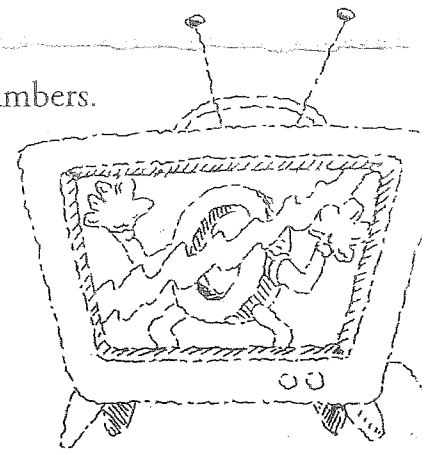
Estimate with Mixed Numbers

You can use rounding to estimate the sums and differences of mixed numbers.



Round each mixed number to the nearest whole number.

Add or subtract the rounded numbers.

Estimate: $1\frac{3}{4} + 2\frac{1}{3} + 2\frac{7}{8}$

$1\frac{3}{4} + 2\frac{1}{3} + 2\frac{7}{8}$

$\downarrow \quad \downarrow \quad \downarrow$

$2 + 2 + 3$

$2 + 2 + 3 = 7$

The sum is about 7.

Estimate: $16\frac{2}{5} - 9\frac{5}{6}$

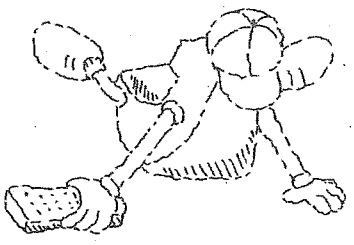
$16\frac{2}{5} - 9\frac{5}{6}$

$\downarrow \quad \downarrow$

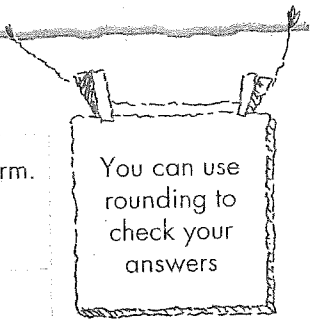
$16 - 10$

$16 - 10 = 6$

The difference is about 6.



Add Mixed Numbers



To add mixed numbers:

Rewrite the fractional parts as equivalent fractions with a common denominator.

Add the fractions.
Add the whole numbers.

Write the sum in simplest form.

Add: $2\frac{2}{5} + 4\frac{1}{3}$

$2\frac{2}{5} = 2\frac{6}{15}$

$+ 4\frac{1}{3} = 4\frac{5}{15}$

$2\frac{2}{5} = 2\frac{6}{15}$

$+ 4\frac{1}{3} = 4\frac{5}{15}$

$6\frac{11}{15}$

$6\frac{11}{15}$ is in simplest form.

The sum is $6\frac{11}{15}$.

Check:

$2\frac{2}{5} \rightarrow 2$

$+ 4\frac{1}{3} \rightarrow 4$

6

Add: $1\frac{5}{6} + 4\frac{2}{3}$

$1\frac{5}{6} = 1\frac{5}{6}$

$+ 4\frac{2}{3} = 4\frac{4}{6}$

$1\frac{5}{6} = 1\frac{5}{6}$

$+ 4\frac{2}{3} = 4\frac{4}{6}$

$5\frac{9}{6}$

$5\frac{9}{6} = 5 + 1\frac{3}{6} = 6\frac{3}{6} = 6\frac{1}{2}$

The sum is $6\frac{1}{2}$.

Check:

$1\frac{5}{6} \rightarrow 2$

$+ 4\frac{2}{3} \rightarrow 5$

7

Subtract Mixed Numbers

To subtract mixed numbers:

Rewrite the fractional parts as equivalent fractions with common denominators.	Subtract the fractions. Regroup if needed. Subtract the whole numbers.	Write the difference in simplest form.

Subtract: $4\frac{7}{12} - 2\frac{1}{4}$

$4\frac{7}{12} = 4\frac{7}{12}$

$-\ 2\frac{1}{4} = 2\frac{3}{12}$

$4\frac{7}{12} = 4\frac{7}{12}$

$-\ 2\frac{1}{4} = 2\frac{3}{12}$

$2\frac{4}{12}$

$2\frac{4}{12} = 2\frac{1}{3}$

The difference is $2\frac{1}{3}$.

Check:

$2\frac{1}{3} \rightarrow 2\frac{4}{12}$

$+\ 2\frac{1}{4} \rightarrow 2\frac{3}{12}$

$4\frac{7}{12}$

Subtract: $3\frac{1}{2} - 1\frac{5}{8}$

$3\frac{1}{2} = 3\frac{4}{8}$

$-\ 1\frac{5}{8} = 1\frac{5}{8}$

$3\frac{1}{2} = 3\frac{4}{8} = 2\frac{12}{8}$

$-\ 1\frac{5}{8} = 1\frac{5}{8} = 1\frac{5}{8}$

?

$1\frac{7}{8}$

Regroup: $3\frac{4}{8} = 2 + 1\frac{4}{8} = 2\frac{12}{8}$

The difference is $1\frac{7}{8}$.

Check:

$1\frac{7}{8}$

$+\ 1\frac{5}{8}$

$2\frac{12}{8} = 3\frac{4}{8} = 3\frac{1}{2}$

You can add to check your answers.

Multiply Fractions

To multiply fractions:

Multiply the numerators.	Multiply the denominators.	Write the product in simplest form.

Multiply: $\frac{2}{3} \times \frac{5}{8}$

$\frac{2}{3} \times \frac{5}{8} = \frac{10}{}$

$\frac{2}{3} \times \frac{5}{8} = \frac{10}{24}$

$\frac{10}{24} = \frac{5}{12}$

The product is $\frac{5}{12}$.

You can use a shortcut called cancelling to simplify the factors before multiplying. The shortcut works because you are actually finding the common factors of the numerator and denominator and they cancel each other out.

Recognize common factors in the numerator and denominator.	Multiply the numerators. Multiply the denominators.	Write the product in simplest form.

Multiply: $\frac{2}{3} \times \frac{5}{8}$

$\frac{\cancel{2}^{1}}{3} \times \frac{5}{\cancel{8}_{4}} =$

2 is a factor of 2 and 8.
$2 \div 2 = 1 \quad 8 \div 2 = 4$

$\frac{\cancel{2}^{1}}{3} \times \frac{5}{\cancel{8}_{4}} = \frac{5}{12}$

The product is $\frac{5}{12}$.

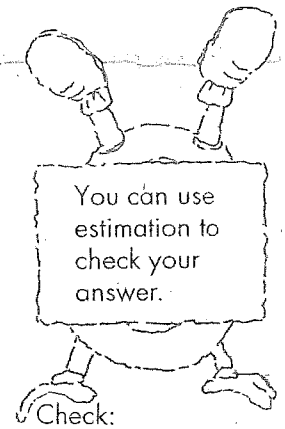
If one of the factors is a whole number, rewrite the whole number as an improper fraction with a denominator of 1.

$\frac{2}{3} \times 8 = \frac{2}{3} \times \frac{8}{1} = \frac{16}{3} = 5\frac{1}{3}$

$8 = \frac{8}{1}$

Multiply Mixed Numbers

You must rewrite mixed numbers as improper fractions before you can multiply. Also, remember to rewrite whole numbers as improper fractions.



Write the mixed numbers as improper fractions.

Multiply the numerators. Multiply the denominators.

Write the product in simplest form.

Multiply: $1\frac{2}{3} \times 2\frac{1}{4}$

$1\frac{2}{3} \times 2\frac{1}{4} =$

$\frac{5}{3} \times \frac{9}{4} = \frac{45}{12}$

$\frac{45}{12} = 3\frac{9}{12} = 3\frac{3}{4}$

The product is $3\frac{3}{4}$.

Check:

$1\frac{2}{3} \times 2\frac{1}{4}$

$2 \times 2 = 4$

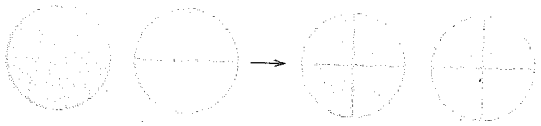
Divide with Fractions

When dividing with fractions, you find how many of one amount is contained in another amount.

Divide: $1\frac{1}{2}$ by $\frac{1}{4}$

Think: How many $\frac{1}{4}$s in $1\frac{1}{2}$?

Use a picture.



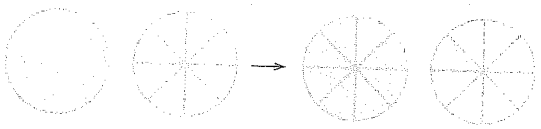
If $1 = \frac{4}{4}$ and $2 = \frac{8}{4}$, then $1\frac{1}{2} = \frac{6}{4}$.

$1\frac{1}{2} \div \frac{1}{4} = 6$

Divide: $1\frac{1}{8}$ by $\frac{3}{8}$

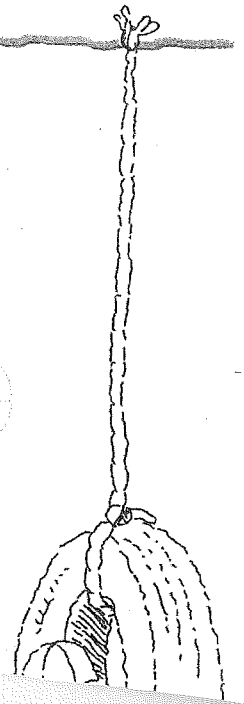
Think: How many $\frac{3}{8}$s in $1\frac{1}{8}$?

Use a picture.



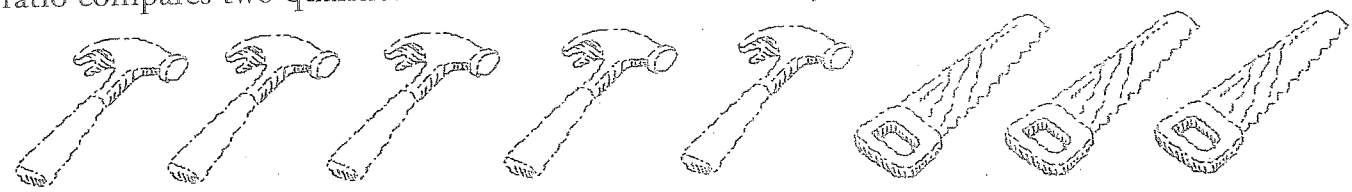
There are 3 groups of $\frac{3}{8}$ in $1\frac{1}{8}$.

$1\frac{1}{8} \div \frac{3}{8} = 3$ Think: $\frac{9}{8} \div \frac{3}{8} = ?$



Ratios

A ratio compares two quantities. It can be written three ways:

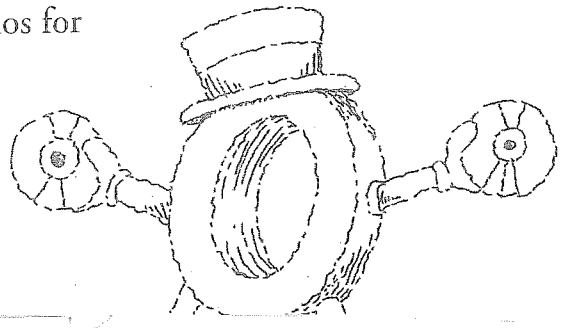


The ratio of hammers to saws is 5 to 3.

Use a fraction.	Use a colon.	Use the word *to*.
$\frac{5}{3}$	5:3	5 to 3

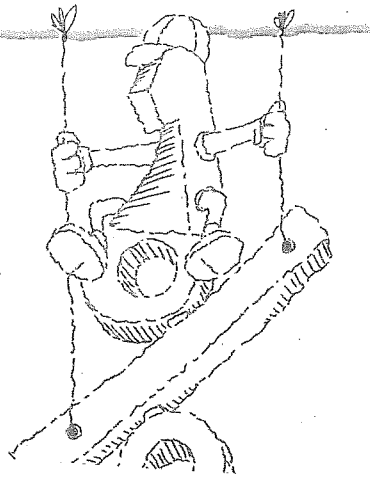
Ratios can compare one part to another part or one part to the whole.

The *order* of the comparison is important. Look at these ratios for the set of hammers and saws above.



The ratio of hammers to saws is 5:3.
The ratio of saws to hammers is 3:5.
The ratio of hammers to tools is 5:8.
The ratio of saws to tools is 3:8.

Percent



A percent is a ratio that compares a number to 100. The word *percent* means "per hundred." The symbol for percent is %.

The grid has 100 small squares.
25 of the 100 squares are shaded.
$\frac{25}{100}$ or 25% of the squares are shaded.

Percents and Decimals

To write a percent as a decimal:

Write the percent as a fraction.
Write the fraction as a decimal.

Write 42% as a decimal.

$42\% = \frac{42}{100} = 0.42$

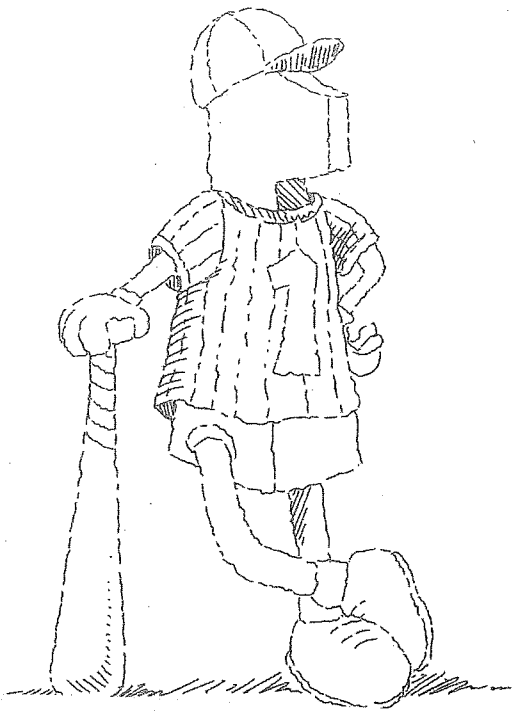
To write a decimal as a percent:

When the decimal names hundredths, write a fraction with a denominator of 100. Then write the fraction as a percent.

$0.27 = \frac{27}{100} = 27\%$ $0.08 = \frac{8}{100} = 8\%$

When the decimal names tenths, write a fraction with a denominator of 10. Find an equivalent fraction with a denominator of 100. Then write the fraction as a percent.

$0.7 = \frac{7}{10} = \frac{70}{100} = 70\%$



Percents and Fractions

To write a percent as a fraction:

Write the percent as a fraction with a denominator of 100, and then simplify the fraction.

$40\% = \frac{40}{100}$; $\frac{40}{100} = \frac{2}{5}$ $40\% = \frac{2}{5}$

To write a fraction as a percent:

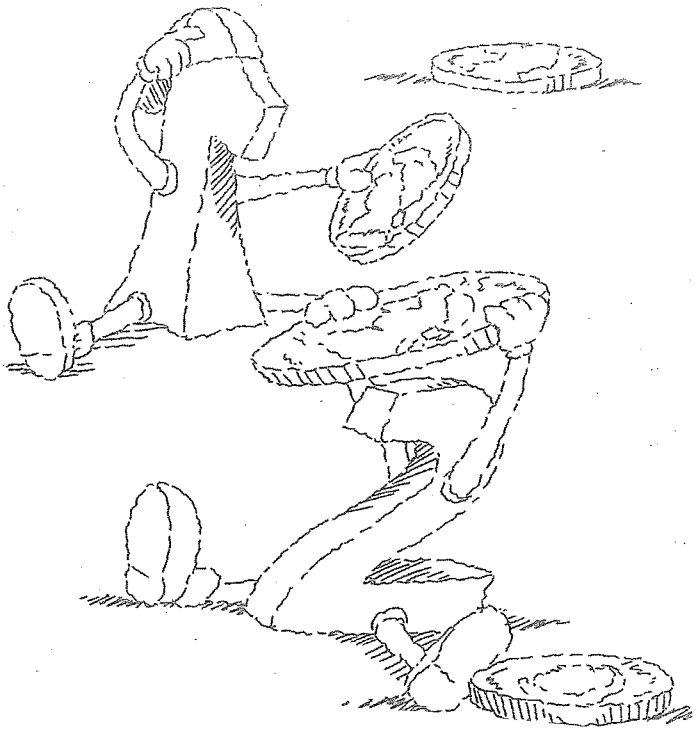
When the fraction has a denominator of 100, use the numerator and write a percent sign.

$\frac{6}{100} = 6\%$ $\frac{28}{100} = 28\%$

When the fraction has a denominator that is a factor or multiple of 100, find an equivalent fraction with a denominator of 100. Use the numerator and write a percent sign.

$\frac{3}{5} = \_\_\_\_\%$ $\frac{4}{200} = \_\_\_\_\%$

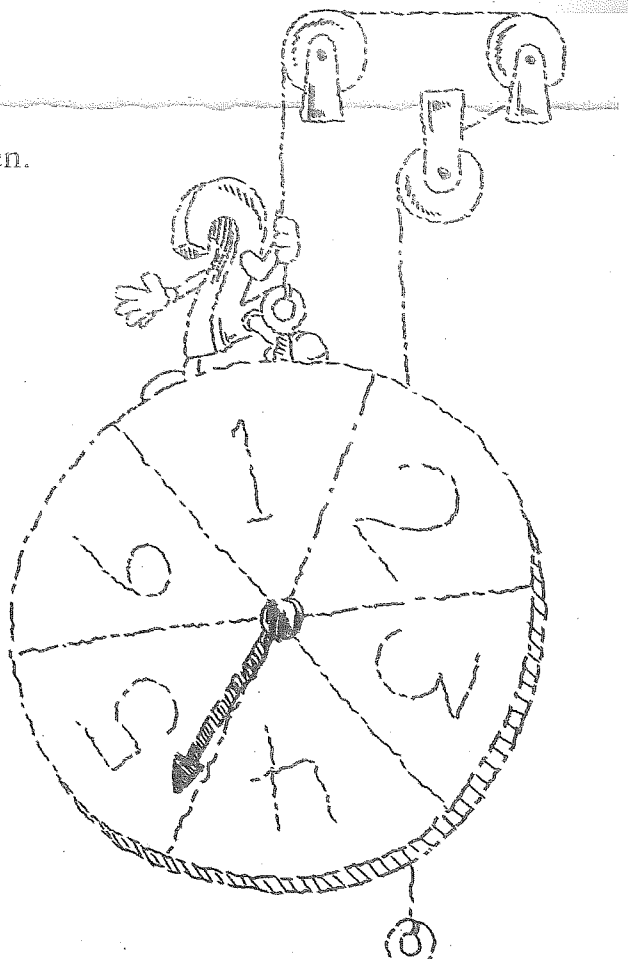
$\frac{3}{5} = \frac{60}{100} = 60\%$ $\frac{4}{200} = \frac{2}{100} = 2\%$



Probability

A probability tells the likelihood that an event will happen.

$$\text{Probability (event)} = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$



6 possible outcomes 1, 2, 3, 4, 5, or 6.
The pointer is *equally likely* to land on any one of the numbers because each section is the same size.

Probability that the spinner will land on

any of the numbers is $\frac{1}{6}$.

a number less than 3 is $\frac{2}{6}$ or $\frac{1}{3}$.

an even number is $\frac{3}{6}$ or $\frac{1}{2}$.

Probability of spinning a 7 is $\frac{0}{6}$ or 0.

What is the probability of spinning a number less than 4?

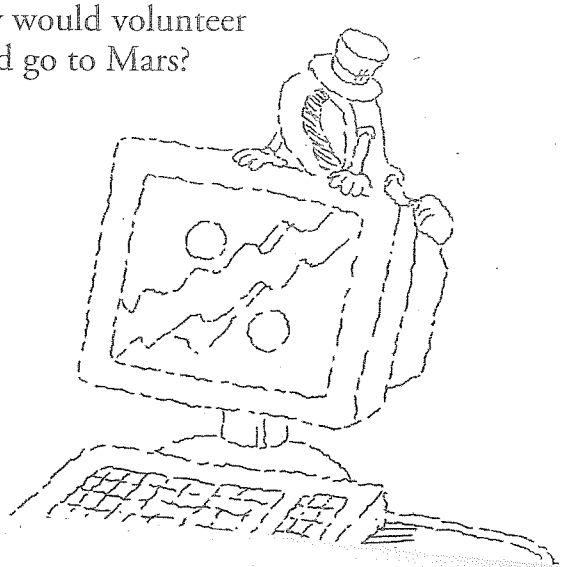
$\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{3}{6}$ Spinner can land on 1, 2, or 3. $\frac{3}{6} = \frac{1}{2}$

The probability of spinning a number less than 4 is $\frac{1}{2}$.

Write the probability in simplest form.

Percent of a Number

Of 75 students surveyed at Sara's school, 60% of them said they would volunteer to go on a mission to Mars. How many students said they would go to Mars?



Find 60% of 75.

Write the percent as a decimal.

60% = 0.60 = 0.6

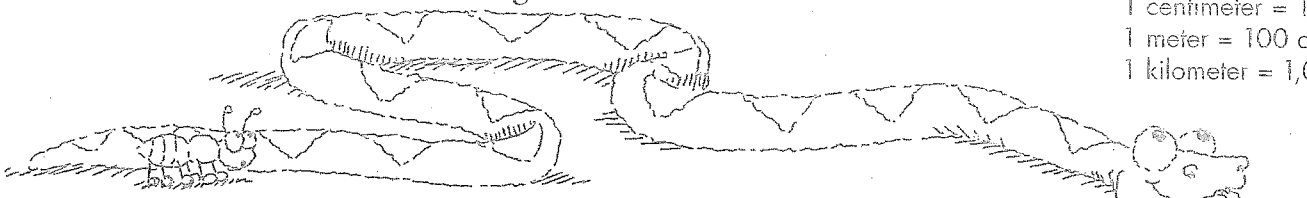
Multiply by the decimal.

$$\begin{array}{r} 75 \\ \times\ 0.6 \\ \hline 45.0 \end{array}$$

60% of 75 is 45.
45 students said they would volunteer for a mission to Mars.

Metric Units of Length

The millimeter (mm), centimeter (cm), meter (m), and kilometer (km) are common metric units of length. The *meter* is the basic unit.

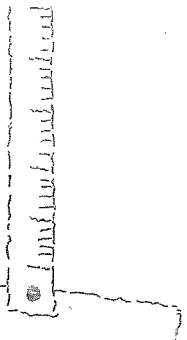


1 centimeter

1 meter

Metric Units of Length

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



To convert larger units to smaller units, multiply. Sometimes you also have to add additional smaller units.

How many millimeters in 21 centimeters?

1 cm = 10 mm

21 cm = 21 x 10 = 210 mm

21 centimeters = 210 millimeters

To convert smaller units to larger units, divide. Use the quotient to give the answer in larger units only, or as a combination of larger and smaller units.

How many kilometers is 4,852 meters?

1,000 m = 1 km

4,852 m ÷ 1,000 = 4.852 km

4,852 meters = 4.852 kilometers

When converting units of measure in the metric system, multiply or divide by 10, 100, or 1,000.

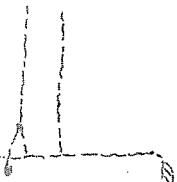
Metric Units of Capacity and Mass

The liter (L) and milliliter (mL) are two common metric units of capacity.

The gram (g) and kilogram (kg) are two common metric units of mass.

Metric Units of Capacity and Mass

1 liter = 1,000 milliliters
1 kilogram = 1,000 grams



To convert larger units to smaller units, multiply. Sometimes you also have to add additional smaller units.

How many milliliters are in 2.2 liters?

1 L = 1,000 mL

2.2 L = 2.2 x 1,000 = 2,200 mL

2.2 liters = 2,200 milliliters

To convert smaller units to larger units, divide. Use the quotient to give the answer in larger units only, or as a combination of larger and smaller units.

How many kilograms is 428 grams?

1,000 g = 1 kg

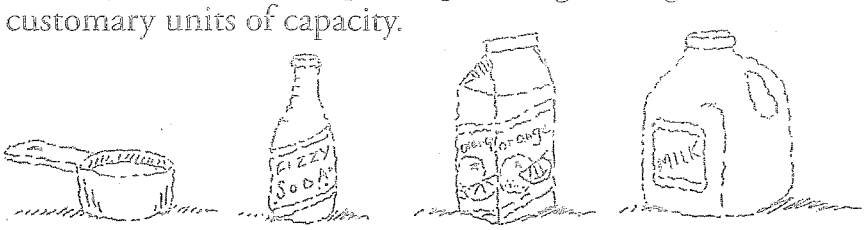
428 g ÷ 1,000 = 0.428 kg

428 grams = 0.428 kilograms

When converting units of measure in the metric system, multiply or divide by 10, 100, or 1,000.

Customary Units of Capacity

The cup (c), pint (pt), quart (qt), and gallon (gal) are customary units of capacity.



1 cup 1 pint 1 quart 1 gallon

Customary Units of Capacity

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts

To convert larger units to smaller units, multiply. Sometimes you also have to add additional smaller units.

How many pints in 2 gallons?

1 gal = 4 qt and 1 qt = 2 pt

so, 1 gal = 8 pt

2 gal = 8 x 2 = 16 pt

There are 16 pints in 2 gallons.

To convert smaller units to larger units, divide. Use the quotient to give the answer in larger units only, or as a combination of larger and smaller units.

How many cups and ounces are in 44 fluid ounces?

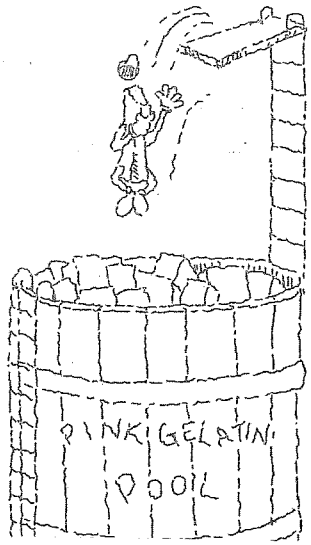
1 c = 8 fl oz

$$\begin{array}{r} 5 \\ 8\overline{)44} \\ -\,40 \\ \hline 4 \end{array}$$

5 ← cups
4 ← fluid ounces

44 fluid ounces = 5 cups, 4 fluid ounces

Also, 44 fluid ounces = $5\frac{4}{8} = 5\frac{1}{2}$ cups



Computing with Customary Units

Adding and subtracting with different units of measure is similar to computing with mixed numbers. You may need to regroup units of measure when you add and subtract measurements. The regroupings are different for length, weight, and capacity.

Kayla caught two fish. One weighed 4 pounds 12 ounces. The other one weighed 3 pounds 9 ounces. How much did both fish weigh?

$$\begin{array}{r} 4 \text{ lb } 12 \text{ oz} \\ +\,3 \text{ lb } 9 \text{ oz} \\ \hline 7 \text{ lb } 21 \text{ oz} = 8 \text{ lb } 5 \text{ oz} \end{array}$$

21 oz = 1 lb 5 oz

The total weight of both fish is 8 pounds and 5 ounces.

Mr. Wiley is 6 feet 2 inches tall. His son is 4 feet 9 inches tall. How much taller is Mr. Wiley than his son?

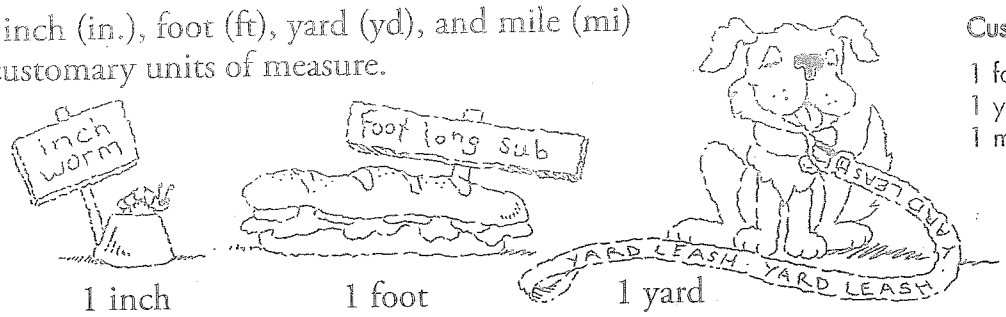
$$\begin{array}{r} 6 \text{ ft } 2 \text{ in.} \\ -\,4 \text{ ft } 9 \text{ in.} \\ \hline ? \end{array} \qquad \begin{array}{r} {\scriptstyle 5 \text{ ft } 14 \text{ in.}} \\ \not{6} \text{ ft } \not{2} \text{ in.} \\ -\,4 \text{ ft } 9 \text{ in.} \\ \hline 1 \text{ ft } 5 \text{ in.} \end{array}$$

not enough inches to subtract

Mr. Wiley is 1 foot 5 inches taller than his son.

Customary Units of Length

The inch (in.), foot (ft), yard (yd), and mile (mi) are customary units of measure.



1 inch 1 foot 1 yard

Customary Units of Length

1 foot = 12 inches
1 yard = 3 feet
1 mile = 5,280 feet

To convert larger units to smaller units, multiply. Sometimes you may also have to add additional smaller units.

How many feet in 5 yards?
1 yd = 3 ft

5 yd = 5 x 3 ft = 15 ft

How many feet in 8 yards, 2 feet?
1 yd = 3 ft

8 yards, 2 feet = (8 x 3) + 2 = 26 ft

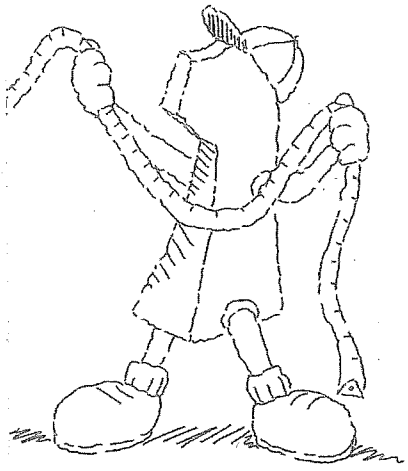
To convert smaller units to larger units, divide. Use the quotient to give the answer in larger units only, or as a combination of larger and smaller units.

How many feet and inches in 40 inches?
1 ft = 12 in.

$$\begin{array}{r} 3 \leftarrow \text{feet} \\ 12\overline{)40} \\ -\,36 \\ \hline 4 \leftarrow \text{inches} \end{array}$$

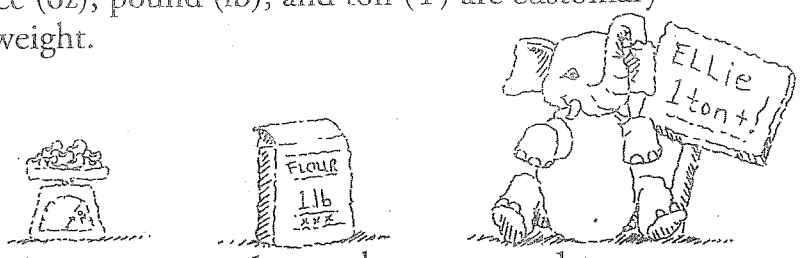
40 inches = 3 feet, 4 inches

Also, 40 inches = $3\frac{4}{12} = 3\frac{1}{3}$ ft



Customary Units of Weight

The ounce (oz), pound (lb), and ton (T) are customary units of weight.



1 ounce 1 pound 1 ton

Customary Units of Weight

1 pound = 16 ounces
1 ton = 2,000 pounds

To convert larger units to smaller units, multiply. Sometimes you also have to add additional smaller units.

How many pounds in $4\frac{1}{2}$ tons?
1 T = 2,000 lb

$4\frac{1}{2}$ T = $4\frac{1}{2}$ x 2,000 = 9,000 lb

You can also multiply by a decimal.

4.5 x 2,000 = 9,000 lb

There are 9,000 pounds in $4\frac{1}{2}$ tons.

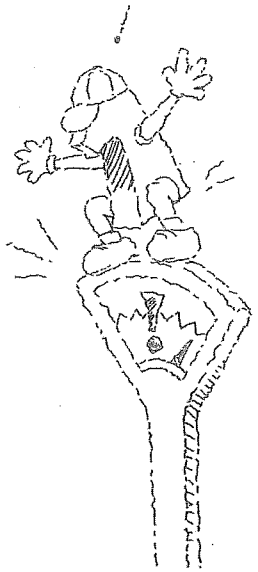
To convert smaller units to larger units, divide. Use the quotient to give the answer in larger units only, or as a combination of larger and smaller units.

How many pounds in 50 ounces?
1 lb = 16 oz

$$\begin{array}{r} 3 \leftarrow \text{pounds} \\ 16\overline{)50} \\ -\,48 \\ \hline 2 \leftarrow \text{ounces} \end{array}$$

50 ounces = 3 pounds, 2 ounces

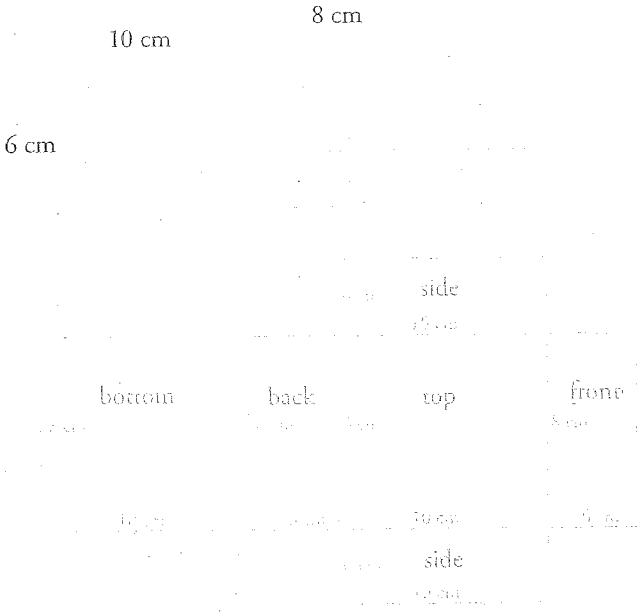
Also, 50 ounces = $3\frac{2}{16} = 3\frac{1}{8}$ pounds.



Surface Area of Rectangular Prisms

The surface area of a prism is the total area of its faces.

A rectangular prism is a space figure whose 6 faces are rectangles or squares. The opposite faces of rectangular prisms match and are parallel.



To find the surface area of a rectangular prism:

- Find the area of the top face, side face, and front face.
- Multiply each area by 2, since opposite faces have the same area.
- Add these three products.

For the rectangular prism above:

Area of top face = 8 x 10 = 80 2 x 80 = 160
Area of front face = 8 x 6 = 48 2 x 48 = 96
Area of side face = 10 x 6 = 60 2 x 60 = 120

160 + 96 + 120 = 376

The figure has a surface area of 376 cm^2.

Remember: Each surface is a rectangle and every rectangle is a parallelogram. To find the area of each surface, find $b \times h$. Give the answer in square units.

Area of Parallelograms

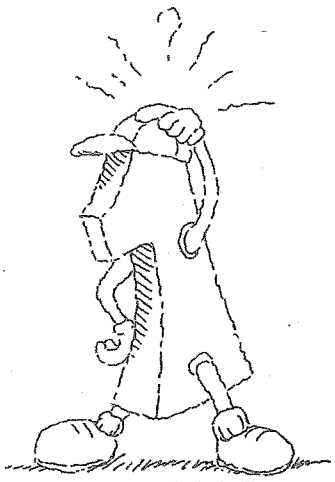
A parallelogram is a quadrilateral whose opposite sides are parallel. Squares and rectangles are special parallelograms.

The height of a parallelogram is the distance between two opposite sides along the perpendicular bases.

The base of this parallelogram is 9 cm and its height is 5 cm.

$h = 5$ cm ← The height is a perpendicular line segment from base to base.

$b = 9$ cm



To find the area of a parallelogram, multiply the base (b) by the height (h).
$A = b \times h$

For the parallelogram shown above:
$A = b \times h$
$A = 9 \times 5$
$A = 45$

The parallelogram has an area of 45 square cm or 45 cm^2.

Volume of Rectangular Prisms

Volume is the number of cubic units needed to fill a space. Volume is measured in cubic units, such as cubic centimeters (cm^3), cubic meters (m^3), cubic feet (ft^3), or cubic yards (yd^3).

Find the volume of a rectangular prism.

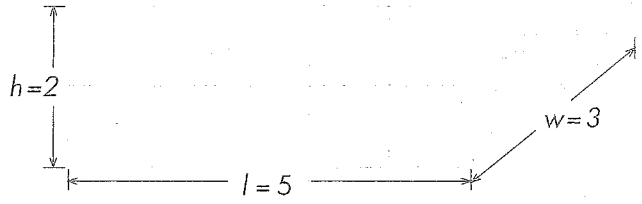
Each layer is 5 x 3 or 15 cm^3.

There are two layers.
2 x 15 = 30
Volume = 30 cm^3

To find the volume of any rectanglar prism:

Volume = length x width x height

$V = l \times w \times h$
$V = 5 \times 3 \times 2$
$V = 30$ cm^3



Circles and Circumference

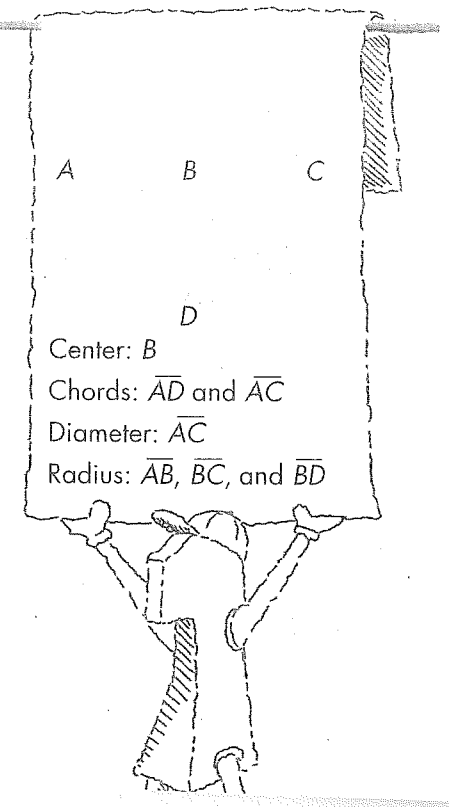
A circle is a closed curved figure. All points in a circle are the same distance from its center.

A radius is a line segment that connects a point on a circle with the center.

A chord is a line segment that connects any two points on a circle.

A diameter is a chord that passes through the center of a circle.

The circumference is the distance around the circle.



To find the circumference of a circle with d = 8 in., multiply d by pi(π).

8 x 3.14 = 25.12 $C = \pi \times d$ Use $\pi = 3.14$
C is about 25.12 in.

To find the circumference when r = 3 ft, multiply r by π. Since $r = \frac{1}{2} d$, multiply r by 2.

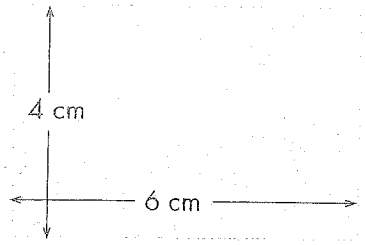
3 x 2 x 3.14 = 18.84
The circumference is about 18.84 ft.

Perimeter and Area

The perimeter is the distance around a figure. Perimeter is measured in linear units.

The area is the number of square units needed to cover a figure. Area is measured in square units.

Perimeter and area of a *rectangle*:

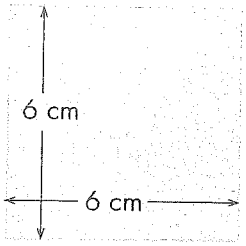


P = 2 *lengths* + 2 *widths*
$P = 2l + 2w$
$P = (2 \times 6) + (2 \times 4)$
$P = 12 + 8$
$P = 20$
The perimeter is 20 cm.

A = *length* x *width*
$A = l \times w$
$A = 6 \times 4$
$A = 24$

The area is 24 sq cm or 24 cm^2.

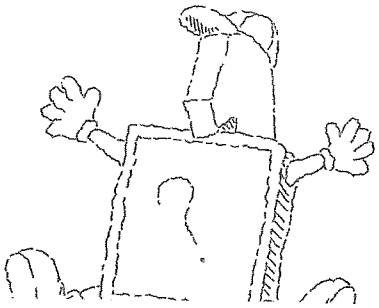
Perimeter and area of a *square*:



P = 4 *sides*
$P = 4\ s$
$P = 4 \times 6$
$P = 24$
The perimeter is 24 cm.

$A = s \times s$
$A = 6 \times 6$
$A = 36$

The area is 36 sq cm or 36 cm^2.



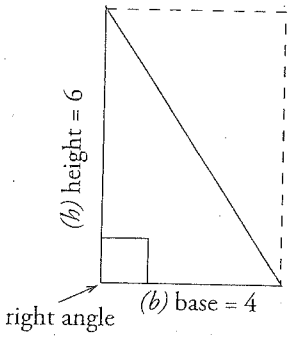
Area of Right Triangles

A right triangle is a triangle with a right angle. It is half of a rectangle.

To find the area of a right triangle, multiply the base (b) by the height (h) and then divide by 2.

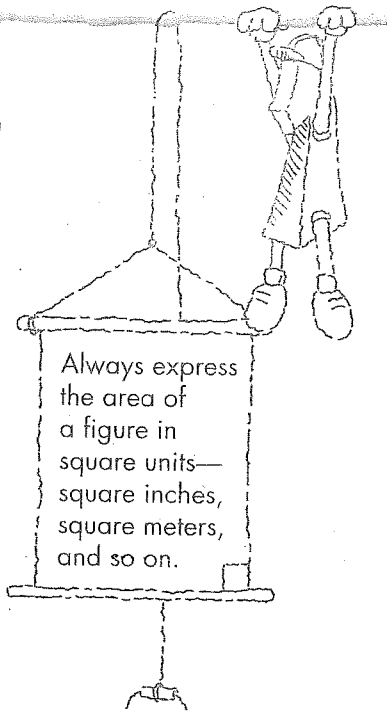
$$A = \frac{1}{2} \times b \times h$$

For this triangle:

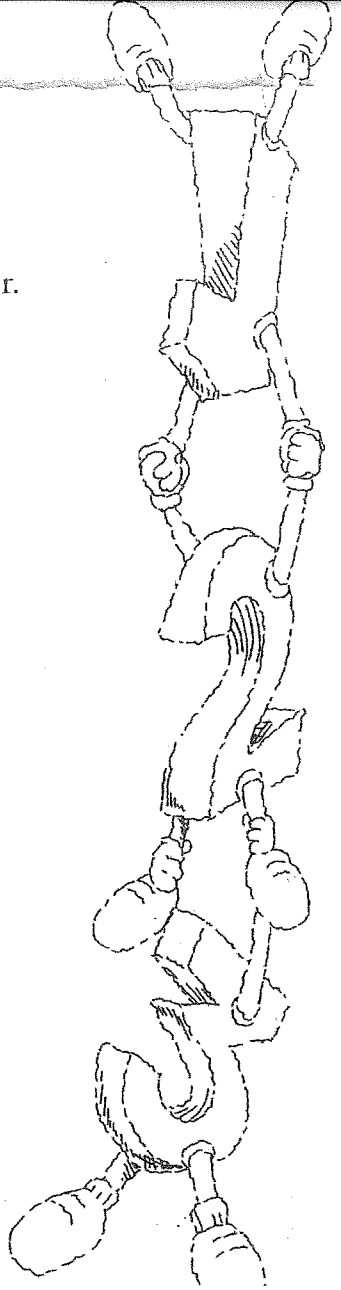


$$A = \frac{1}{2} \times b \times h$$
$$A = \frac{1}{2} \times 4 \times 6$$
$$A = \frac{1}{2} \times 24$$
$$A = 12$$

The triangle has an area of 12 square units.



Least Common Denominator



Fractions that have the same denominator have a common denominator. To find the *least common denominator (LCD)* of two or more fractions, find the *least common multiple (LCM)* of the denominators of the fractions.

To find the least common denominator, list the multiples of each denominator. Use the least common multiple of each denominator as the least common denominator.

Find the LCD of $\frac{3}{4}$ and $\frac{1}{6}$.

Multiples of 4: 4, 8, *12*, 16, 20, *24*,...
Multiples of 6: 6, *12*, 18, *24*, 30,...
The LCM is 12.

The LCD of $\frac{3}{4}$ and $\frac{1}{6}$ is 12.

You can use equivalent fractions with the least common denominator to compare, add, or subtract fractions.

$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$ and $\frac{1}{6} \times \frac{2}{2} = \frac{2}{12}$

Multiplying the two denominators always gives a common denominator, but not necessarily the least common denominator.

For $\frac{3}{4}$ and $\frac{1}{6}$, the denominators $4 \times 6 = 24$,

but 12 is the *least* common denominator.

Sometimes the least common denominator is one of the denominators.

Find the LCD of $\frac{3}{8}$ and $\frac{1}{2}$. Since 8 is a multiple of 2 the LCD of $\frac{3}{8}$ and $\frac{1}{2}$ is 8.

Mixed Numbers and Improper Fractions

A mixed number is a number greater than 1. It is made up of a whole number and a fraction.

$1\frac{1}{5}$ $3\frac{5}{8}$ $2\frac{2}{3}$

To write a mixed number as an improper fraction:

Multiply the whole number by the denominator.
Add the numerator to the product.
Write the sum over the denominator.

Write $2\frac{1}{3}$ as an improper fraction:

$2 \xrightarrow{\times} 3 \xrightarrow{+} 1$ $2 \times 3 + 1 = 7$ $2\frac{1}{3} = \frac{7}{3}$

An improper fraction is a fraction equal to or greater than 1. The numerator is equal to or greater than its denominator.

$\frac{5}{5}$ $\frac{5}{3}$ $\frac{6}{4}$

To write an improper fraction as a mixed number:

Divide the numerator by the denominator.
Write the quotient as the whole number.
Write the remainder as the numerator over the denominator.

Write $\frac{7}{3}$ as a mixed number:

$$3\overline{)7}\ \begin{matrix}2\\ -6\\ \hline 1\end{matrix}$$

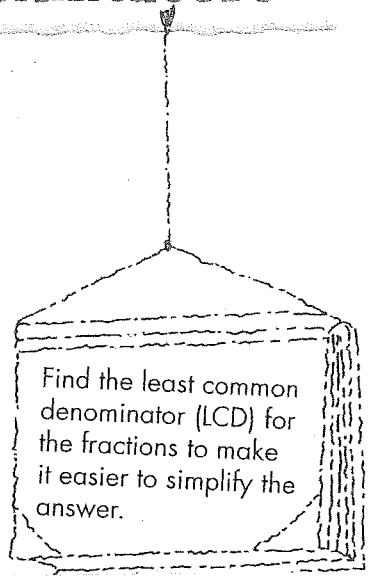
quotient
remainder
divisor

$2\frac{1}{3}$

Subtract Fractions with Unlike Denominators

These fractions have unlike denominators.

Rewrite the fractions as equivalent fractions with common denominators.	Subtract the numerators. Use the common denominator.	Write the difference in simplest form.
Subtract: $\frac{5}{8} - \frac{7}{24}$		
$\frac{5}{8} = \frac{15}{24}$ $-\frac{7}{24} = \frac{7}{24}$	$\frac{5}{8} = \frac{15}{24}$ $-\frac{7}{24} = \frac{7}{24}$ $\frac{8}{24}$	$\frac{8}{24} = \frac{1}{3}$ The difference is $\frac{1}{3}$.



Compare and Order Fractions

To compare fractions with common denominators, compare the numerators.

Compare $\frac{4}{5}$ and $\frac{2}{5}$.

Compare numerators $\frac{4}{5}$ and $\frac{2}{5}$ $4 > 2$

So $\frac{4}{5} > \frac{2}{5}$.

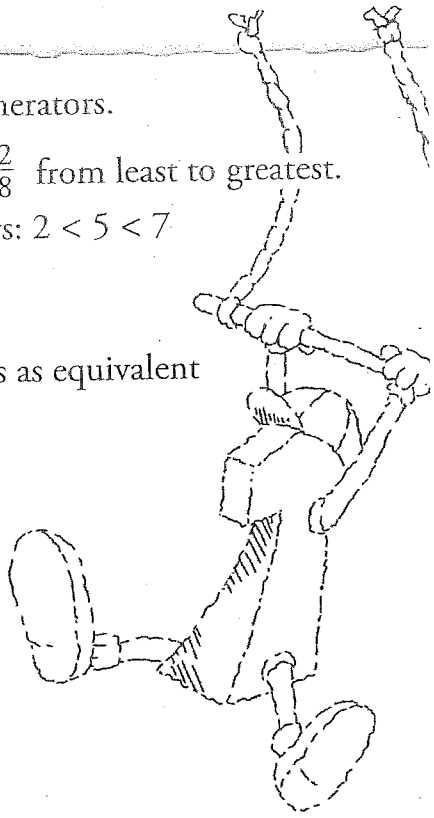
Order $\frac{5}{8}$, $\frac{7}{8}$, and $\frac{2}{8}$ from least to greatest.

Compare numerators: $2 < 5 < 7$

So $\frac{2}{8} < \frac{5}{8} < \frac{7}{8}$.

To compare fractions with unlike denominators, rewrite the fractions as equivalent fractions with the same denominator.

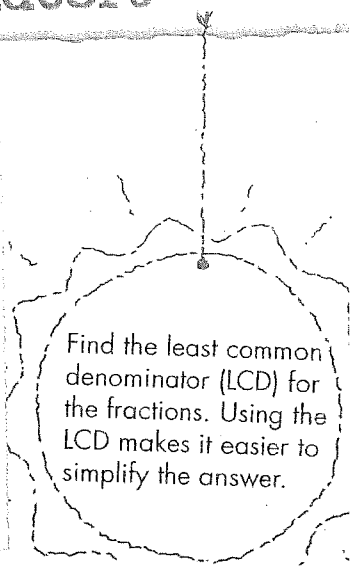
Rewrite the fractions as equivalent fractions with a common denominator.	Compare the numerators.
Compare: $\frac{2}{3}$ and $\frac{3}{4}$	Now compare: $\frac{8}{12}$ and $\frac{9}{12}$
The LCD of 3 and 4 is 12.	Compare numerators → $\frac{8}{12}$ and $\frac{9}{12}$
$\frac{2}{3} = \frac{8}{12}$ and $\frac{3}{4} = \frac{9}{12}$	$8 < 9$ $\frac{2}{3} < \frac{3}{4}$



Add Fractions with Unlike Denominators

These fractions have unlike denominators.

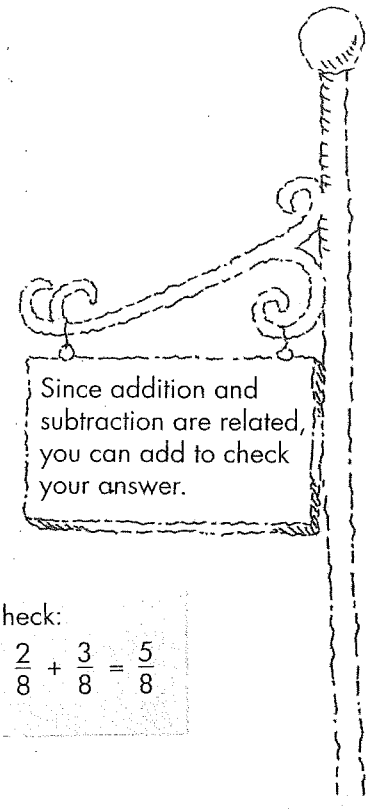
Rewrite the fractions as equivalent fractions with common denominators.	Add the numerators. Use the common denominator.	Write the sum in simplest form.
Add: $\frac{5}{6} + \frac{2}{3}$ $\frac{5}{6} = \frac{5}{6}$ $+ \frac{2}{3} = \frac{4}{6}$	$\frac{5}{6} = \frac{5}{6}$ $+ \frac{2}{3} = \frac{4}{6}$ $\frac{9}{6}$	$\frac{9}{6} = 1\frac{3}{6} = 1\frac{1}{2}$ The sum is $1\frac{1}{2}$.



Add and Subtract Like Fractions

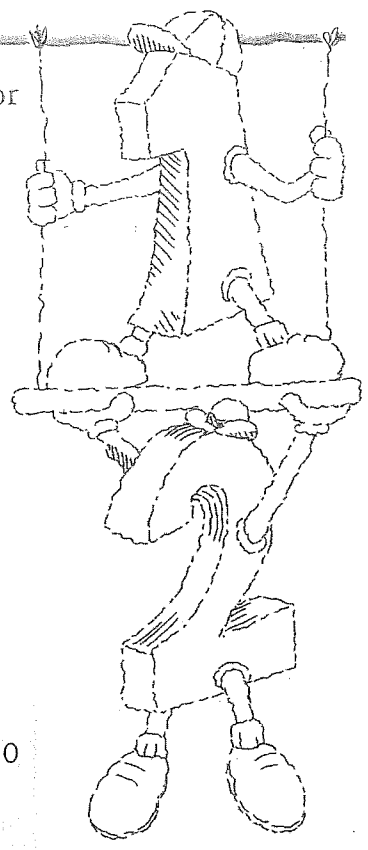
To add or subtract fractions with a common denominator, add or subtract the numerators and use the same denominator.

Add or subtract the numerators.	Use the common denominator.	Write the answer in simplest form.
Add: $\frac{2}{9} + \frac{4}{9}$ $\frac{2}{9} + \frac{4}{9} = \frac{6}{}$	$\frac{2}{9} + \frac{4}{9} = \frac{6}{9}$	$\frac{6}{9} = \frac{2}{3}$ The sum is $\frac{2}{3}$.
Add: $\frac{7}{12} + \frac{11}{12}$ $\frac{7}{12} + \frac{11}{12} = \frac{18}{}$	$\frac{7}{12} + \frac{11}{12} = \frac{18}{12}$	$\frac{18}{12} = 1\frac{6}{12} = 1\frac{1}{2}$ The sum is $1\frac{1}{2}$.
Subtract: $\frac{5}{8} - \frac{3}{8}$ $\frac{5}{8} - \frac{3}{8} = \frac{2}{}$	$\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$	$\frac{2}{8} = \frac{1}{4}$ The difference is $\frac{1}{4}$.



Check:
$\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

Fractions in Simplest Form



A fraction is in simplest form when the only common factor of its numerator and denominator is 1.

The simplest form of $\frac{4}{6}$ is $\frac{2}{3}$.

$$\frac{4}{6} = \frac{2}{3}$$

You can find the simplest form of a fraction two ways.

Divide the numerator and the denominator by common factors until the common factor is 1.

$\frac{12}{30} \div \frac{3}{3} = \frac{4}{10}$ — 3 is a common factor.

$\frac{4}{10} \div \frac{2}{2} = \frac{2}{5}$ — 2 is a common factor.

Divide the numerator and the denominator by their greatest common factor (GCF).

$\frac{12}{30} \div \frac{6}{6} = \frac{2}{5}$

The greatest common factor is 6.

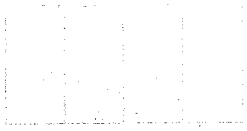
factors of 12: 1, 2, 3, 4, 6, 12
factors of 30: 1, 2, 3, 5, 6, 10, 15, 30

common factors: 1, 2, 3, 6

greatest common factor: 6

Fractions

A fraction is a number that stands for part of a region or a set.



Three-fourths of the region is shaded.

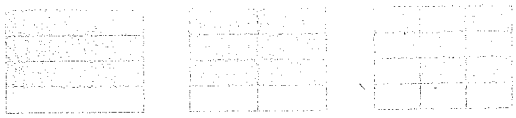
numerator → 3 number of parts shaded
denominator → 4 total number of equal parts

Three-fourths of the set is shaded.

$\frac{3}{4}$ number of things shaded
4 total number of things

Equivalent fractions are fractions that name the same amount. Use equivalent fractions to compare, add, or subtract fractions. To find equivalent fractions, multiply or divide the numerator and the denominator by the same nonzero number.

$\frac{3}{4} \times \frac{2}{2} = \frac{6}{8}$ $\quad \frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$



$\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$

The same amount is shaded.

$\frac{4}{8} \div \frac{2}{2} = \frac{2}{4}$ $\quad \frac{2}{4} \div \frac{2}{2} = \frac{1}{2}$

$\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$

The same amount is shaded.

Estimate Decimal Quotients

To estimate quotients, think of basic facts to round the dividend and divisor to compatible numbers.

Round the divisor to its greatest place.

Round the dividend to its greatest place to be compatible with the rounded divisor.

Divide using mental math. Think of basic facts.

Estimate: $17\overline{)386.22}$

$17\overline{)386.22}$ → $20\overline{)386.22}$ → $20\overline{)400}$

$20\overline{)400}$ = 20

The quotient is about 20.

Check: 20×20 → 400

Estimate: $21\overline{)12.6}$

$21\overline{)12.6}$ → $20\overline{)12.6}$ → $20\overline{)12.0}$

$20\overline{)12.0}$ = 0.6

The quotient is about 0.6.

Check:

$$\begin{array}{r} 20 \leftarrow \text{0 places} \\ \times\ 0.6 \leftarrow \text{1 place} \\ \hline 12.0 \leftarrow \text{1 place} \end{array}$$

Also think: $20 \times 6 = 120$ but 0.6 is 10 times smaller. So, $20 \times 0.6 = 12.0$

Multiply Decimals

When you multiply decimals, be sure to write the decimal point in the correct place in the product.

Multiply like whole numbers. (You do not have to line up the decimal points.)

Count all the places to the right of the decimal point in each factor. Count the same number of places in the product and write the decimal point.

Multiply: 6.82×4.3

$$\begin{array}{r} 6.82 \\ \times\ 4.3 \\ \hline 2046 \\ +27280 \\ \hline 29326 \end{array}$$

$$\begin{array}{r} 6.82 \leftarrow \text{2 places} \\ \times\ 4.3 \leftarrow \text{1 place} \\ \hline 2046 \\ +27280 \\ \hline 29.326 \leftarrow \text{3 places} \end{array}$$

The product is 29.326.

Multiply: 0.3×0.24

$$\begin{array}{r} 0.24 \\ \times\ 0.3 \\ \hline 72 \end{array}$$

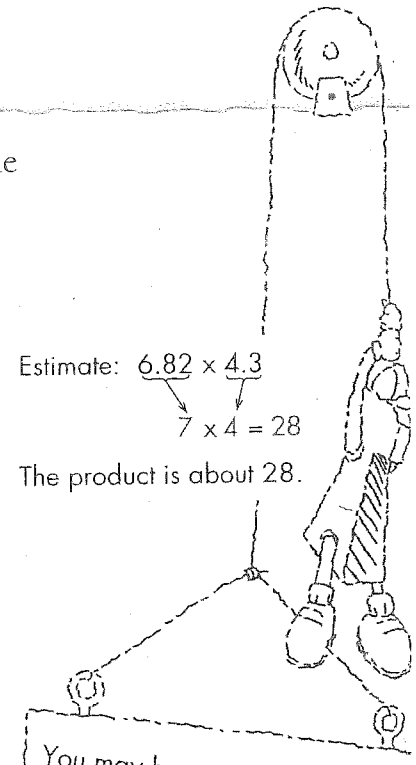
$$\begin{array}{r} 0.24 \leftarrow \text{2 places} \\ \times\ 0.3 \leftarrow \text{1 place} \\ \hline 0.072 \leftarrow \text{3 places} \end{array}$$

The product is 0.072.

Estimate: 6.82×4.3

$7 \times 4 = 28$

The product is about 28.



You may have to write some zeros as place holders in order to put the decimal point in the correct place in the product.

Divide Whole Numbers

Divide 3,769 by 53.

You can estimate to see if your answer makes sense.
3,769 ÷ 53 →
3,500 ÷ 50 = 70

Estimate the first digit of the quotient and where it goes.

```
      7
53 ⟌3,769
```

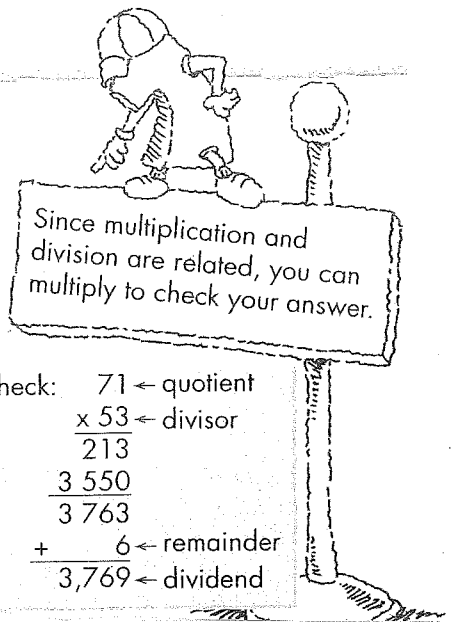
Think: $50 \overline{)350}$ → 7

Divide. Multiply. Subtract. Bring down.

```
      7
53 ⟌3,769
  -371↓
     59
```

Repeat the steps until the dividing is finished.

```
     71 R6
53 ⟌3,769
  -371↓
     59
    -53
      6
```



Check:
71 ← quotient
× 53 ← divisor
213
3 550
3 763
+ 6 ← remainder
3,769 ← dividend

Multiply and Divide by Powers of 10

Here are some shortcuts to help you multiply by powers of 10. Notice that the decimal point changes position.

To multiply by 10: Move the decimal point 1 place to the *right* in the other factor.	10 x 2.85 = 2.85 = 28.5	10 x 0.053 = 0.053 = 0.53
To multiply by 100: Move the decimal point 2 places to the *right* in the other factor.	100 x 2.85 = 2.85 = 285	100 x 0.053 = 0.053 = 5.3
To multiply by 1,000: Move the decimal point 3 places to the *right* in the other factor.	1,000 x 2.85 = 2.850 = 2,850	1,000 x 0.053 = 0.053 = 53

Here are some shortcuts to help you divide by powers of 10.

To divide by 10: Move the decimal point 1 place to the *left* in the dividend.	1,824 ÷ 10 = 1,824 = 182.4	35.5 ÷ 10 = 35.5 = 3.55
To divide by 100: Move the decimal point 2 places to the *left* in the dividend.	1,824 ÷ 100 = 1,824 = 18.24	35.5 ÷ 100 = 35.5 = 0.355
To divide by 1,000: Move the decimal point 3 places to the *left* in the dividend.	1,824 ÷ 1,000 = 1,824 = 1.824	35.5 ÷ 1000 = 035.5 = 0.0355

Estimate Decimal Products

Round each factor so you can find the product quickly using mental math.

Round each factor to its greatest place.

Multiply the rounded numbers.

Estimate: 42 x $2.89.

42 x $2.89

40 x $3

40 x $3 = $120

The product is about $120.

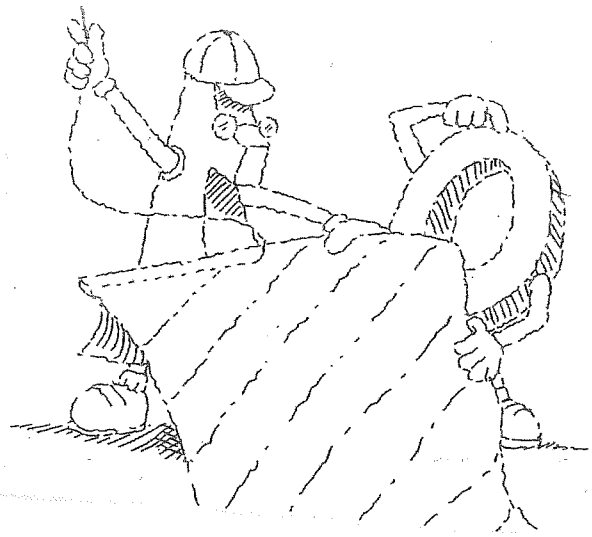
Estimate: 2.8 x 6.75.

2.8 x 6.75

3 x 7

3 x 7 = 21

The product is about 21.



Divide with Zeros in the Quotient

Find the quotient of 9,635 ÷ 19.

You can estimate to see if your answer makes sense.

9,635 ÷ 19 →

10,000 ÷ 20 = 500

Start to divide as usual. Divide. Multiply. Subtract. Bring down.

```
   5
19)9,635
  -95
   13
```

When the divisor is larger than the number being divided, write a zero in the quotient.

```
   50
19)9,635
  -95
   13
```

Think: ? × 19 = 13

Continue the division process.

```
   507 R2
19)9,635
  -95
   13
  - 0      0 x 19 = 0
   135
  -133
     2
```

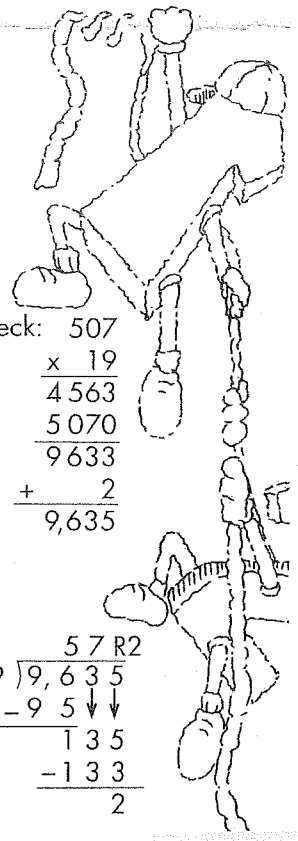
Check:

```
  507
x  19
 4563
 5070
 9633
+   2
 9,635
```

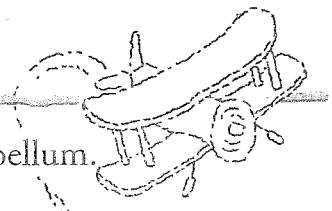
The problem at the right has the wrong answer. More than one digit was brought down instead of dividing digit by digit. Making an estimate before you divide can help you decide whether your answer is correct.

Estimate: 9,635 ÷ 19 is about 500.

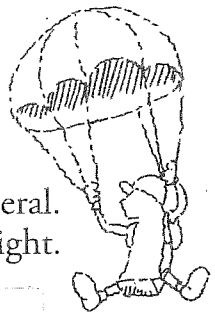
```
   57 R2
19)9,635
  -95
   135
  -133
     2
```



Decimal Place Value



It's a FACT! The smallest cell in the human body is a brain cell in the cerebellum. It measures about 0.005 millimeters in diameter.

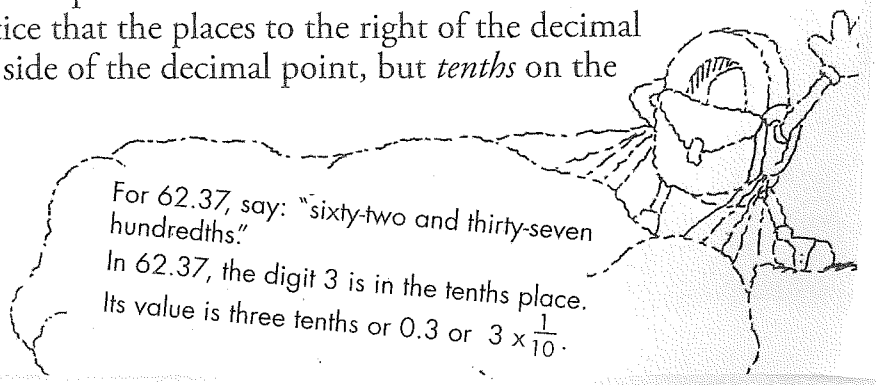


standard form: 0.005
short word form: 5 thousandths
meaning: $\frac{5}{1{,}000}$

Use place value to read a decimal or to determine the value of a digit in a decimal numeral. In the decimal system, each place to the left has 10 times the value of the place on its right.

Hundreds 100	Tens 10	Ones 1		Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$	Thousandths $\frac{1}{1{,}000}$	Read as:
5	2	1	.	8			521 and 8 tenths
	6	2	.	3	7		62 and 37 hundredths
		0	.	0	0	5	5 thousandths

The decimal point separates the whole number part of the decimal number from the fractional part of the decimal number. Notice that the places to the right of the decimal point end with *ths*. You say *tens* on the left side of the decimal point, but *tenths* on the right side.



To read a decimal:

Say the whole number first if there is one.
Say "*and*" for the decimal point.
Say the rest of the number as a whole number.
Say the place of the last digit.

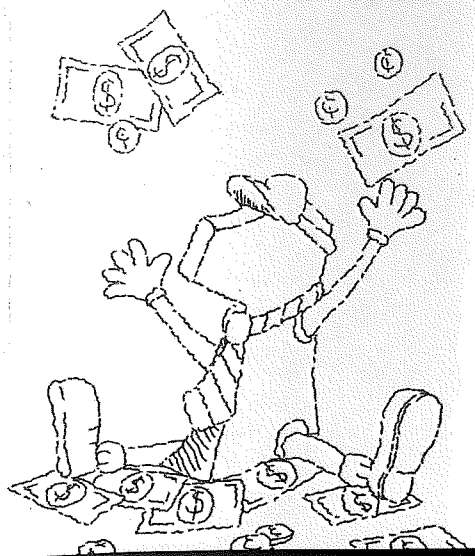
For 62.37, say: "sixty-two and thirty-seven hundredths."

In 62.37, the digit 3 is in the tenths place. Its value is three tenths or 0.3 or $3 \times \frac{1}{10}$.

Round Decimals

Round 4.617 to the nearest hundredth.

Find the place to round to.	Look at the digit to its right. Underline it.	If the digit is less than 5, round down. If the digit is 5 or greater, round up.
4.617 ↑ hundredth	4.617	4.617 7 > 5 Round up. 4.617 rounds to 4.62 to the nearest hundredth.



Here are more examples:

Round 0.735 to the nearest *tenth*.	0.735	3 < 5	Round down to 0.7.
Round $52.84 to the nearest *dollar*.	$52.84	8 > 5	Round up to $53.00.

Compare and Order Decimals

Which number is greater: 2.436 or 2.364?

Line up the digits by place value.	Look at the digits from left to right. Find the first place where the digits are different.	Compare the values of the digits. The numbers compare the same way.
2.436	2.436	4 tenths > 3 tenths
2.364	2.364 ↑ different	2.436 > 2.364 2.436 *is greater than* 2.364.

You could also write 2.364 *is less than* 2.436 or 2.364 < 2.436.

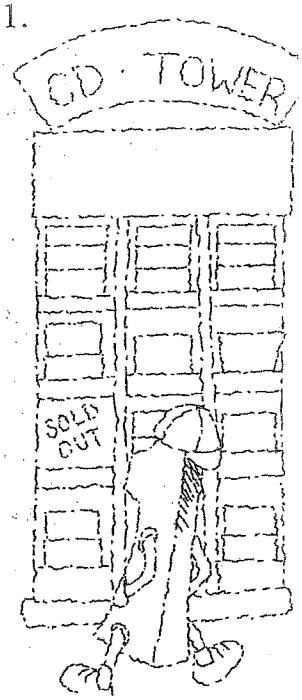
To compare more than two numbers, use the same steps. It is a good idea to write all the numbers as equivalent decimals to the same place.

Compare 3.005, 3.15, and 3.5.

3.5 = 3.500	3.5 is the greatest. It has the most tenths.	3.500
3.15 = 3.150	Then compare the other two numbers.	→ 3.150
3.005 = 3.005	3.15 is greater. It has more hundredths.	3.005

Estimate Decimal Sums and Differences

Here are two ways to estimate sums and differences for decimals greater than 1.



Use rounding.
Round each decimal to the nearest whole number. Then add or subtract.

Estimate: 8.7 → 9
+ 2.36 → + 2
11

8.7 + 2.36 is about 11.

Estimate: 7.37 → 7
− 3.89 → − 4
3

7.37 − 3.89 is about 3.

Use front-end estimation.
Add or subtract the front digits.

Estimate: 8.7
+ 2.36
10.00

Adjust: 0.7 + 0.36 is about 1.0, or 1.
So, 10 + 1 = 11

8.7 + 2.36 is about 11.

Estimate: 7.37
− 3.89
4.00

Adjust: Since 37 < 89, regrouping is needed.

7.37 − 3.89 is a little less than 4.

Use the method that fits the numbers the best.

Add and Subtract Decimals

When you add and subtract decimals, remember to place the decimal point in the answer.

Line up the decimal points. Write equivalent decimals if needed.	Add or subtract.	Write the decimal point in the answer.	Estimate:
Add: 3.8 + 1.357 3.8 = 3.800 + 1.357 + 1.357	1 3.800 + 1.357 5 157	1 3.800 + 1.357 5.157	3.8 → 4 + 1.357 → + 1 5
Subtract: 0.9 – 0.37 0.9 = 0.90 – 0.37 – 0.37	810 0.9Ø – 0.37 53	810 0.9Ø – 0.37 0.53	Add to check: 1 0.53 + 0.37 0.90 = 0.9