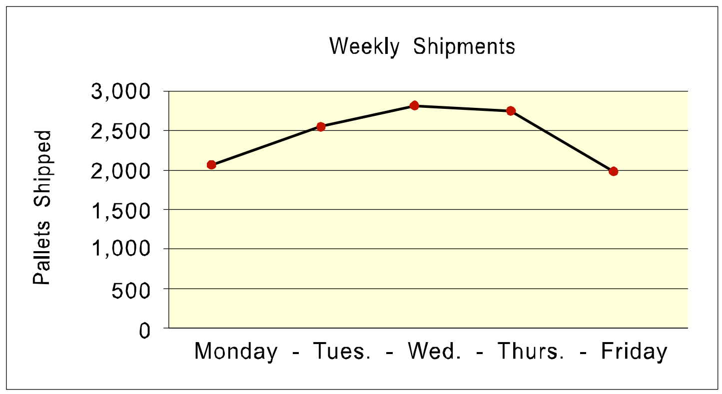
Line Graphs

When we are interested in changes or trends, we can use a line graph. Again, no calculations are necessary since the raw numbers are used.

Example

In this line graph we can see that more work gets done during the middle of the week.

Monday	2,163
Tuesday	2,598
Wednesday	2,743
Thrusday	2,682
Friday	1,955



Line Graph

Why do you think production lags on Monday and Friday?

Averages

An average is something that is in the middle of a group or represents what is most common in the group. In statistics, the average is referred to as the "mean".

Averages are important because they give us a quick "snapshot" of a group of numbers.

Knowing the average amount of product fabricated each day enables a manager to determine how many units can be fabricated during an average week or month.

Knowing the average number of defects on a machine each day enables the Quality Department to monitor trends and take action when the number of defects begins to deviate from the norm, that is, the average.

Calculating an Average

Determining an average requires two of the basic skills we have already discussed: adding and dividing.

We must first add all of the numbers in the group being averaged. Then we must divide the total by the number of items in the group.

Example

Your child received the following school grades:

English	85
U.S. History	77
Mathematics	92
Science	84
Physical Education	72

To determine how well your child is doing in school you must determine the average grade.

Using the addition process, add all five grades together. Then, using the division process, divide the total (410) by the number of grades in the group (5).

Completing the process, you learn that your child's average grade is 82.

Progress Check #7

1. Match the type of chart to its most common use.

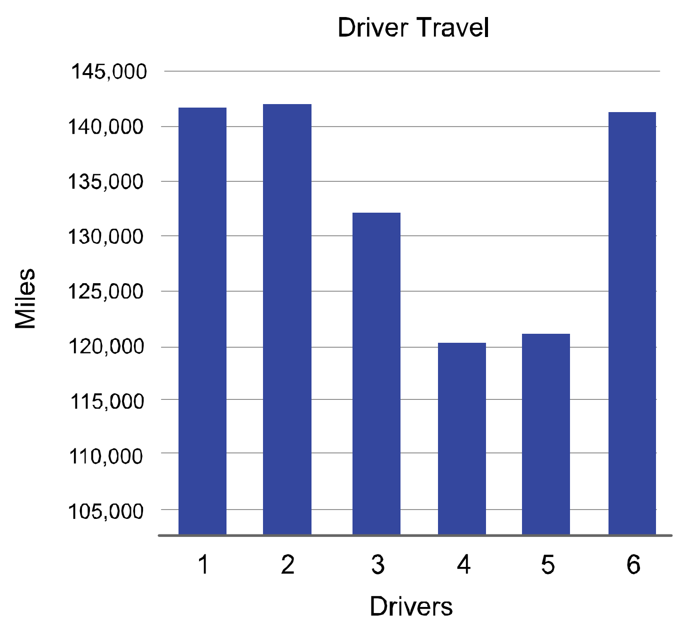
_____	Pie	A.	To compare one number against another.
_____	Bar	B.	To show trends.
_____	Line	C.	To compare parts of a whole.

2. Create a pie graph showing the amount of money spent on each category.

Building Lease:	$420,000
Utilities:	$174,000
Maintenance:	$112,000
Taxes:	$134,000

3. Using the bar graph below, which driver traveled the most miles? The fewest?

1. Bill	142,467
2. Bob	142,877
3. Mary	132,765
4. Mark	120,875
5. Karla	121,554
6. Wayne	141,235



4. Using the line chart below, predict the approximate number of units that will be shipped in July.

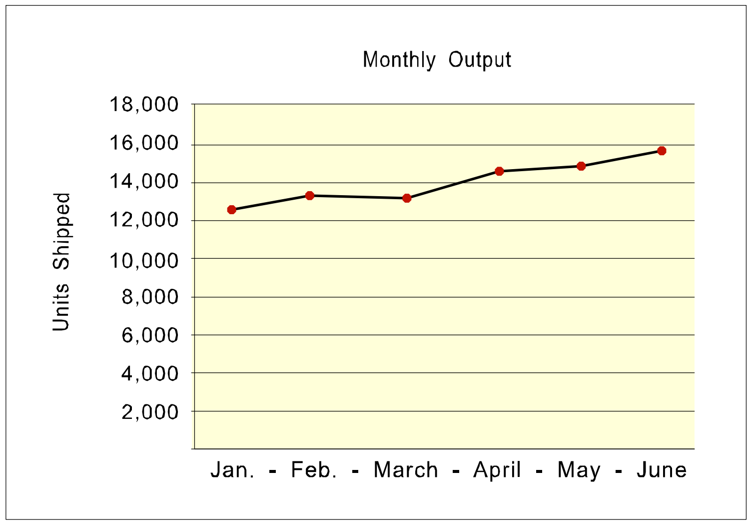
   a. Approximately 12,000

   b. Approximately 14,000

   c. Approximately 16,000

   d. Approximately 18,000

January	12,286
February	13,352
March	13,289
April	14,322
May	14,688
June	15,786



5. Calculate the average height of all of the participants in your class.

Geometry

Angles

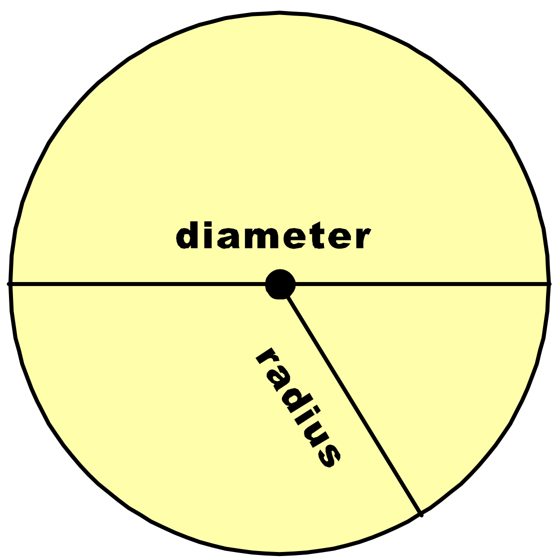
An angle is formed when two straight lines meet.

The size of the angle is the amount of turn that is needed to take one line and place it on top of the other line.

The amount of turn is measured in degrees.

Degrees are indicated by a small "o" above the number.

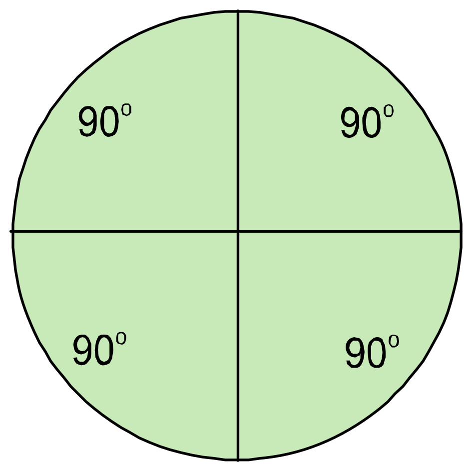
There are 360° in a full circle.



Right Angles

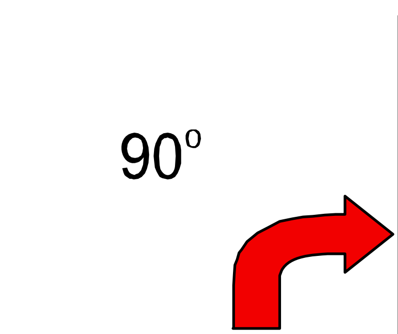
If we cut a circle into four equal parts, each of the angles that are formed would contain 90°.

Looking at just one of those parts, we can see that a 90° angle would equal a quarter of a complete turn through the circle.



Squares and rectangles contain four 90° angles.

A 90° angle is commonly referred to as a right angle.

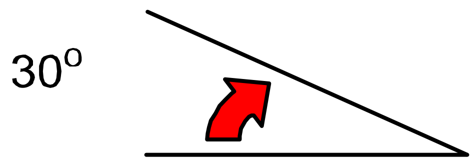


Acute Angles

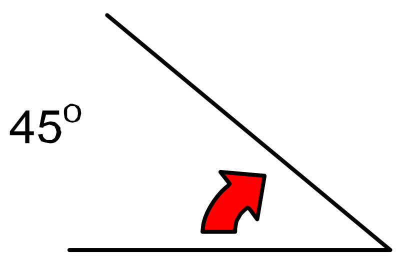
Acute angles are angles that are less that 90^{o}.

Common acute angles are:

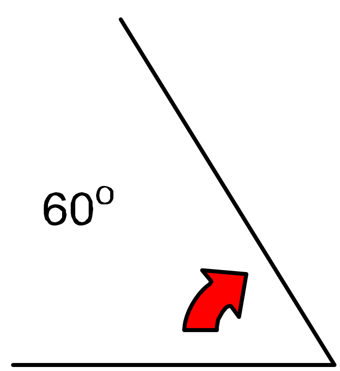
30^{o} (one-third of a 90^{o} angle)



45^{o} (half of a 90^{o} angle)



60^{o} (two-thirds of a 90^{o} angle).

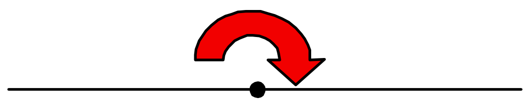


Straight Angles

If we cut a circle into two equal parts, each of the angles that are formed would contain 180^o.

Looking at just one of those parts, we can see that a 180^o angle would equal a half of a complete turn through the circle.

A 180^o angle is commonly referred to as a straight angle.



$$90^o + 90^o = 180^o$$

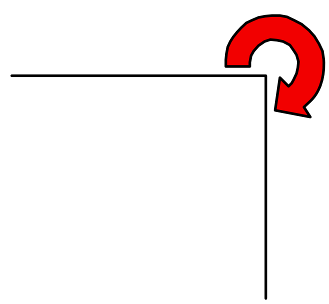
Obtuse Angles

Obtuse angles are angles that are greater than 90°.

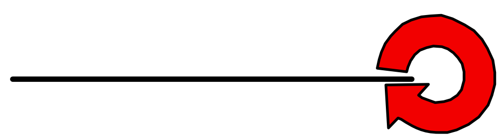
As stated previously, if we cut a circle into four equal parts, each of the angles that are formed would contain 90°.

Looking at three of those parts, we can see that a 270° angle (3 × 90°) would equal a three-quarter turn through the circle.

$$90^{o} + 90^{o} + 90^{o}$$



Looking at all four of those parts, we can see that a 360° angle (4 × 90°) would equal a complete turn through the circle.



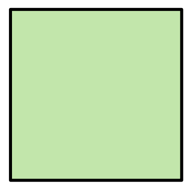
$$90^{o} + 90^{o} + 90^{o} + 90^{o} = 360^{o}$$

Common Shapes

There are several common shapes that we all recognize. Understanding their makeup and how to measure them is important.

Square

All four sides of a square are equal. All four angles are 90°. The total of all four angles is 360°. The opposite sides are parallel to each other.



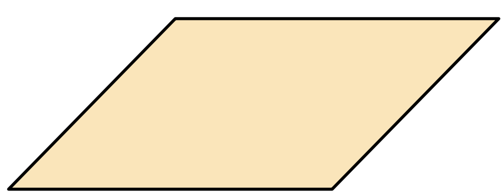
Squares

Rectangle

Opposite sides are equal. All four angles are 90°. The total of all four angles is 360°. The opposite sides are parallel to each other.

Parallelogram

Opposite sides are equal. Opposite angles are equal. The total of all four angles is 360°. The opposite sides are parallel to each other.



Triangles

A triangle has three sides. The total of all three angles is 180°. There are many different kinds of triangles.

Equilateral Triangle

All three sides are equal. All three angles are 60°.

Isosceles Triangle

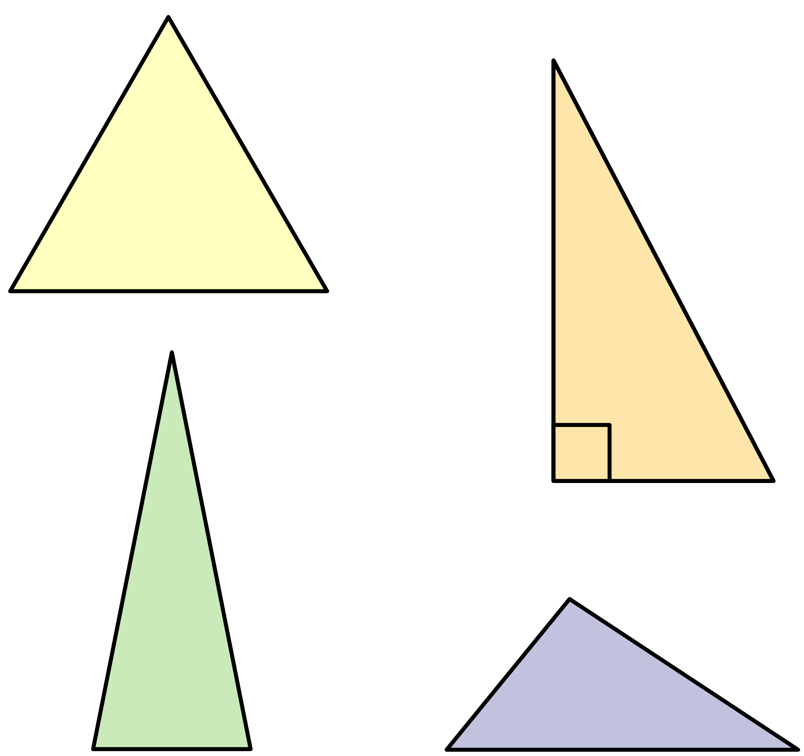
Two sides are equal. Two angles are equal.

Right Triangle

One angle is 90°.

Scalene Triangle

No equal sides. No equal angles. No angle is 90°.



Triangles

Circles

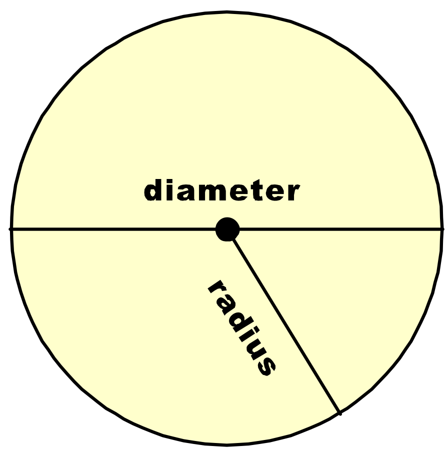
A circle is perfectly round. That is to say that all points on the circle are an equal distance from its center.

Radius

A line drawn from the center of the circle to its edge is called a radius.

Diameter

A line drawn from one edge through the center to another edge is called a diameter. A diameter is equal to two radii.



Circle

Measuring Shapes

Perimeter

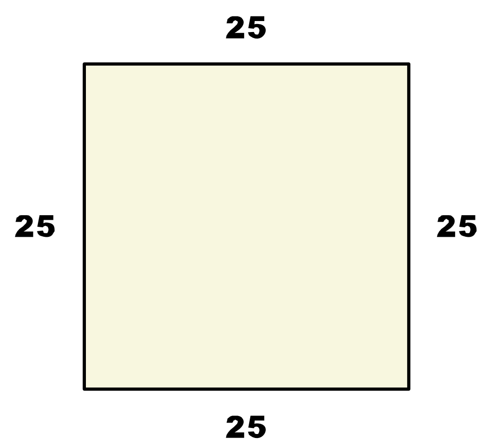
The distance around a shape is called a perimeter. To determine the perimeter of *squares, rectangles, or parallelograms,* simply add up the total length of the four sides.

$$P = S1 + S2 + S3 + S4$$

To determine the perimeter of *triangles,* simply add up the total length of the three sides.

$$P = S1 + S2 + S3$$

Example 1

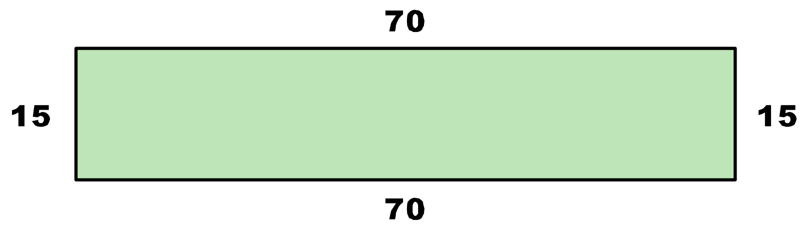


Step 1: $P = S1 + S2 + S3 + S4$

Step 2: $P = 25 + 25 + 25 + 25$

Step 3: $P = 100$

Example 2

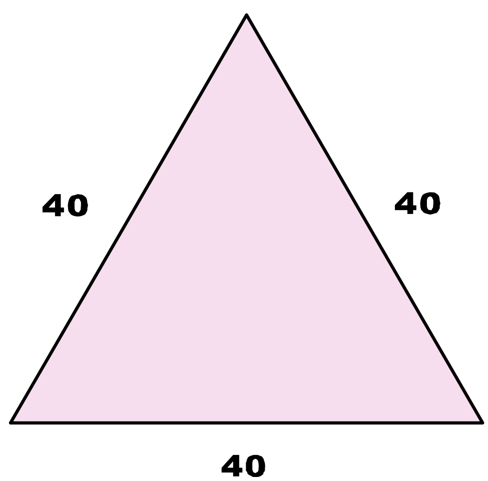


Step 1: P = S1 + S2 + S3 + S4

Step 2: P = 70 + 15 + 70 + 15

Step 3: P = 170

Example 3



Step 1: P = S1 + S2 + S3

Step 2: P = 40 + 40 + 40

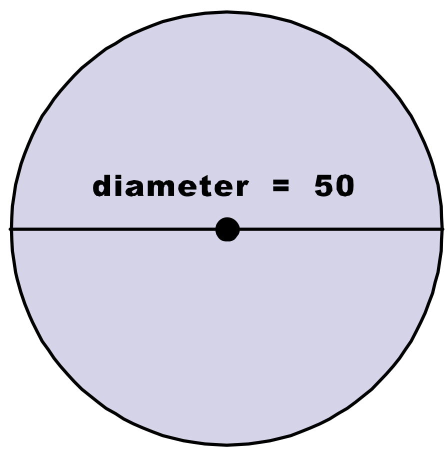
Step 3: P = 120

Circumference

The distance around a circle is called its *circumference*. It has been proven that the circumference of any circle is 3.14 times its diameter. The number 3.14 is referred to as "*pi*". To calculate the circumference of a circle, multiply the diameter times pi.

Note: Pi is actually a much longer number (3.141592+). It is usually shortened for ease of calculation.

Example



Step 1: $C = \pi d$

Step 2: $C = 3.14 \times 50$

Step 3: $C = 157$

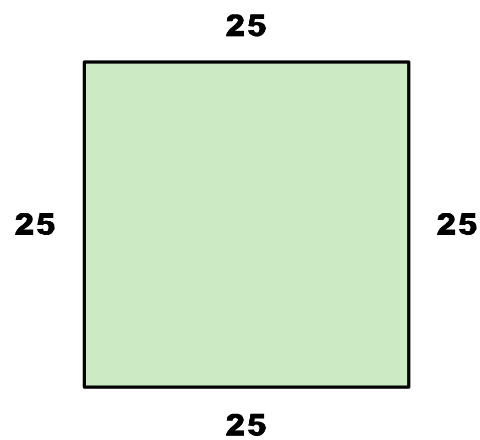
Area

Area is the amount of surface occupied by a shape.

To determine the area of *squares and rectangles*, simply multiply the length of one side by the length of an adjacent side.

$A = L \times H$

Example 1

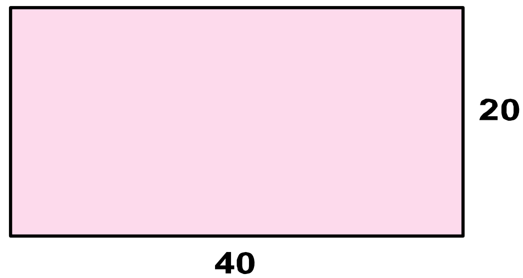


Step 1: $A = L \times H$

Step 2: $A = 25 \times 25$

Step 3: $A = 625$

Example 2



Step 1: $A = L \times H$

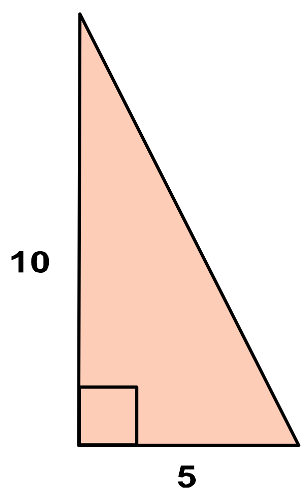
Step 2: $A = 20 \times 40$

Step 3: $A = 800$

To determine the area of a *right triangle*, multiply the lengths of the sides adjacent to the right angle and divide by two.

$$A = (L \times H)/2$$

Example 3



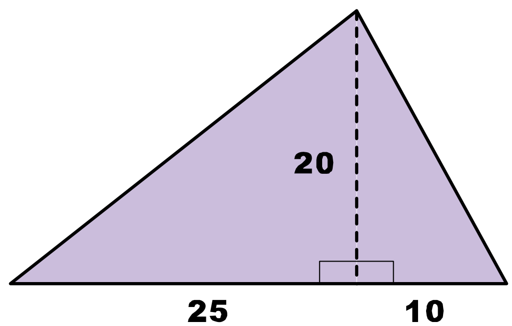
Step 1: $A = (L \times H) / 2$

Step 2: $A = (5 \times 10) / 2$

Step 3: $A = 25$

To determine the area of *any other triangle*, draw an imaginary line through the triangle to form two right triangles. Calculate the area of the "new" right triangles and add them together.

Example 4



Step 1: A = (L × H) / 2 + (L × H) / 2

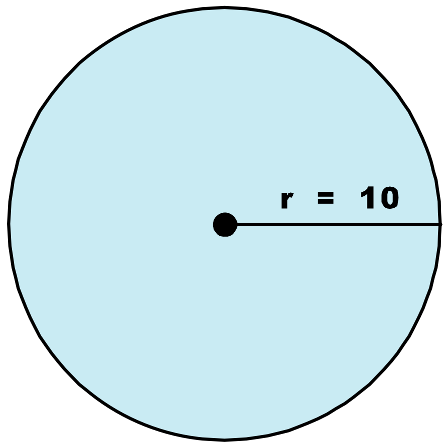
Step 2: A = (10 × 20) / 2 + (25 × 20) / 2

Step 3: A = 100 + 250

Step 4: A = 350

To determine the area of a *circle*, we will again use pi. It has been proven that the area of a circle is equal to the radius times itself ("r" squared or r^2) times pi.

Example 5



Step 1: $A = \pi r^2$

Step 2: $A = 3.14 \times (10)^2$

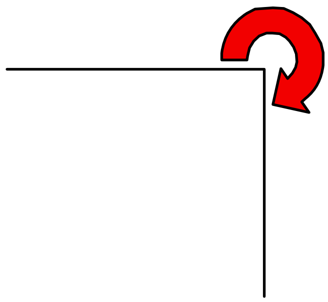
Step 3: $A = 3.14 \times 100$

Step 4: $A = 314$

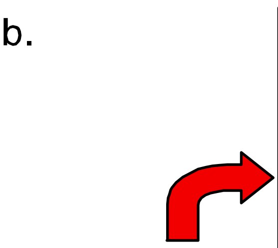
Progress Check #8

1. Identify the measure of each of the following angles.

a.

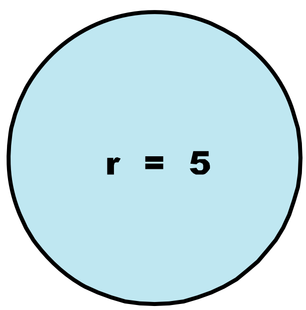


b.

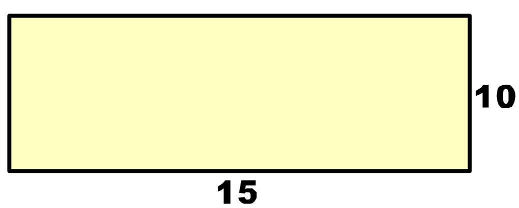


2. Calculate the following perimeters:

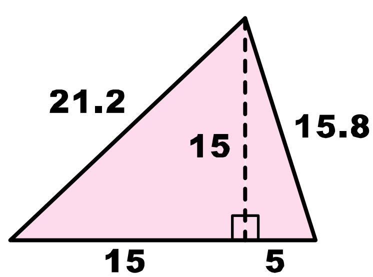
a.



b.



c.



3. Calculate the areas for the above shapes.

4. If one wall of your rectangular warehouse is 350 feet long and the other wall is 175 feet long, what is the area?

Notes:

Summary

In this module we have covered basic arithmetic with whole numbers and decimals. We have worked with fractions and percentages. We looked at the two measuring systems (standard and metric). We saw how graphs were used. Lastly, we discussed angles and shapes.

As you have seen, mathematics is crucial to the operation of a warehouse. From determining the number of items received to calculating the area needed for storage, working with numbers is an everyday necessity for inventory management. Understanding how to use mathematics in the workplace will not only make your job easier, but it will help you achieve your career goals.