

math

MAMMOTH

Measuring 1



Measuring length



Measuring weight



Measuring volume



Lessons for both
customary and
metric units



Many hands-on activities



Maria Miller

Blue
Series

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2024 EDITION

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Contents

Introduction	5
Measuring Length	7
Exploring Measuring	11
Measuring Lines in Inches	13
Inches and Half-Inches	16
Measuring Lines in Centimeters	19
Measuring to the Nearest Centimeter	21
Some More Measuring	24
Measuring to the Nearest Fourth-Inch	27
Centimeters and Millimeters	30
Line Plots	33
Feet and Miles	35
Feet, Yards, and Miles	38
Meters and Kilometers	40
Common Metric Units of Length	42
Review 1	44
Weight in Pounds	45
Pounds and Ounces	47
Weight in Kilograms	50
Grams and Kilograms	52
Cups, Pints, Quarts, and Gallons	56
Milliliters and Liters	58
Word Problems and More	60
Review 2	62
Answers	65
More from Math Mammoth	77

Introduction

Math Mammoth Measuring 1 is a worktext that covers measurement-related topics over the span of three grade levels (grades 1-3; ages 6-9 years). Being a worktext, it contains both explanations of the concepts (the “text”) and exercises (the “work”). The lessons cover measuring length, weight and volume using the most common metric and customary units, and some easy conversions between the units.

In general, the lessons require very little teacher preparation; however in several you will need to have on hand common measuring tools, such as a ruler, a scale or measuring cups.

This book is not organized by grade levels. Instead, the lessons are grouped by topic. The first part of the book (up to the lesson *Review 1*) deals with measuring length, in increasing difficulty. The very first lessons only deal with inches and centimeters, and teach students how to measure the length of objects using a ruler and a measuring tape. Then there are lessons that also include feet, yards, miles, meters, and kilometers.

Then follow four lessons about weight (mass). In these lessons, students use a bathroom scale and a kitchen scale to weigh objects both in metric and customary units. Then the book also has two lessons about volume (one for metric, one for customary units), which include many hands-on activities.

When it comes to measuring, experience is the best teacher. We all use various measurement units in our everyday life, and *using* them is the key to remembering what they are and how to convert between them. The units your student is not using are likely to be forgotten easily. So encourage your student to have free “play time” with measuring devices such as scales, measuring cups, measuring tapes and rulers.

Note: If you have the downloadable version of this book (PDF), you need to print the pages as 100%, not with “shrink to fit,” “print to fit,” or similar setting. The “shrink to fit” setting (which is typically the default) will cause the images and lines in some exercises to be “shrunk” compared to what was intended, and thus the student’s measurements will not match the answer key.

Math Mammoth Blue Series also includes another worktext, *Math Mammoth Measuring 2*, which is a sequel to this one. In it, students practice conversions between measurement units and problem solving.

I wish you success in teaching math!

Maria Miller, the author

Games and Activities

The lessons in this book have a lot of hands-on activities. Below, you will find a few more activities and games.

Set the Course!

You need: A measuring tape that measures in feet or meters. Markers to mark distances outside. These could be little flags you can stick in the ground, colorful caps, etc.

Game play: The players can work as one team, several teams, or as individuals. For each round of the game, the game leader announces a target distance to be run, such as 60 ft or 15 m. Each player or team then designs a course with that distance. For example, it could be a square with 15-ft sides, a rectangle with 25 ft and 5 ft sides, a triangle, or a single marker 30 ft away so that you run to it and back.

Once the courses are designed, it is time to do the racing. If using teams, this can be a relay race. The player or team that runs the fastest gains a point.

Also, each player/team gets 1-3 points according to how accurately they measured the course (how close the total distance of their course is to the target distance).

Estimation Game

You need: A measuring tape and/or a ruler. Paper and pencil for each player. Before the game, write down a list of lengths, widths, heights, and distances that the players will estimate. For example, you might ask them to estimate the width of a table, the length of a room, the height of someone, etc.

Game play: The game leader announces the length/width/height/distance to estimate. Each player writes down their estimate, including the unit of measure. Then, one of the players measures the distance in question, and the player whose estimate came the closest gets a point.

The winner is the player with most points after a pre-determined number of rounds.

Variations:

1. Play in teams instead of as individuals.
2. Estimate weights (in pounds or kilograms) instead of lengths.
3. Announce a given distance (such as 25 cm), and the task is to find an object with that length, width, or height.

Games and Activities at Math Mammoth Practice Zone

Measurement Units Matching Game

Practice converting measurement units while also uncovering a hidden picture in this fun matching game! You can choose which unit conversions to practice (includes both metric and customary units). There are also several difficulty levels.

<https://www.mathmammoth.com/practice/measurement-units>

Here are quick links to some common options.

Common customary units; easy level:

<https://www.mathmammoth.com/practice/measurement-units#tiles=12&level=1&opts=ft-in,yd-ft,lb-oz,gal-qt,qt-pint>

Common metric units; easy level:

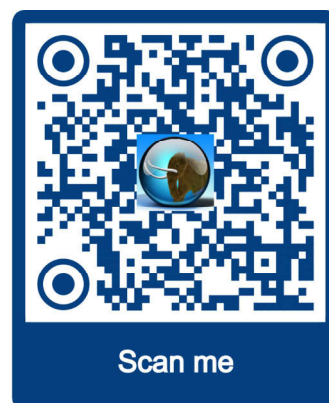
<https://www.mathmammoth.com/practice/measurement-units#tiles=12&level=1&opts=km-m,m-cm,kg-g,L-ml>

Helpful Resources on the Internet

In the link below, you will find Internet resources that match the topics in this book, and that offer:

- **online practice** for concepts;
- online **games**, or occasionally, printable games;
- **animations** and interactive **illustrations** of math concepts;
- **articles** that teach a math concept.

We heartily recommend you take a look. Many of our customers love using these resources to supplement the bookwork. The resources provide extra practice, illustrate concepts, and some simply provide some fun. Enjoy!



<https://l.mathmammoth.com/blue/measuring1>

Measuring Length

In this lesson, we measure things to find how long or how wide they are as compared to other things. For all measuring, you need a **measuring unit**. You repeat the measuring unit many times, and compare it to the thing you are measuring.

1. Measure how wide or how long things are, using shoes as measuring units.

You need: two small shoes and two bigger shoes.

- a. Measure a desk or a table. Place one shoe at the edge of the table and the other one directly behind it. Then move the first shoe in front of the second, and so on. Keep count.



The table is _____ small shoes wide.



The table is _____ big shoes wide.

- b. Measure two more things now, using both the small shoes and the big shoes.

Some ideas:

- how wide the blackboard is;
- how long your friend is when lying on the floor;
- how tall your chair is;
- how long the room is.

The _____ is _____ small shoes wide.

The _____ is _____ big shoes wide.

The _____ is _____ small shoes wide.

The _____ is _____ big shoes wide.

2. Ryan noticed that each daddy shoe was about three baby shoes.

Ryan measured his desk and it was four daddy shoes wide, like this:



How many baby-shoes wide is Ryan's desk?

Hint: Draw the baby shoes under the daddy shoes.

3. Ryan measured that his room was 27 shoes wide, using daddy shoes.
He also measured it using baby shoes.
Was Ryan's room 81 baby shoes wide, or 9 baby shoes wide?

4. Measure the length of small things with paperclips.

You need: several paperclips that are the same size,
small things to measure such as an eraser, a pencil,
crayons, toys, or books.



Write the things below **in order**, from shortest to longest.

_____	_____ paperclips
_____	_____ paperclips
_____	_____ paperclips
_____	_____ paperclips
_____	_____ paperclips

5. How many crayons long are these pencils? How many paperclips long are they?



a.



b.



c.



d.



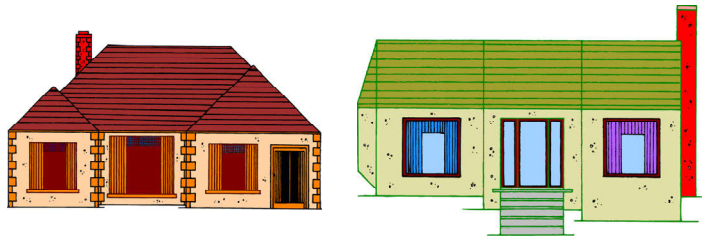
pencil a. _____ crayons long; _____ paperclips long

pencil b. _____ crayons long; _____ paperclips long

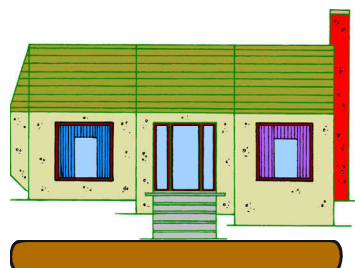
pencil c. _____ crayons long; _____ paperclips long

pencil d. _____ crayons long; _____ paperclips long

Sometimes we cannot easily tell about two things which one is longer or wider. We can use a third thing as a “measuring stick.” Look at these two houses. Can you tell which one is longer?



Now let’s use this “log” as a measuring stick:



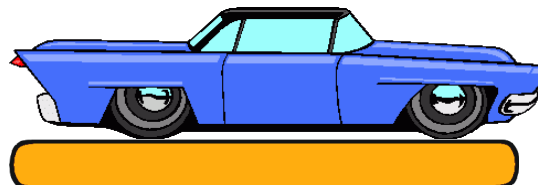
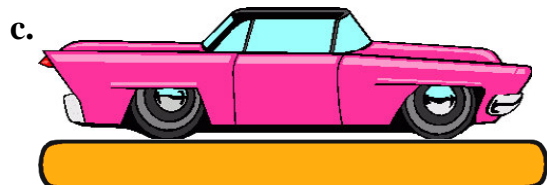
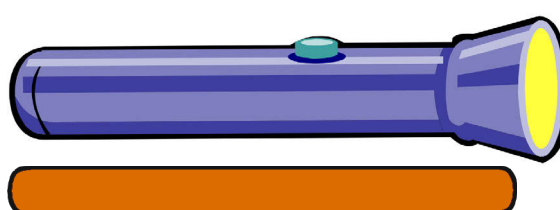
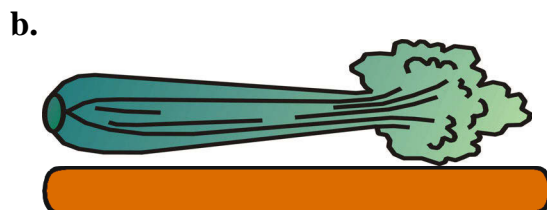
House 1 is a little shorter than our log.

House 2 is a little longer than our log.

Is house 1 longer than house 2? Or the other way around?

House 2 is longer than house 1, because it is longer than our log, whereas house 1 is shorter than the log.

6. Compare the things to the “measuring stick.” Mark the longer of the two.



7. Draw a picture to match the situation. You can use stick figures.

- a.** Jerry is shorter than the top of the cabinet.
The top of the cabinet is shorter than Mike.

- b.** The table is taller than little Kyle. Little Mary is taller than the table.

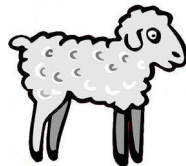
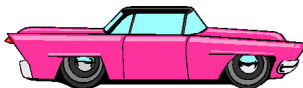
Exploring Measuring

Besides measuring length, we also measure things to find how heavy something is, how much liquid it holds, or how much space it takes, as compared to other things.

1. Find five things you can carry, some lighter and some heavier. Put them in order from the lightest to the heaviest. You can draw the things or write them in the space below.

2. Order these things from lightest to heaviest by writing 1, 2, and 3 next to them. Don't just go by which picture looks bigger. Think how heavy these things would be in real life.

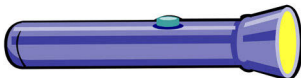
a.



b.



c.



3. If you have a bathroom scale, step on it and measure how much you weigh. Weigh some other things, also. If your scale measures in pounds, write “lb” after the number, such as 45 lb. If it measures in kilograms, write “kg”, such as 22 kg.

I weigh _____ .

_____ weighs _____ .

_____ weighs _____ .

_____ weighs _____ .

For all measuring, you need a **measuring unit**. You repeat the measuring unit a lot of times to compare it to the thing you are measuring.

4. Measure how much water a pot holds.

You need: water, a large coffee cup, a food jar, and a pot or other big container.

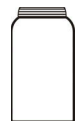
Fill the cup with water and pour into the pot. Repeat until the pot is full.
Keep count of how many cups full of water you need to fill the pot.



The pot holds _____ cups full of water.

Now do the same using a jar:

The pot holds _____ jars of water.



5. Measure how much water a jar or a cup holds.

You need: water, a small measuring cup, a food jar, a drinking glass.

Fill the measuring cup with water and pour it into the food jar.
Repeat until the jar is full. Keep count.



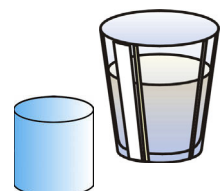
The jar holds _____ measuring cups of water.

Now do the same with a large drinking glass.

The glass holds _____ measuring cups of water.



6. Peter measured how much water fits into a bucket. First he measured it using a large drinking glass. The bucket holds 32 big drinking glasses. Then he measured it using a smaller drinking glass. Which is correct: did the bucket hold 19 or 53 smaller drinking glasses?



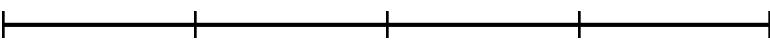
Measuring Lines in Inches


This line is 1 inch long. 

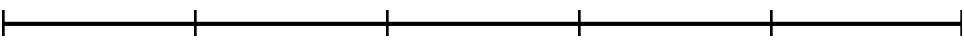
We also write “1 in.” for short.

1. How many inches are end-to-end?

a.  _____ inches

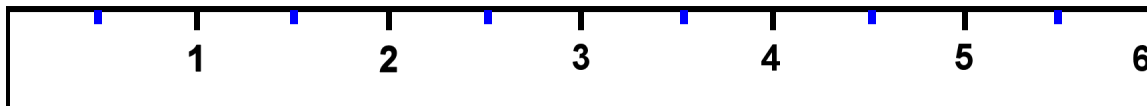
b.  _____ inches

c.  _____ inches

d.  _____ inches

2. How many inches long are these items?

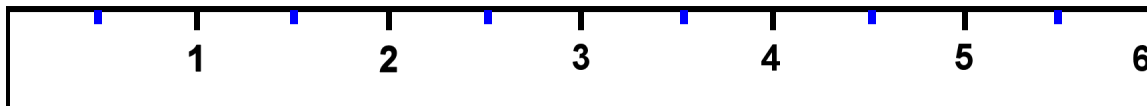
 _____ in.



 _____ in.

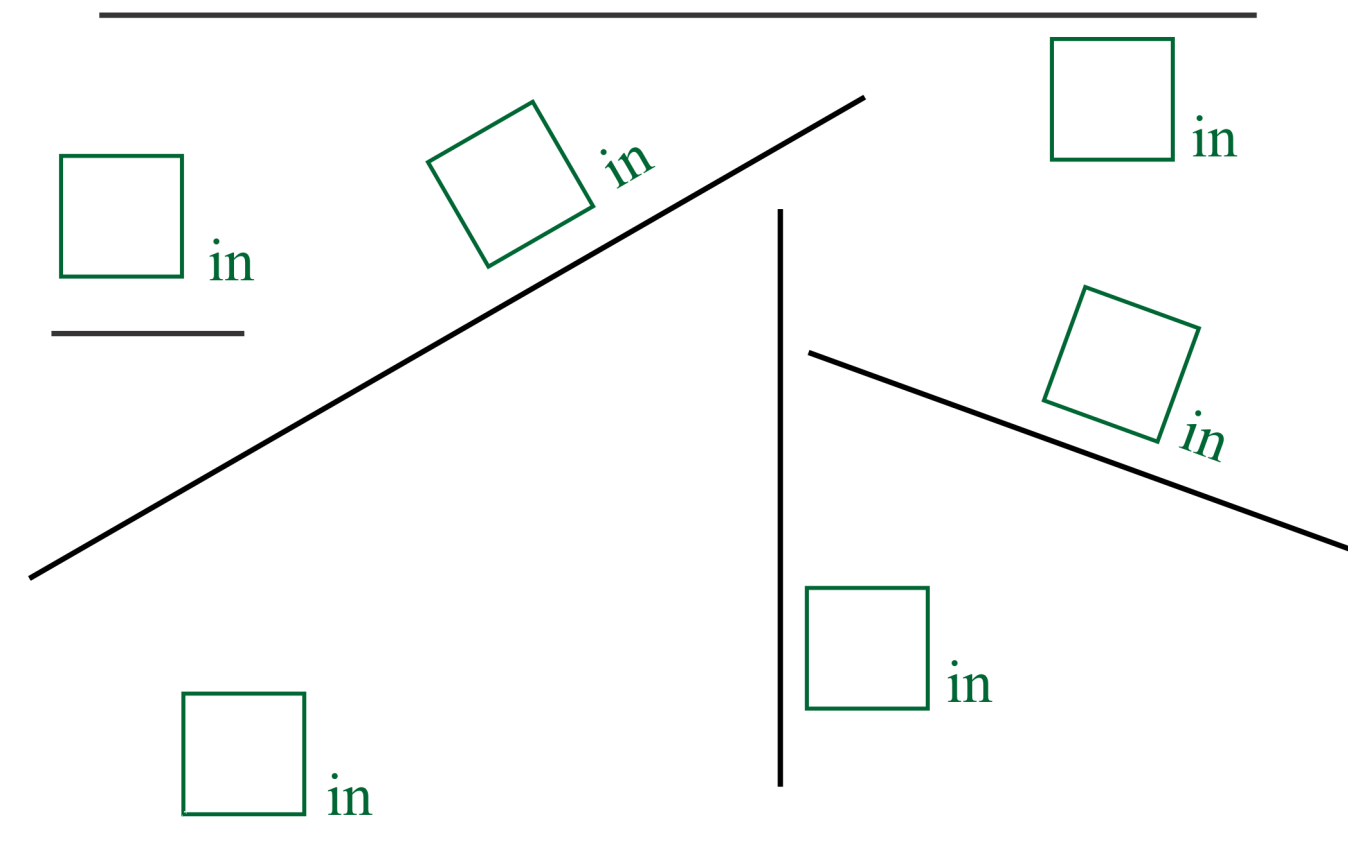
 _____ in.

 _____ in.

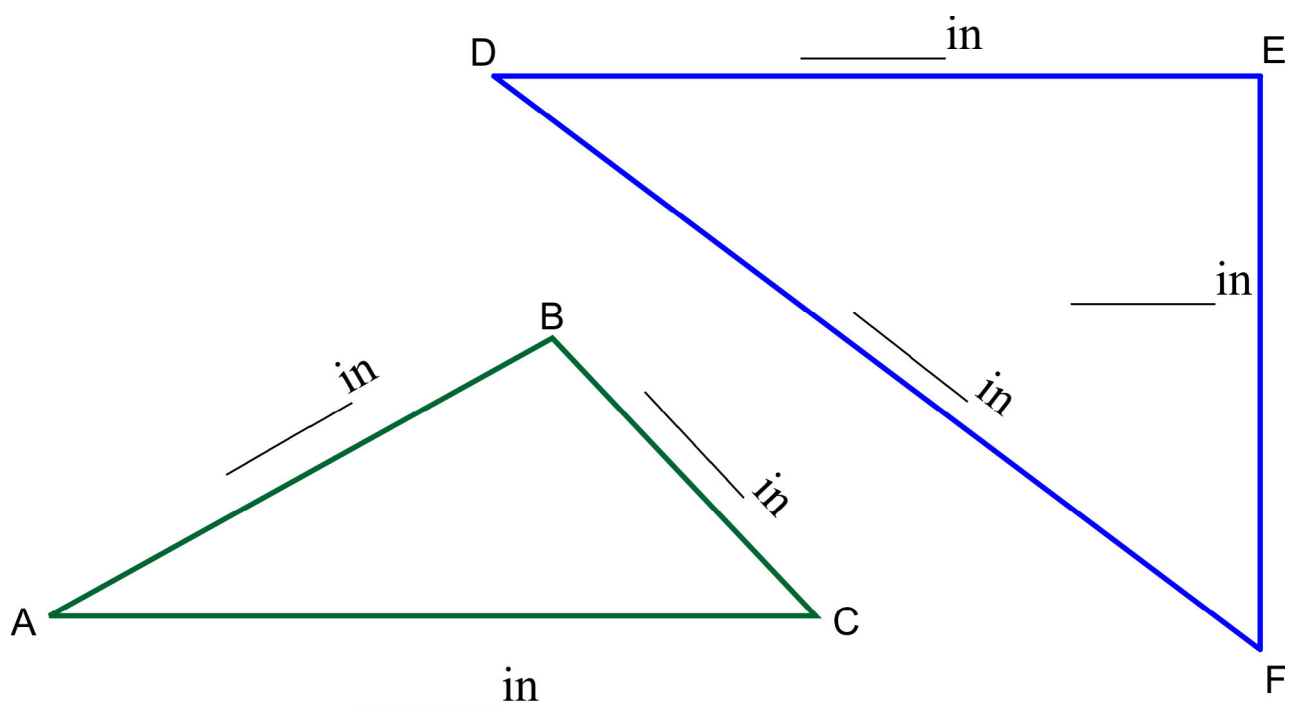


 _____ in.

3. Measure the lines with a ruler.



4. Measure the sides of the triangles.



5. Use a ruler and draw lines with these lengths:

a. 4 in.

b. 2 in.

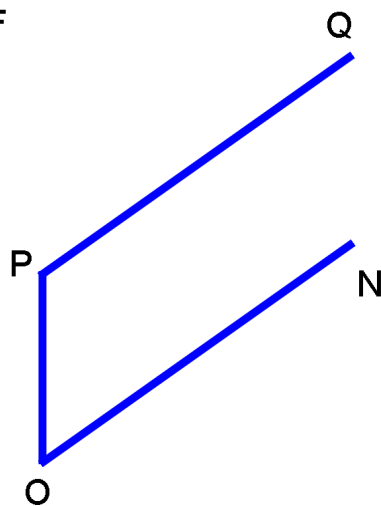
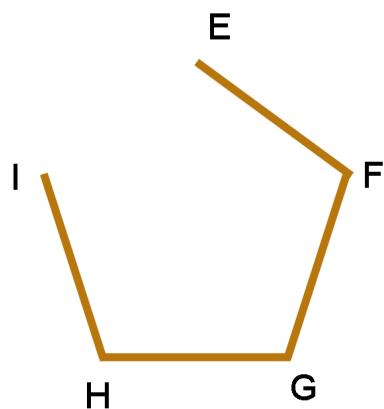
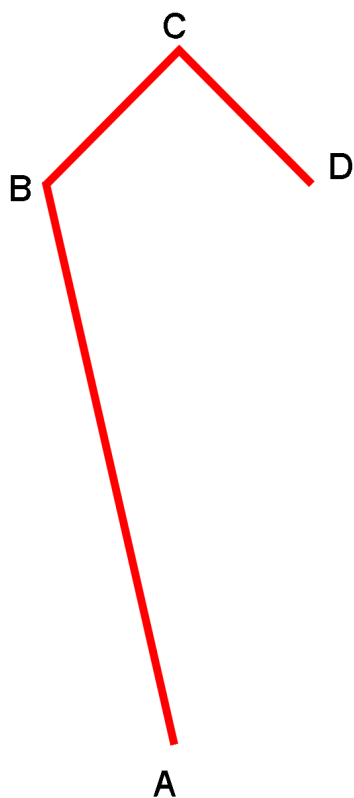
c. 5 in.

d. 7 in.








e. 1 in.

f. 8 in.





6. Draw the last side for these figures with a ruler. Then measure all the sides of each figure. Write the measurement next to each side (for example “2 inches” or “2 in.”).



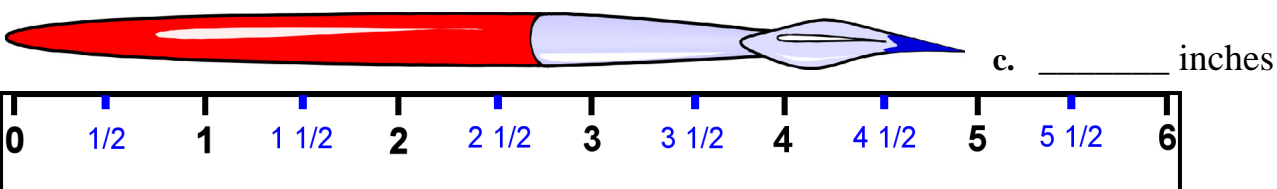
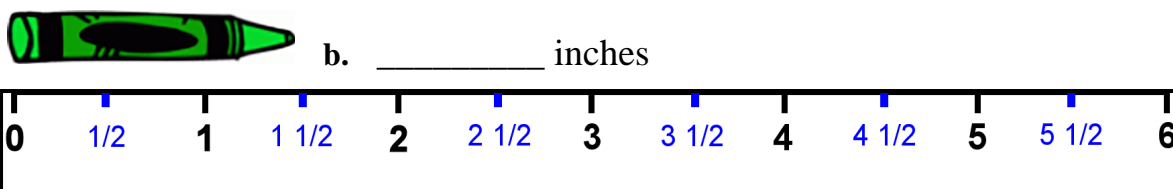
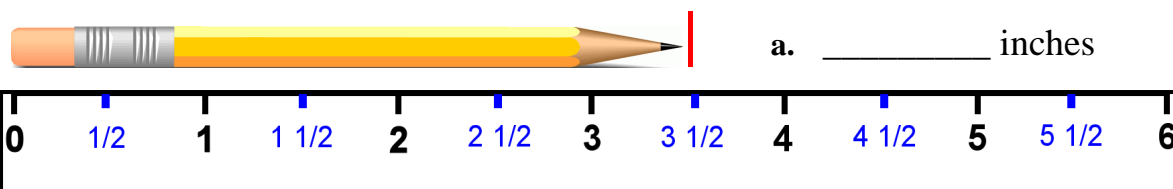
Inches and Half-Inches

 This line is 1 inch long.  This line is $\frac{1}{2}$ inch long.	 Two half-inches  make an inch!
 <p>3 inches and a $\frac{1}{2}$-inch = $3 \frac{1}{2}$ inches (three and a half inches)</p>	  <p>three half-inches = $1 \frac{1}{2}$ inches (one and a half inches)</p>

1. How long are the lines of inches and half-inches when placed end-to-end?

- a.  _____ inches
- b.  _____ inches
- c.  _____ inches
- d.  _____ in.

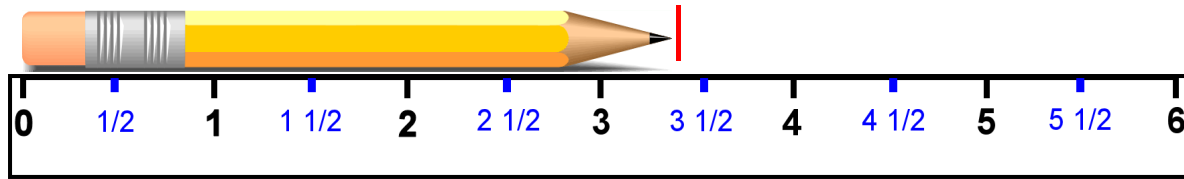
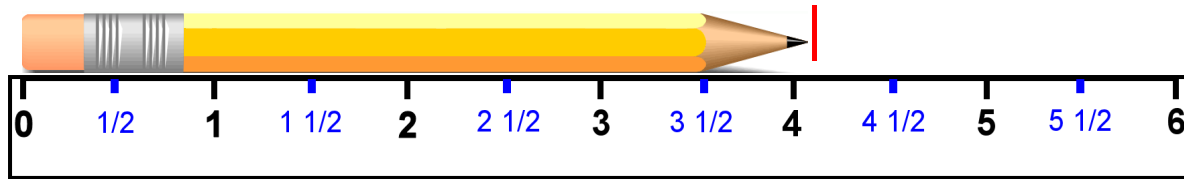
2. How long are these things in inches?



You can cut out one of the rulers in this lesson and tape it on an existing ruler or cardboard after you have finished the exercises on this and the next page!

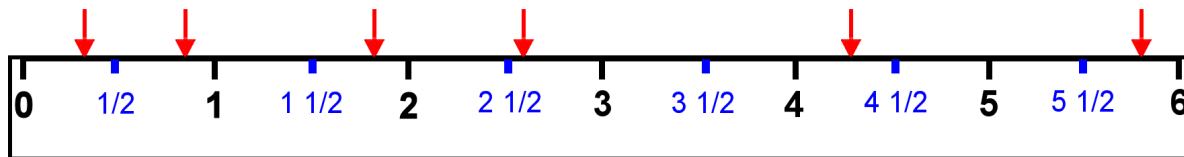
Most objects are NOT exactly a certain number of whole inches, or even whole and half inches. You can measure them to the nearest inch, or to the nearest half-inch.

The pencil below is a little over 4 inches long. It is about 4 inches long.

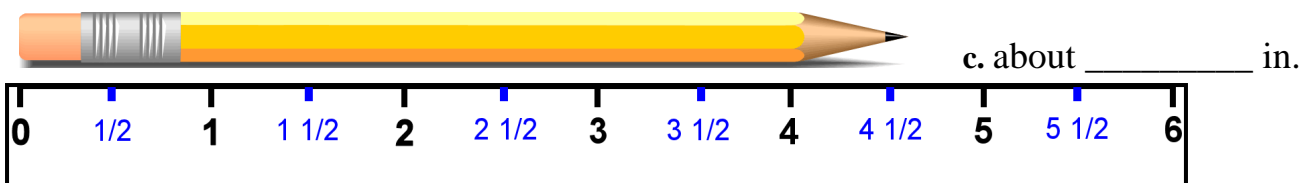
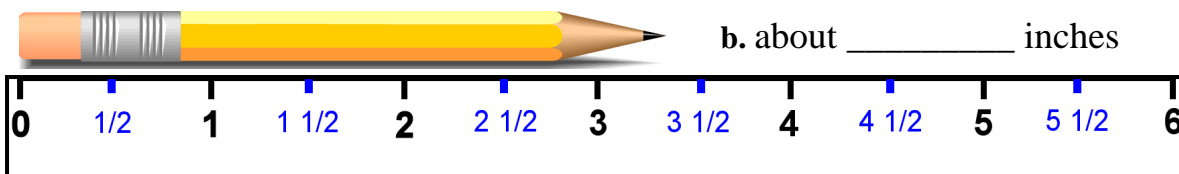
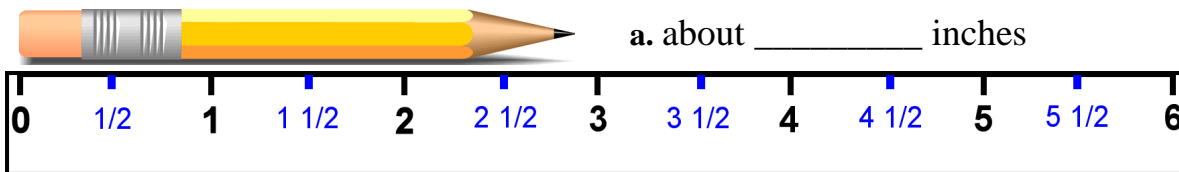


The pencil above is about 3 1/2 inches long. The end of the pencil is closer to 3 1/2 than to 3.




3. Circle the whole-inch or half-inch number that is nearest to each arrow.



4. Measure the pencils to the nearest whole inch or half-inch.



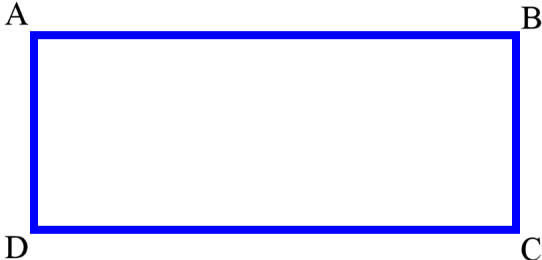
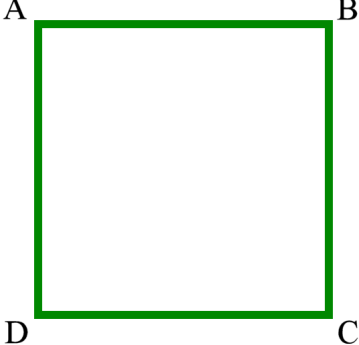
5. First GUESS how long these lines are in inches and half-inches. Write down your guess. After that, measure how long the lines are.

		GUESS	MEASUREMENT
a.		_____ inches	_____ inches
b.		_____ inches	_____ inches
c.		_____ inches	_____ inches

6. Draw some lines on a blank paper. Use a ruler. Hold the ruler down tight with one hand, while drawing the line with the other. It takes some practice!

- a. 5 in. long b. 2 in. long
c. 12 in. long d. 9 in. long

7. Write the names of these shapes. Measure the sides of the shapes. “All the way around” means you need to find the *total* length of the four sides (use addition!).

<p>a. _____ ABCD</p> <div style="text-align: center;">  </div> <p>Side AB _____ inches Side BC _____ inches Side CD _____ inches Side DA _____ inches All the way around _____ inches</p>	<p>b. _____ ABCD</p> <div style="text-align: center;">  </div> <p>Side AB _____ inches Side BC _____ inches Side CD _____ inches Side DA _____ inches All the way around _____ inches</p>
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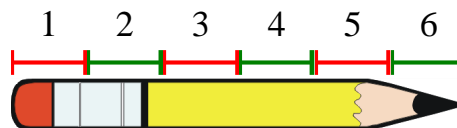
Measuring Lines in Centimeters

You can find out how long things are in *centimeters*.




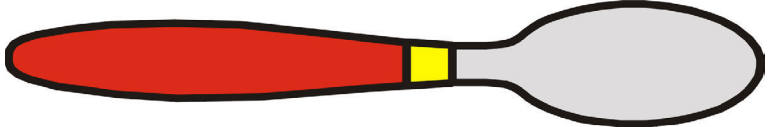
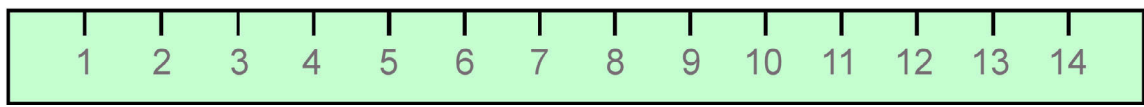

This line is 1 centimeter long: 

A centimeter is written in its short form as “cm.”


This pencil is 6 cm long.

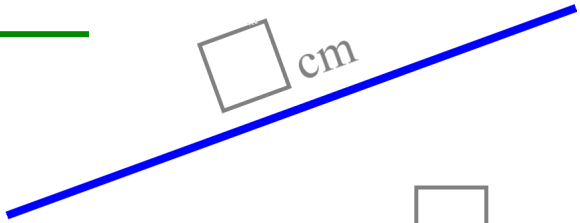



1. How many centimeters long are these things?


<p>a.  _____ cm</p>	<p>b.  _____ cm</p>
<p>c.  _____ cm</p>	
<p>d.  _____ cm</p> 	
<p>e.  _____ cm</p>	


2. Measure the lines with a ruler. (If you don't have one, cut out the ruler at the bottom of the page.)

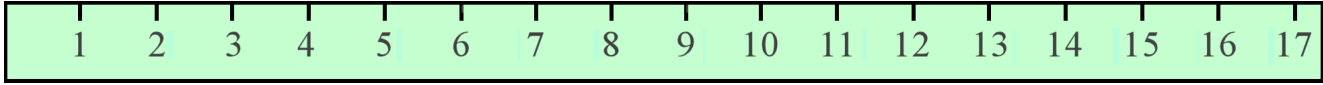
 cm

 cm

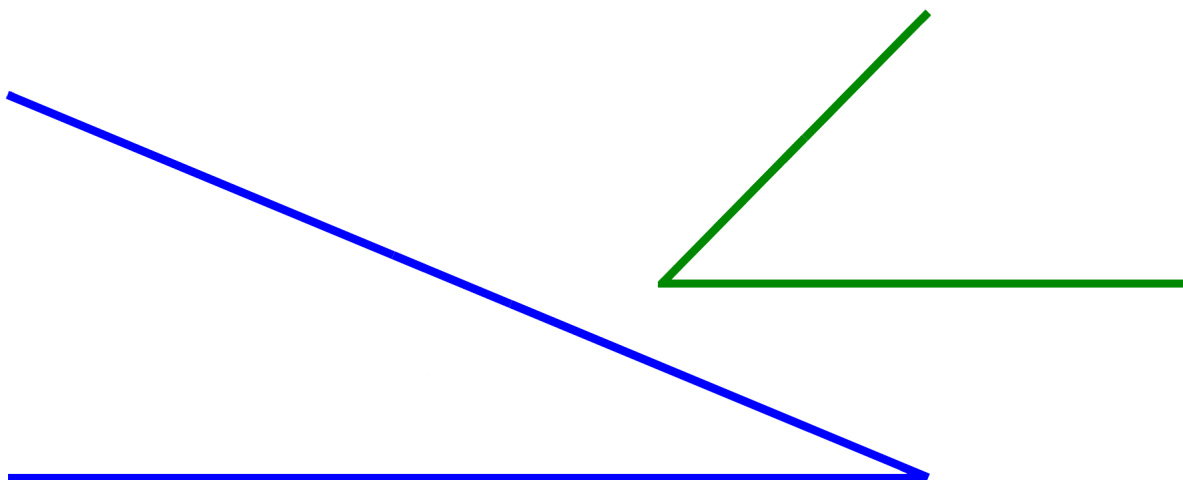
 cm

 cm

 cm



3. Draw the last side for these figures with a ruler. Then measure all three sides of each figure. Write the measurement next to each line (for example “6 cm”).



4. Use your own ruler and draw lines that are these lengths.

- a. 4 cm
- b. 5 cm
- c. 8 cm
- d. 16 cm

5. Measure some things around you! For example, a book, your pencil, a table, etc.

Thing	How long?

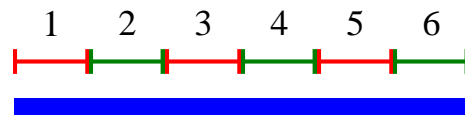
Measuring to the Nearest Centimeter

Remember? We can measure how long things are using *centimeters*.

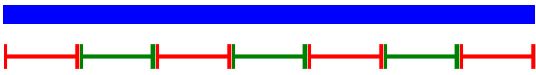
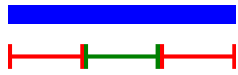
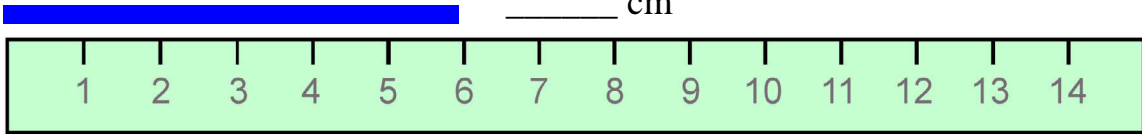

This line is 1 centimeter long: 

A centimeter is written in short form as “cm.”

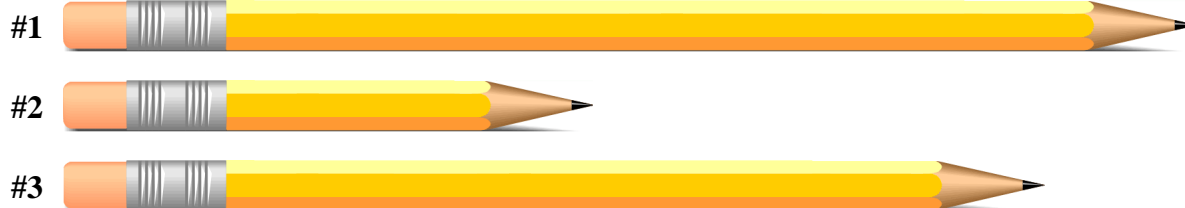
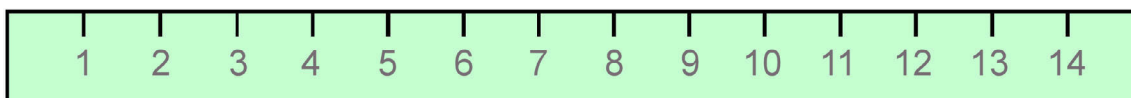
The blue line on the right is 6 cm long. →



1. How many centimeters long are these lines?

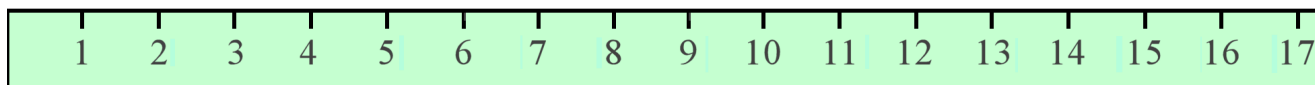
<p>a.  _____ cm</p>	<p>b.  _____ cm</p>
<p>c.  _____ cm</p>	
<p>d.  _____ cm</p>	

2. Measure the pencils with a centimeter ruler. If you don't have one, you can cut out the one from the bottom of this page. Then answer the questions.



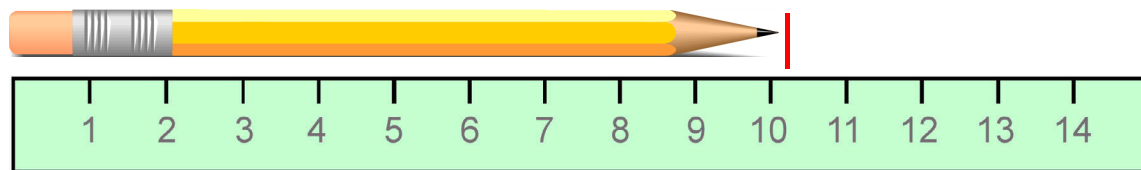
a. How much longer is pencil #1 than pencil #2? _____ cm

b. How much longer is pencil #3 than pencil #2? _____ cm

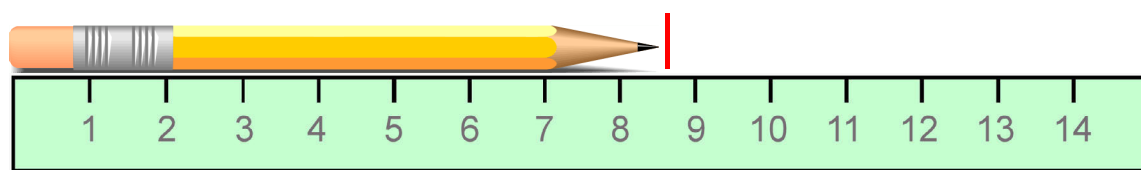


Most things are NOT exactly a certain number of whole centimeters. You can measure them to the nearest centimeter.

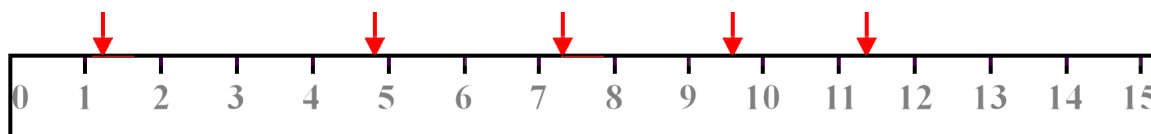
The pencil below is a little over 10 cm long. It is about 10 cm long.



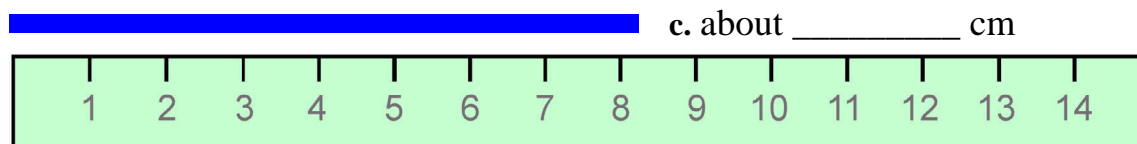
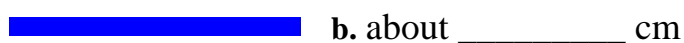
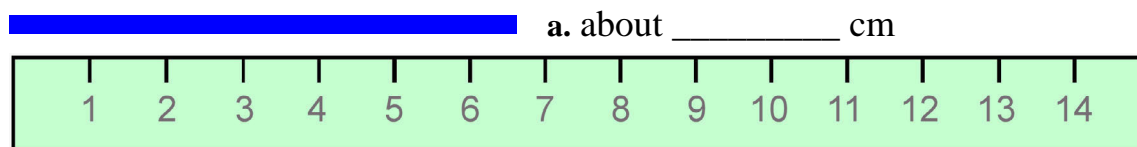
This pencil is about 9 cm long. The end of the pencil is closer to 9 cm than to 8 cm.




3. Circle the number that is nearest to each arrow.



4. Measure the lines to the nearest centimeter.



5. This line is 1 cm long: . Your finger is probably about that wide; put it on top of the 1-cm line and check! Guess how long these lines are. Then measure.

	<u>My guess:</u>	<u>Measurement:</u>
a. _____	about _____ cm	about _____ cm
b. _____	about _____ cm	about _____ cm
c. _____	about _____ cm	about _____ cm

6. **a.** Find two small objects. Measure to find *about* how many centimeters longer one is than the other.

The _____ is *about* _____ cm longer
than the _____.

- b.** Find other two small objects. Measure to find *about* how many centimeters longer one is than the other.

The _____ is *about* _____ cm longer
than the _____.

7. Draw some lines here or on blank paper. Use a ruler. Hold the ruler down tight with one hand, while drawing the line with the other. It takes some practice!

a. 6 cm long

b. 3 cm long

c. 12 cm long

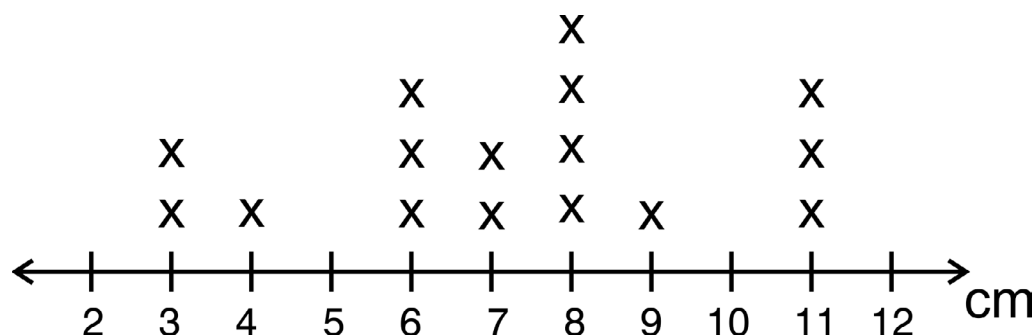
d. 17 cm long

8. Find some small objects. First GUESS how long or tall they are. Then measure. If the item is not exactly so-many centimeters long, then measure it to the nearest centimeter and write “about” before the centimeter-amount, such as *about 8 cm*.

Item	GUESS	MEASUREMENT
	cm	cm
	cm	cm
	cm	cm
	cm	cm
	cm	cm

Some More Measuring

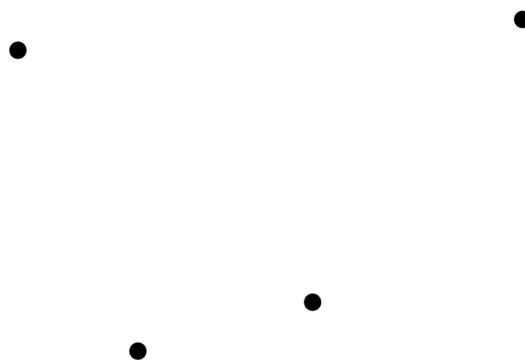
1. Jackie measured the length of a bunch of pencils at her home. She recorded her results in a line plot below. For each pencil, she put an “x” mark above the number line, to show how many centimeters long it was.



- How many of Jackie's pencils were 3 cm long?
- How many were 8 cm long?
- How many pencils were 9 cm *or* longer?
- How many pencils were 5 cm or shorter?
- Find how long Jackie's longest pencil is and her shortest pencil is.

How much longer is the longest pencil than the shortest pencil?

2. Join these dots with lines to form a four-sided shape. What is the name for the shape?



Measure its sides to the nearest centimeter.
Write “about ____ cm” next to each side.

How many centimeters is the *perimeter*?

(all the way around the shape) It is _____ cm.

3. Measure many pencils of different lengths to the nearest whole centimeter.

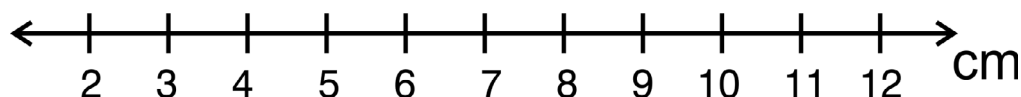
Write the lengths below. (You don't have to measure as many pencils as there are empty lines.)

_____ cm, _____ cm, _____ cm, _____ cm, _____ cm, _____ cm

_____ cm, _____ cm, _____ cm, _____ cm, _____ cm, _____ cm

_____ cm, _____ cm, _____ cm, _____ cm, _____ cm, _____ cm

Now, make a line plot about your pencils like what Jackie made. Write an “X” mark for each pencil.



- a. How much longer is your longest pencil than your shortest pencil?

- b. If you take your three longest pencils and put them end-to-end, how long is your line of pencils? Add to find out.

It is _____ cm. (If you can, measure to check your answer.)

4. Measure all the sides of this triangle to the nearest half-inch.

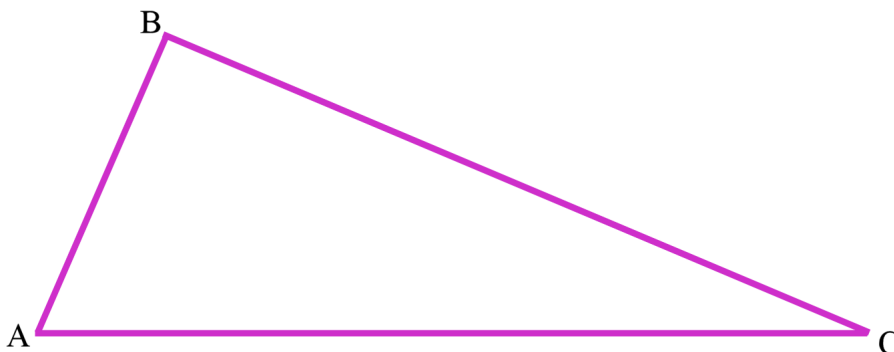
Also, find the *perimeter* (all the way around the triangle).

Side AB _____ in.

Side BC _____ in.

Side CA _____ in.

Perimeter _____ in.



5. Measure some things in your classroom or at home *two times*. First measure them in inches, to the nearest half-inch. Then measure them in centimeters, to the nearest whole centimeter. Remember to write “about” if the thing is not exactly so many inches or centimeters. Write your results in the table below.

Item	in inches	in centimeters
	in.	cm
	in.	cm
	in.	cm
	in.	cm
	in.	cm

- a. Which numbers are bigger, the centimeter-amounts or the inch-amounts?
- b. Which measuring unit is bigger, one centimeter or one inch?

Notice: If your measuring unit is small (like 1 cm), you need MORE of them THAN if you use a longer measuring unit (inch).

- c. Megan measured a spoon. It was 13 cm long. If she measures it in inches, will the result be more than 13 inches, or less than 13 in.?
- d. Harry measured a toy car in inches. It was 3 in. If he measures it in centimeters, will the result be more than 3 cm, or less than 3 cm?

6. Draw three dots on a blank paper so you can join them and make a triangle. Then, measure its sides BOTH in inches (to the nearest half-inch) and in centimeters (to the nearest centimeter). Write your results in the table.

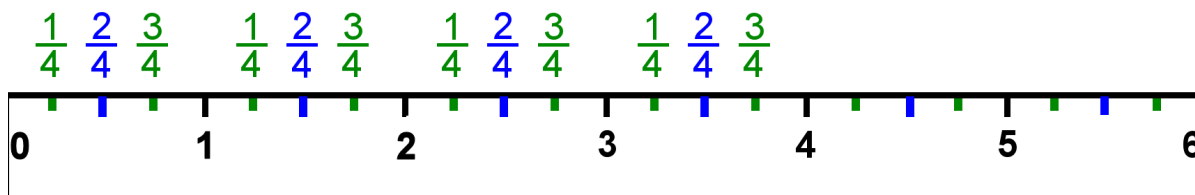
My Triangle	in inches	in centimeters
Side 1	in.	cm
Side 2	in.	cm
Side 3	in.	cm

How many centimeters is the *perimeter* (all the way around the shape)? _____ cm

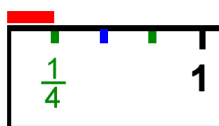
How many inches is the *perimeter* (all the way around the shape)? _____ in.

Measuring to the Nearest Fourth-Inch

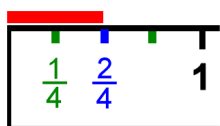
This ruler measures in inches. You can see three lines between each two numbers on the ruler. Those three lines divide each inch *into four parts*. The parts are *fourth parts* or *quarters* of an inch. We have marked those quarters with fractions.



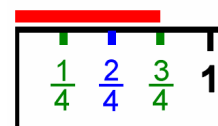
The $\frac{2}{4}$ mark is also the $\frac{1}{2}$ mark. We normally use $\frac{1}{2}$ instead of $\frac{2}{4}$.



This line is $\frac{1}{4}$ of an inch long.

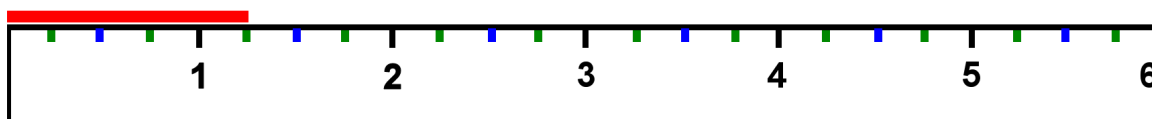


This line is two quarters of an inch long. It is also a half inch long.

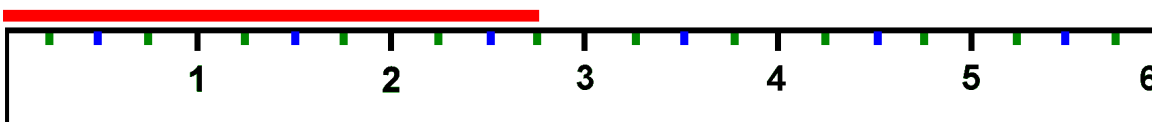


This line is $\frac{3}{4}$ of an inch long.

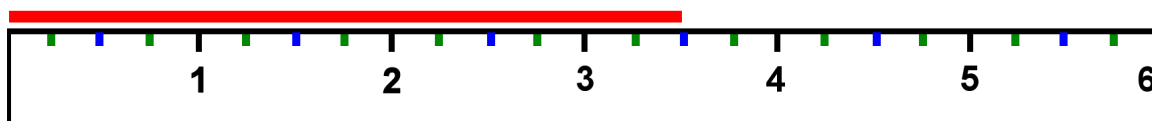
If a line reaches to the $\frac{1}{4}$ -inch mark after the number 1, the line is 1 inch *and* $\frac{1}{4}$ inches long. But when writing it, we omit the “and” and write: The line is $1 \frac{1}{4}$ inches long.



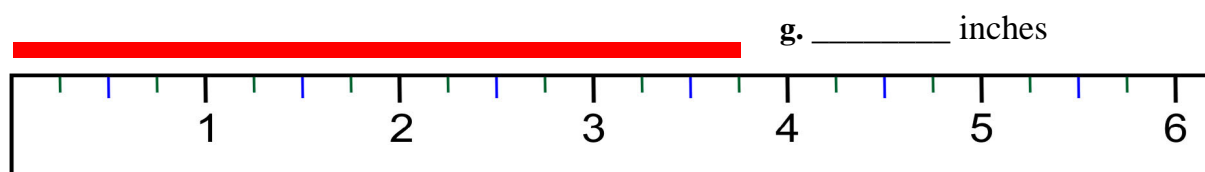
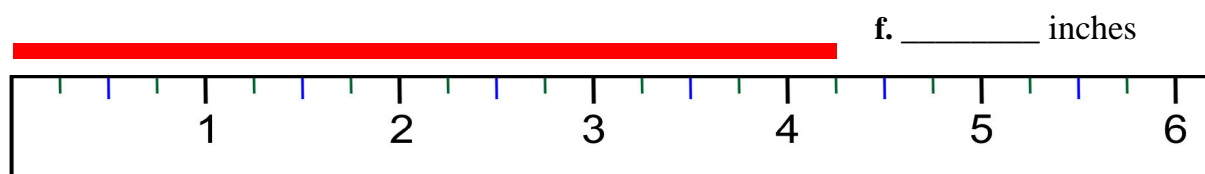
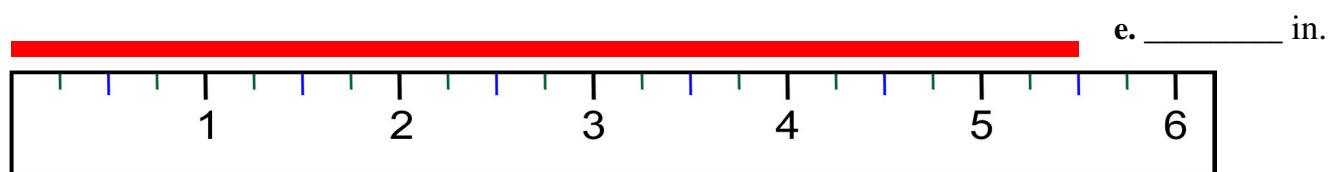
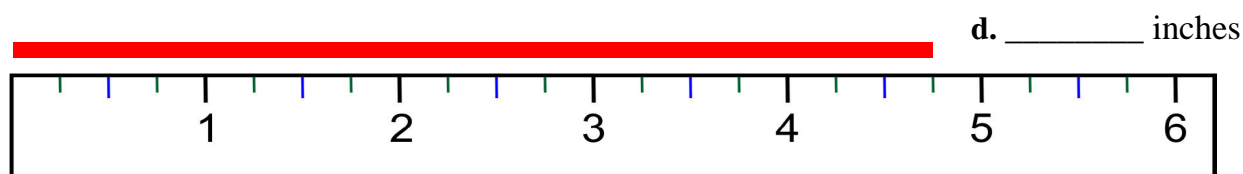
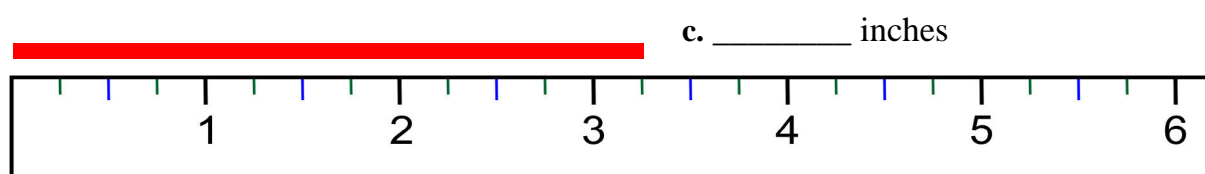
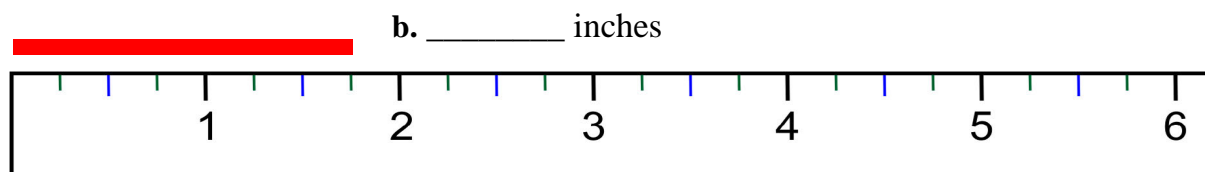
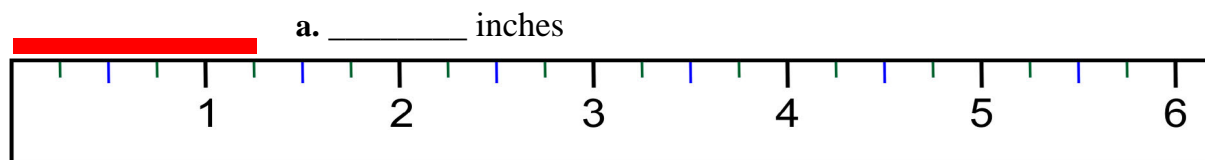
If a line reaches the $\frac{3}{4}$ -inch mark after the number 2, then the line is 2 inches *and* $\frac{3}{4}$ inch long, but we write it as $2 \frac{3}{4}$ inches long.



This line is $3 \frac{1}{2}$ inches long.



1. Measure the lines using the ruler.



2. Draw lines using a ruler. Your own ruler may have many more little lines between the whole-inch marks. If you find your own ruler confusing, you can cut out one of the rulers from the previous pages, and use that. Glue it on cardboard, or tape it on top of your ruler.

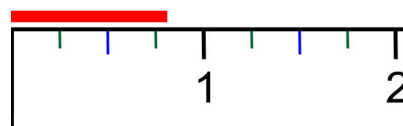
a. 4 $\frac{1}{2}$ inches long

b. 2 $\frac{1}{4}$ inches long

c. 5 $\frac{1}{4}$ inches long

d. 4 $\frac{3}{4}$ inches long

This line is not exactly $\frac{3}{4}$ inch long, nor exactly 1 inch long, but its length is between those two. The endpoint of the line is closer to the $\frac{3}{4}$ -inch mark than it is to the 1-inch mark. We say the line is *about* $\frac{3}{4}$ of an inch long, or *approximately* $\frac{3}{4}$ of an inch long.



3. Measure items using the ruler that has the $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ -inch marks (quarters of an inch). If the item is not exactly as long as the markers on the ruler show, choose the nearest mark as the length, and write “about 5 $\frac{1}{4}$ inches,” etc.

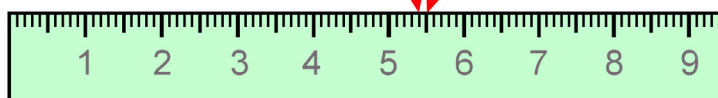
Item	Length

Centimeters and Millimeters

This ruler measures in centimeters.
The numbers signify whole centimeters. All the shorter lines between those are for *millimeters*.

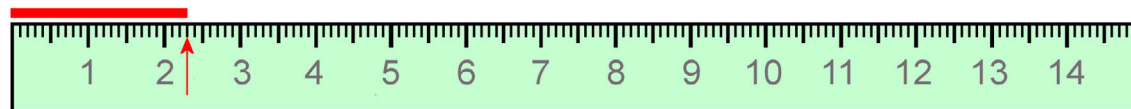
The distance from one short line to the next is 1 millimeter.
We write 1 mm.
Millimeters are very tiny!

The distance between these two is 1 mm.



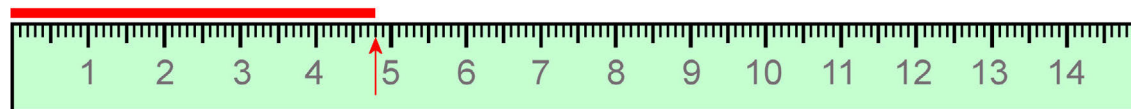
Look at the ruler: **there are 10 millimeters in each centimeter.**

Measuring lines: First see how many whole centimeters long the line is.
Then count how many little millimeter-lines beyond that it reaches.



This line is 2 cm 3 mm long. At the same time, it is 23 mm long. Why?

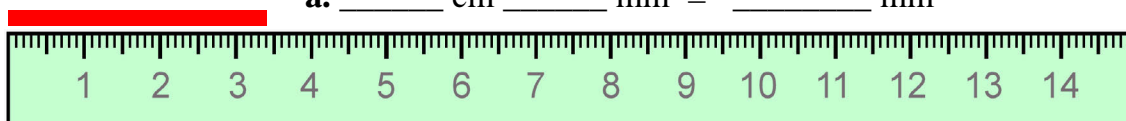
Each centimeter is 10 mm, so 2 cm is 20 mm. So, 2 cm 3 mm makes 23 mm in total.



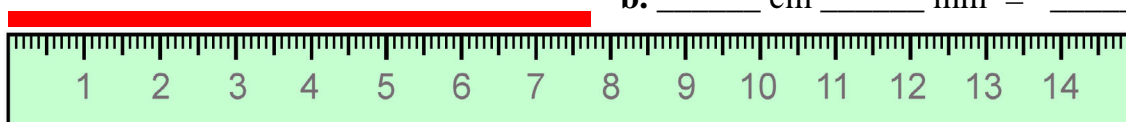
This line is 4 cm 8 mm long. At the same time, it is 48 mm long.

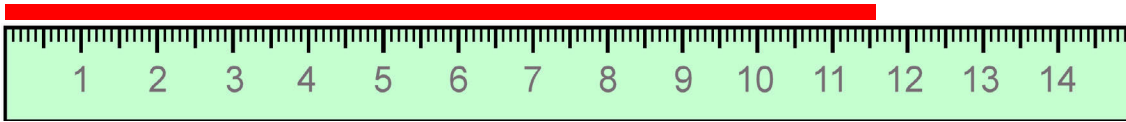
1. Measure the lines using the ruler, first in whole centimeters and millimeters. Then write their lengths using millimeters only.

a. _____ cm _____ mm = _____ mm

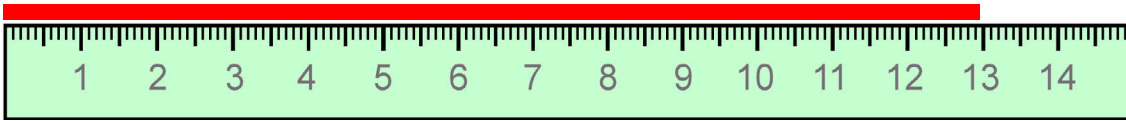


b. _____ cm _____ mm = _____ mm

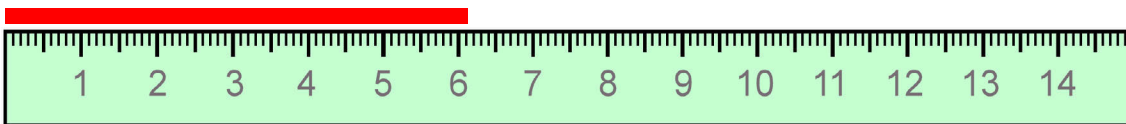




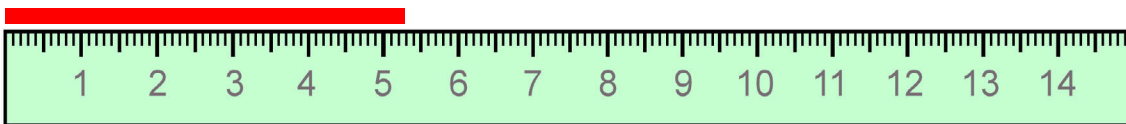
c. _____ cm _____ mm = _____ mm



d. _____ cm _____ mm = _____ mm



e. _____ cm _____ mm = _____ mm



f. _____ cm _____ mm = _____ mm

2. Draw lines using a ruler.

a. 7 cm 8 mm

b. 10 cm 5 mm

c. 14 mm

d. 55 mm

e. 126 mm

3. Measure items, using a centimeter-millimeter ruler. If the item is not exactly as long as the markers on the ruler, choose the nearest mark.

Item	Length

4. Change between centimeters and millimeters. Remember that 1 cm = 10 mm.

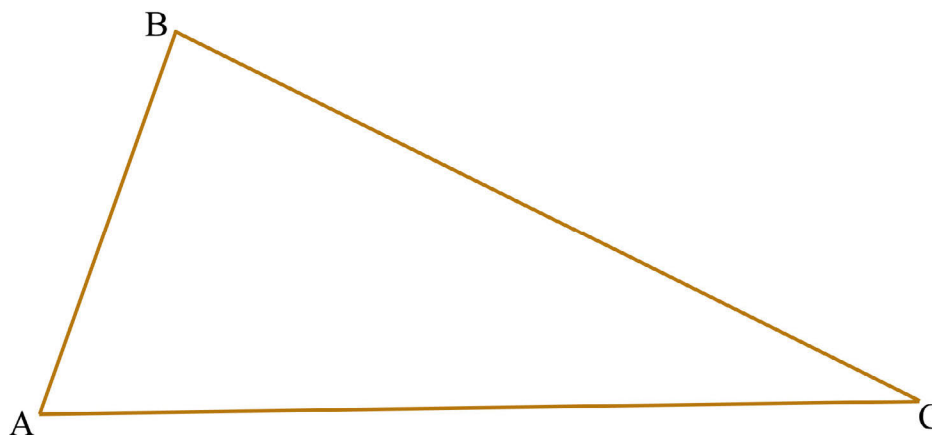
a.	b.	c.
2 cm = _____ mm	1 cm 1 mm = <u>11</u> mm	4 cm 5 mm = _____ mm
5 cm = _____ mm	1 cm 8 mm = _____ mm	7 cm 8 mm = _____ mm
8 cm = _____ mm	2 cm 3 mm = _____ mm	10 cm 4 mm = _____ mm

5. Measure the sides of this triangle in millimeters.

Side AB: _____ mm

Side BC: _____ mm

Side CA: _____ mm

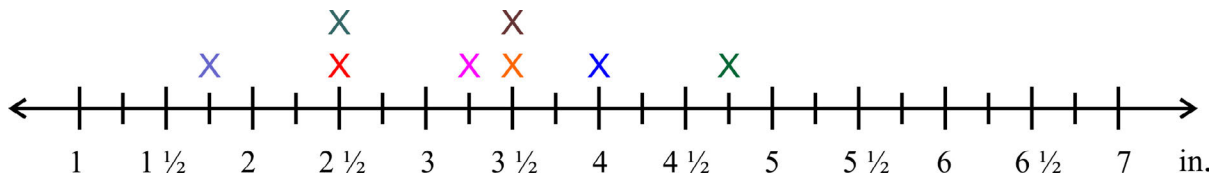


6. If you went all the way around the triangle in #5, what distance would you travel?

Line Plots

Amanda measured the length of some of her colored pencils.

She recorded her results in a **line plot** below. For each pencil, she put an “x” mark above the number line to show how many inches long it was.



For example, Amanda’s longest pencil (green x-mark) is $4 \frac{3}{4}$ inches long.

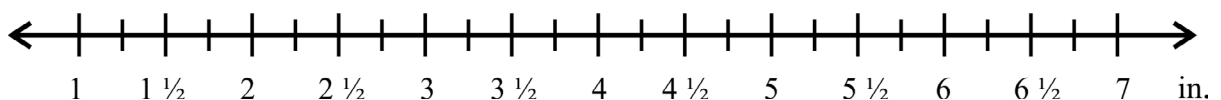
1. Look carefully at the line plot above, and answer:

- How many pencils does Amanda have that are $2 \frac{1}{2}$ inches long?
- How long is the pencil that is *between* 3 and $3 \frac{1}{2}$ inches long?
- How long is Amanda’s shortest pencil?

2. Measure many pencils of different lengths to the nearest quarter inch.
Write the lengths below.

_____ in _____ in _____ in _____ in _____ in
_____ in _____ in _____ in _____ in _____ in
_____ in _____ in _____ in _____ in _____ in

Now, make a line plot about your pencils. Write an “X” mark for each pencil.



3. Refer to your collection of pencils and the line plot you just made.

- a. If you take your two longest pencils and put them end-to-end, how long is your line of pencils?

It is _____ in. (You can measure to check your answer!)

- b. If you take your two shortest pencils and put them end-to-end, how long is your line of pencils?

It is _____ in. (You can measure to check your answer!)

4. Measure a collection of similar items to the nearest quarter inch. For example, you can measure length of spoons or of stuffed animals, or the width of books. Another idea is to ask different people to draw a line 6 inches long without using a ruler (in other words, guess and draw it), and then measure their lines and check who guessed the closest.

(You don't have to find as many items as there are empty lines below.)

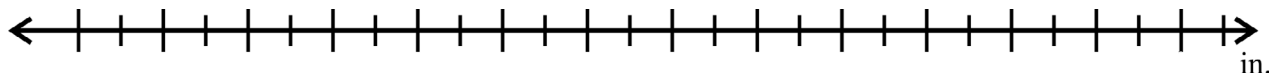
_____ in _____ in _____ in _____ in _____ in.

_____ in _____ in _____ in _____ in _____ in.

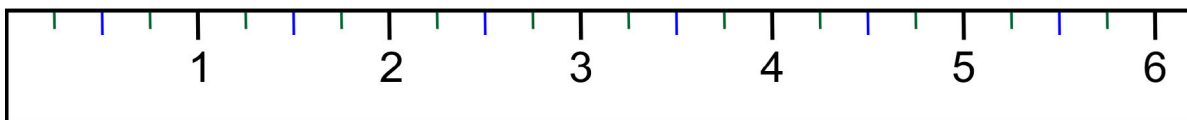
_____ in _____ in _____ in _____ in _____ in.

_____ in _____ in _____ in _____ in _____ in.

Now, make a line plot. Write an "X" mark for each item. Decide the scaling for the number line based on the kind of numbers you have in the list above.



You can cut out the ruler below and glue it on cardboard, or tape it on top of your ruler.



Feet and Miles

This is a tape measure. The numbers 1, 2, 3, and so on, are inches.



Above number 12 you see “1F”. That means 1 foot. 12 inches equals 1 foot.

Now find a tape measure. Unroll it until you find "1 F" or "1 ft", and then "2 F" or "2 ft" (two feet), and so on. Stretch out the tape measure as far as you can. How many feet can it measure?

This tape measure has both inches and centimeters. The numbers on the top part are inches, and the numbers on the bottom part are centimeters. The number 60 means 60 cm, and the “1” after it means 61 cm.



You use feet as your measuring unit when you measure the width of a room or of a table, the length of a house, or of a swimming pool.



People often use both feet and inches. For example, a table can be 5 feet 10 inches long. Or, a boy can be 4 ft 7 in tall. How tall are you in feet and inches?

1. Use the tape measure to find distances in feet, or feet and inches. Let an adult help you.

Thing or distance	How long / tall
the room you are in	
a table	

2. How tall are these people? Ask your mom, dad, or others.

You: _____ ft _____ in _____: _____ ft _____ in

Your mom: _____ ft _____ in _____: _____ ft _____ in

3. Find three things you can measure in feet. But wait! First *guess* how long or tall they are. Then, check your guess by measuring.

Thing or distance	My guess	How long / tall

4. Now, measure again some of the things you already measured in feet, but this time measure them in centimeters. Or, you can still find new things to measure.

Thing or distance	centimeters	feet & inches

5. Which is a bigger (or longer) measuring unit, 1 centimeter or 1 foot?

Jared measured the height of a fridge twice, first in feet and then in centimeters.

It was 5 ft tall. How tall was it in centimeters? **a.** 15 cm **b.** 150 cm **c.** 3 cm

6. He also measured the height of a bucket twice, in feet and then in centimeters.

It was 60 cm tall. How tall was it in feet? **a.** 6 ft **b.** 100 ft **c.** 2 ft

7. Which is a longer measuring unit, a meter or a foot?

Jared measured the length of his room twice, first using feet and then using meters.

It was 4 m wide. How many feet wide was it? **a.** 2 ft **b.** 5 ft **c.** 12 ft

Distances between towns or between countries are measured in miles.
 1 mile is 5,280 feet (five-thousand two-hundred eighty)! That is a lot of feet—many, many more than your tape measure has.

8. Can you think of familiar distances in everyday life or in your neighborhood that are so many miles? An adult can help. You can also look in your social studies book.

Distance	How many miles

9. Aaron went on a trip with his family. On the first day, they drove 80 miles and visited a nature park. On the second day, they drove 200 miles. On the third day, they drove 110 miles back home.

- a. How long a distance did the family drive in all?
 b. How much longer distance did they drive on the second day than on the first day?

10. Which unit would you use to find the following distances: inches (in), feet (ft), miles (mi), or feet and inches (ft in)?

Distance	Unit
from New York to Los Angeles	
from a house to a neighbor's	
the width of a notebook	
the distance around the earth	
how tall a refrigerator is	
the width of a porch	
the length of a board	



Distance	Unit
the length of a train	
the length of a playground	
from a train station to the next	
the width of a computer screen	

Feet, Yards, and Miles

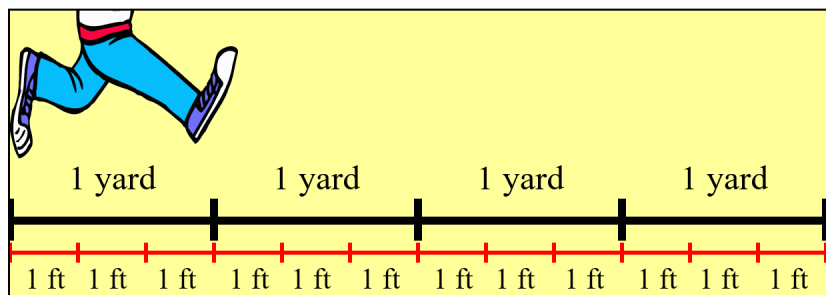
These are the common units in the customary system to measure medium-size and long distances and lengths:

mile	mi	to measure long distances
yard	yd	to measure medium-sized distances
foot	ft	to measure medium-sized objects and distances

Miles are used to measure long distances, such as between towns or countries. One mile is 5,280 feet. An adult can typically walk one mile in about 15-20 minutes.

1. Outside, using a measuring tape, mark the distances of 1 yard, 2 yards, 3 yards, and so on. Mark also some of the individual feet.

Three feet make one yard.
3 ft = 1 yd.



Take steps that are 1 foot long. That should be easy. Three such steps fit in one yard.

How about steps that are 2 feet long each?

Lastly, try to take steps 1 yard long (three feet). Can you?

2. Use a tape measure to measure lengths of objects in feet and inches.

Item	How long
	_____ ft _____ in

3. Outside, measure some distances and lengths (e.g. length of a building). You can use feet, or yards and feet.

Length or distance	How long

4. Write or say these units in order from the smallest to the biggest:

yard mile inch foot

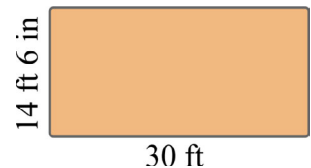
5. Fill in the blanks, using the units in, ft, or mi.

- a. Mark drove his car 15 _____. b. The table is 24 _____ tall.
- c. Annie's house is 32 _____ long. d. The pen is 5 _____ long.
- e. Mr. Green is 6 _____ tall. f. Matt jogged 3 _____ .
- g. From the marketplace to the town library is 2 _____. h. The house is 15 _____ tall.

6. It is 25 yards from Peter's home to his grandma's place.

- a. One day, Peter walked to her place three different times (there and back). What distance did he walk in total?
- b. (optional) If each yard is 3 feet, then what distance did he walk in feet?

A children's play area is in the shape of a rectangle. Matthew ran three times around it. How long a distance did he run, in feet? (12 inches makes one foot.)



Puzzle Corner

Meters and Kilometers

We use *meters* to measure medium and long distances.

Find a tape measure that has centimeters.

Find the 100th centimeter on it. That is the 1-meter point.

100 centimeters equals 1 meter.



1. **a.** Mark **one meter** on the floor. Can you take such a big step?
Can the teacher?
- b.** On the 1-meter line you marked, practice taking two steps that together are 1 meter long. Then take similar steps to *estimate* the length of a room (or if outside, a building).
Count your steps: I took _____ steps
Since you took 2 steps for each meter, find half of
your count to get the length in meters. The room is about _____ m long.
Measure to check your estimation.
You can repeat this to estimate some other distance or length.

2. How tall are these people? Measure, or ask your mom, dad, and friends.

You: _____ cm : _____ cm

Your mom: _____ cm _____: _____ cm

Your dad: _____ cm _____ : _____ cm

3. Measure some things using meters and centimeters. First guess how long or tall they are. Then check your guesses by measuring. Let an adult help you.

Item	My guess	How long/tall

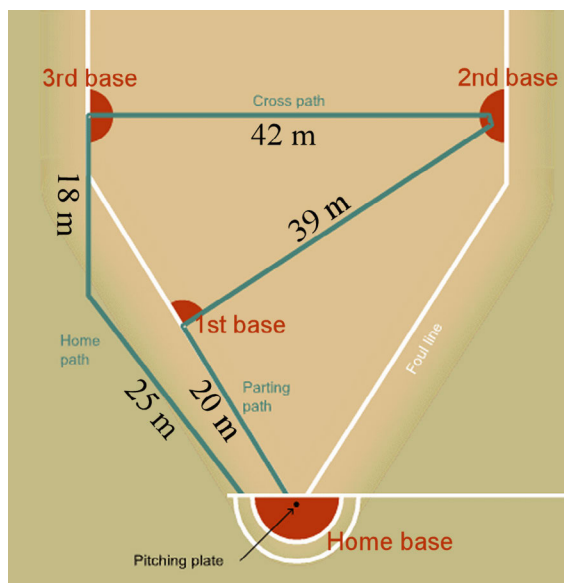
Distances between towns or between countries are measured in kilometers.
1 kilometer is 1 000 meters (one thousand meters)!

4. Write in the table below **three distances** that are important in your life and are measured in kilometers. Ask an adult to help you. Examples include: from home to the library, from home to downtown, from home to Grandmother's, from your town to the capital city, etc.

From ... to	distance in km

5. The picture shows the field for Finnish baseball game (“pesäpallo”).
How many meters do you run with these “routes”?

- You run from the home base to the 1st base and then return to the home base.
- You run from the home base to the 1st base and on to the 2nd base, plus one meter over, because you cannot stop in time.
- (Challenge) You run all the way around the field.



6. Which unit would you use to find these below:
centimeters (cm), meters (m), or kilometers (km)?

Distance	Unit
the length of a park	
from Miami to the North Pole	
the length of a cell phone	
the length of a bus	

Distance	Unit
around your wrist	
the height of a room	
the length of an airplane trip	
the length of a grasshopper	

Common Metric Units of Length

Besides feet, yards, and miles, we can also use millimeters (mm), centimeters (cm), meters (m), and kilometers (km) to measure length.

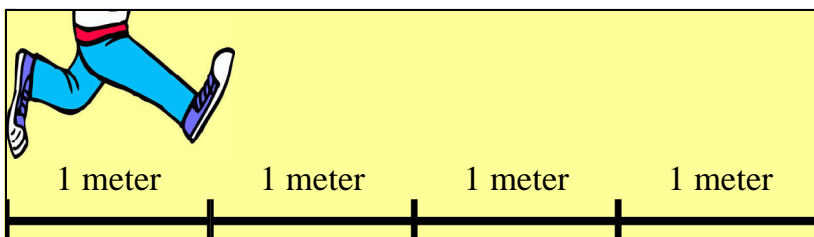
Notice how all of those units have the word *meter* in them. These units form a part of the *metric system* of measuring units.

kilometer for long distances

meter for medium-sized objects and distances

millimeter
centimeter } for small objects

1. Outside, mark the distances of 1 meter, 2 meters, 3 meters, and so on, using a measuring tape. Try to take steps 1 meter long. Can you?



If you can't, try to take small steps so that two steps would be exactly 1 meter.

Notice: one meter is very close to one yard, but a little longer.

2. Use a tape measure to measure lengths of objects and distances in meters and centimeters

Item	How long
	_____ m _____ cm.

3. Fill in the blanks, using the units “cm”, “km”, “mm”, and “m”.

- a. The Jackson's living room is 4 _____ wide
- b. A moth was 38 _____ wide.
- c. Dad is 178 _____ tall.
- d. It is about 3 _____ to the nearest library.
- e. The window was about 1 _____ wide.
- f. The book was 25 _____ long.

4. Use a measuring tape or a tape measure, and measure how tall you and some other people are in meters and centimeters.

Person	How tall
	1 m _____ cm.

5. Write or say these units in order from smallest to greatest, using their full names:

m cm km mm

This section is optional.

1 meter = 100 cm

6. Convert between meters and centimeters.

a. 1 m = _____ cm	b. 1 m 20 cm = _____ cm	c. 5 m 85 cm = _____ cm
2 m = _____ cm	1 m 14 cm = _____ cm	2 m 17 cm = _____ cm
5 m = _____ cm	1 m 58 cm = _____ cm	3 m 8 cm = _____ cm

7. One pillow is 40 cm long. If you put five such pillows end-to-end, how many meters long is your line of pillows?

8. Ellie is 162 cm tall, and Meredith is 1 m 55 cm tall.
Who is taller? How much taller?

9. A sandbox is 1 m 40 cm by 1 m 40 cm (a square).
Find its perimeter.

Review 1

1. Which unit or units would you use for the following distances: inches (in.), feet (ft), miles (mi), centimeters (cm), or meters (m)? If two different units work, write both.

Distance	Unit or units
from your house to the grocery store	
from Miami to New York	
the distance across the room	
the height of a bookcase	

2. Measure this line to the nearest centimeter and to the nearest half-inch.

 about _____ cm *or* about _____ in.

3. a. Draw a line that is
3 1/2 inches long.

- b. Draw a line that is
9 cm long.

4. Measure these two pencils to the nearest centimeter, *and* to the nearest half-inch.
Then fill in:



The longer pencil is about _____ cm longer than the shorter one.

The longer pencil is about _____ inches longer than the shorter one.

5. Measure the width and length of the room you are in. First, measure them using feet and inches. Then, measure them using meters and centimeters.

Width: _____ ft _____ in *or* _____ m _____ cm

Length: _____ ft _____ in *or* _____ m _____ cm

Weight in Pounds

Weight means *how heavy* something is. You can measure weight using a scale. A bathroom scale measures weight in *pounds* or in *kilograms*.

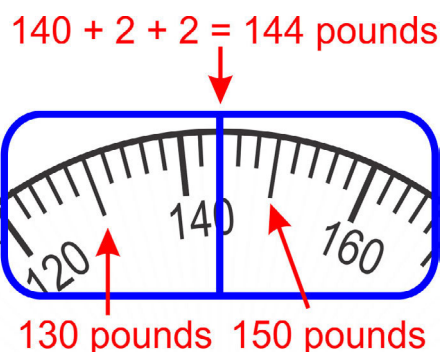
In this lesson you will need:



- a bathroom scale that measures in pounds
- a bucket and water
- encyclopedias or some other fairly heavy books
- a plastic bag or some other bag
- a backpack

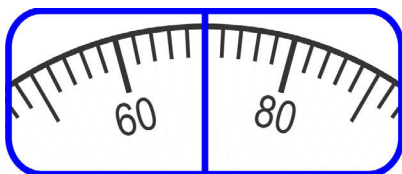
The numbers on your scale may go up by twenties, and not by tens. In the picture here, the longer line halfway in-between the two numbers is TEN more than the smaller of the two numbers. Each little line means 2 pounds more than the previous line.

The scale on the right is stopped at the second little line after 140 pounds, which means $140 + 2 + 2$ pounds, or 144 pounds.

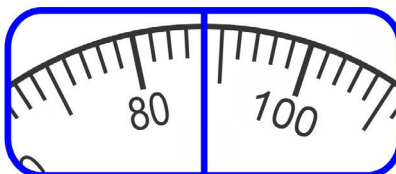


We use "lb" to abbreviate the word pounds. 15 pounds = 15 lb.
The "lb" comes from the Latin word *libra*, which also means a pound.

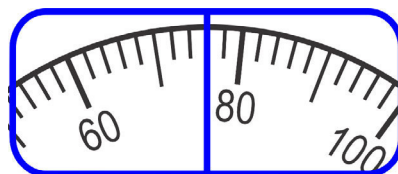
1. How many pounds is the scale showing? You can mark the in-between ten-numbers on the scale to help.



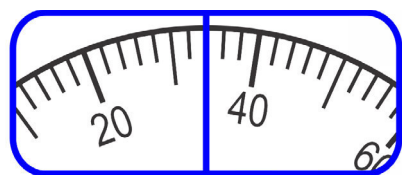
a. _____ lb



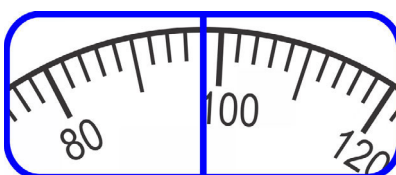
b. _____ lb



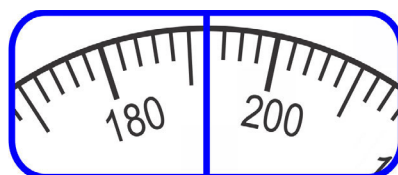
c. _____ lb



d. _____ lb



e. _____ lb



f. _____ lb

2. Step onto the scale. I weigh _____ pounds.

3. Find out how many pounds your family members weigh. Write a list below.

_____ lb _____ lb

_____ lb _____ lb

_____ lb _____ lb

4. Weigh some other items. Note that on a bathroom scale, you cannot weigh very light items, nor very big and bulky ones because you can't place them on the scales.

a bucket full of water _____ lb Mom's skillet _____ lb

a bucket half full of water _____ lb _____ lb

a stack of heavy books _____ lb _____ lb

5. Find out how many pounds of water you can carry. Can you carry the bucket when it is full? If not, pour out some water until you can carry the bucket.

I can carry a bucket of water that weighs _____ lb.

6. a. Find out how many pounds of books you can carry in a bag. Fill the bag with books and weigh it. Can you carry it? If not, take out some books until you are able to carry the bag.

I can carry a bagful of books that weighs _____ lb.

b. The same as above, but use a backpack. (Do you think you can carry more or less?)

I can carry a backpack that weighs _____ lb.

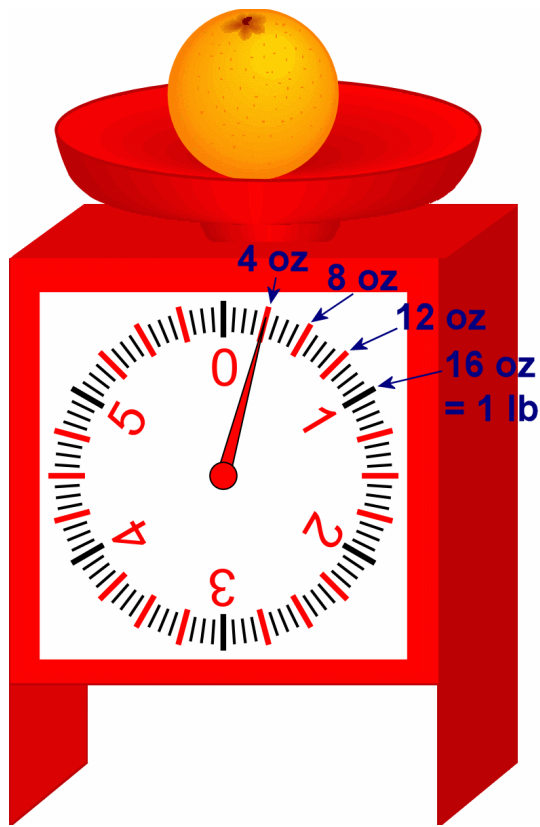
c. Weigh yourself with and without a heavy bag of books.

I weigh _____ lb. I weigh _____ lb with the heavy bag.

What is the difference? _____ lb.

d. Use the method above with a heavy book. The book weighs _____ lb.

Pounds and Ounces



We can measure how heavy something is using **pounds** and **ounces**. The picture shows a kitchen scale and an orange on it. The orange weighs 4 ounces (oz). An egg weighs about 2 oz. An ounce is a fairly small unit for weight.

To weigh heavier things (such as people), we can use pounds (abbreviated with “lb”). Sixteen ounces makes one pound: $16 \text{ oz} = 1 \text{ lb}$.

On this scale, the numbers 0, 1, 2, 3, 4, and 5 refer to whole pounds. Number 6 is not marked, but if the pointer went all the way around one time and was pointing to 0, it would actually mean 6 pounds.

In between the whole pounds are lines to mark the ounces. Some are longer and thicker (red), and some are shorter. The thicker lines mark the 4-ounce, 8-ounce, and 12-ounce points, and the shorter lines mark the individual ounces.

You will need:

- A kitchen scale that measures in pounds and ounces.
- A bathroom scale that measures in pounds.
- Light items to weigh on the kitchen scale.
- Heavier items and people to weigh on the bathroom scale.

1. Weigh light items with a kitchen scale. Write your results here.

Item	Weight
	_____ lb _____ oz

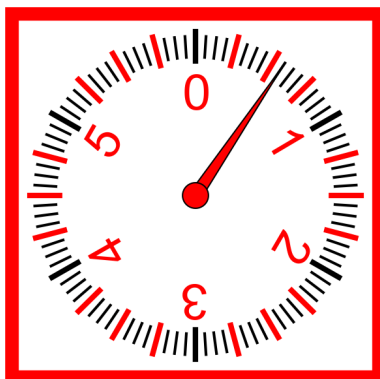
2. Weigh things and people with a bathroom scale that uses pounds. Write your results here.
First, guess how much the thing or person weighs. Then weigh using the scales.

Thing/person	Guess	Weight
	_____ lb	_____ lb

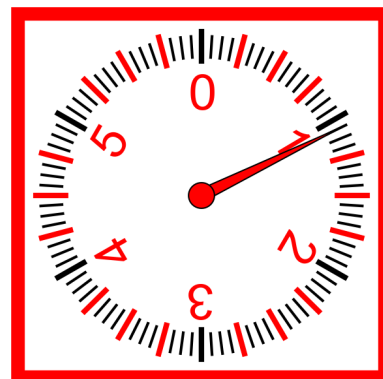
3. Write the pounds and the ounces the scale is showing.



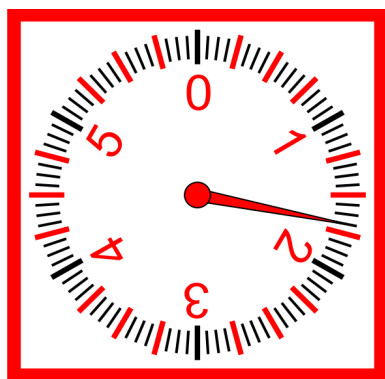
a. _____ lb _____ oz



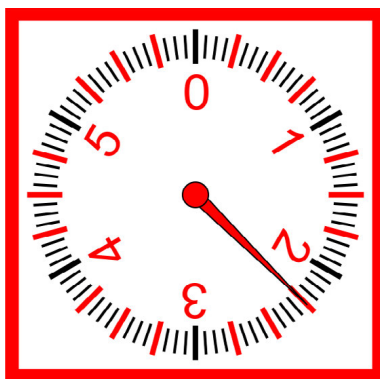
b. _____ lb _____ oz



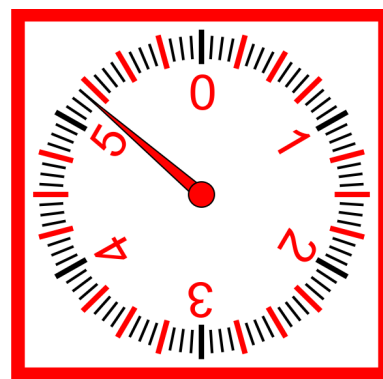
c. _____ lb _____ oz



d. _____ lb _____ oz





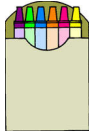

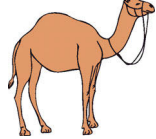

e. _____ lb _____ oz



f. _____ lb _____ oz

4. A label on a big tuna can says: “Net weight 1 lb. Drained weight 11 oz.”
How much does the liquid in the can weigh?
(Hint: think how many ounces one pound is.)

5. Which is the best estimate of weight?

<p>a. </p> <p>2 lb 15 lb 2 oz</p>	<p>b. </p> <p>16 lb 160 lb 16 oz</p>	<p>c. </p> <p>1 lb 13 oz 2 oz</p>
<p>d. </p> <p>70 lb 7 lb 7 oz</p>	<p>e. </p> <p>600 lb 6 lb 60 lb</p>	<p>f. </p> <p>2 lb 6 oz 30 oz</p>

6. Fill in the blanks with a reasonable unit of weight (either lb or oz).

- a. A computer weighs 3 _____. b. A newborn baby weighed 8 _____.
c. Sam ate two bananas. Together they weighed 12 _____.
d. Abby's cell phone weighs 3 _____. e. Matthew weighs 170 _____.

7. At home, find food products that show the weight on the label, using ounces or pounds and ounces. Write the items in order from lightest to heaviest.

Item	Weight

Mary sent a "Thank You" card to each person who had attended her fiftieth birthday party. Each card weighed two ounces, and their total weight was 3 lb. How many people attended her party?

Puzzle Corner

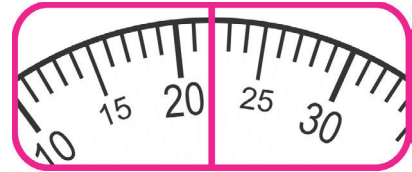
Weight in Kilograms

Weight means *how heavy* something is. You can measure weight using a *scale*. A bathroom scale measures weight in *kilograms* (abbreviated kg).

The scale usually has short lines for each kilogram increment, and long lines for each 10 kilograms. In the picture below, the in-between numbers ending in “5” are marked with the number 5.

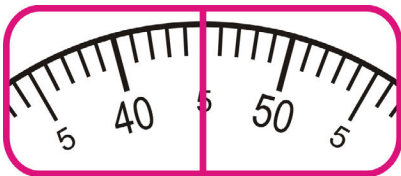
In this lesson, you need to use a bathroom scale that measures weight in kilograms. You will also need

- a bucket and water
- encyclopedias or some other fairly heavy books
- a plastic bag or some other bag
- a backpack

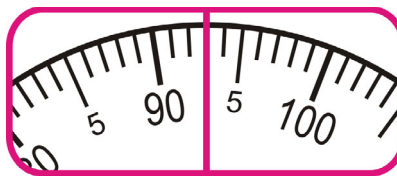


The scale is showing 22 kg.

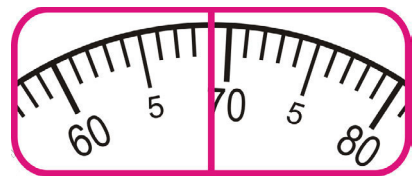
1. How many kilograms is the scale showing?



a. _____



b. _____



c. _____

2. Step onto the scale. How much do you weigh? _____ kg

3. Find out how many kilograms your family members weigh. Write a list below.

_____ kg _____ kg

_____ kg _____ kg

_____ kg _____ kg

4. Also, weigh some of your family members together.

_____ and _____ together weigh _____ kg.

_____ and _____ together weigh _____ kg.

5. Now weigh some other items with the bathroom scale. Note: you cannot weigh very light items on it. You also cannot weigh very big and bulky items (such as tables) on it because you can't place them fully on the scale. Try to find objects that are not very big.

a bucket full of water _____ kg Mom's frying pan _____ kg

a bucket half full of water _____ kg _____ kg

a stack of heavy books _____ kg _____ kg

6. Find out how many kilograms of water you can carry. Can you carry the bucket when it is full? If not, pour out some water until you can carry the bucket.

I can carry a bucket of water that weighs _____ kg.

7. a. Find out how many kilograms of books you can carry in a bag. Fill the bag with books and weigh it. Can you carry it? If not, take out some books until you are able to carry the bag.

I can carry a bagful of books that weighs _____ kg.

- b. The same as above, but use a backpack.

I can carry a backpack that weighs _____ kg.

- c. Weigh yourself with and without the heavy bag of books.

I weigh _____ kg. I weigh _____ kg with the heavy bag.

What is the difference? _____ kg.

You can use this method to weigh items that cannot easily be placed on the scales, but that you can hold.

- d. Weigh yourself with and without a heavy book.

I weigh _____ kg. I weigh _____ kg with the heavy book.

What is the difference? _____ kg. So, the book weighs _____ kg.

Grams and Kilograms

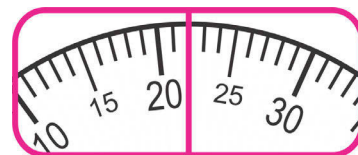
We can measure objects using different types of scales, to find out how heavy they are.

In this lesson we will use scales that show kilograms (kg) and grams (g). Those are units for mass. The **mass** of an object means how much material (or substance or “stuff”) is in it. And the more material is in it, the heavier it is!

- A **gram** (abbreviated “g”) is a very small unit of mass. One large paperclip has a mass of about 1 gram.
- A **kilogram** (kg) is a larger unit of mass. For example, a baby might have a mass of 4 kg. A liter (or a quart) bottle of water has a mass of 1 kg.
- A thousand grams make one kilogram: **1,000 g = 1 kg.**

In this lesson, you will need:

- A bathroom scale that measures in kilograms. An analog scale is great; digital is fine.
- A kitchen scale that measures in grams. An analog scale is great; digital is fine, too.
- Paperclips, thumbtacks, pencils, and other small objects.
- A book, water bottle, or other object with a mass of (approximately) 1 kg.
- An object with a mass of 100 g (a small apple, tomato, or a potato will do).
- Objects to weigh.



1. Let's weigh stuff!

a. How many paperclips do you need to make the scale show 10 grams?

Use both small and large paperclips if you have them.

Note: one paperclip may not make a scale to show anything, because it may be less than one gram. (Small paperclips are about 1/4 to 1/3 of a gram.)

b. Place 20 paperclips on the scale. Then do the same with 20 thumbtacks.

Which is heavier, *one* paperclip or *one* thumbtack?

c. Estimate (make a guess) the mass of a ruler and a pencil. Then check with the scale.

(Note to the teacher: Technically speaking, scales measure weight, not mass. Weight of an object is a force; it is how much gravity pulls on an object. Scales measure the pull of gravity on an object. But, scales we will be using here do not show a measurement of force (which would be in Newtons) but use kilograms or grams which are units of mass. In other words, the scales use gravity to indirectly measure an object's mass. In this lesson, it is alright to use the word “weight” since that is common in everyday usage, and since that is what scales in reality do measure. However, it is also good to get students used to the word and idea of “mass”.)

2. Use a kitchen scale and find:

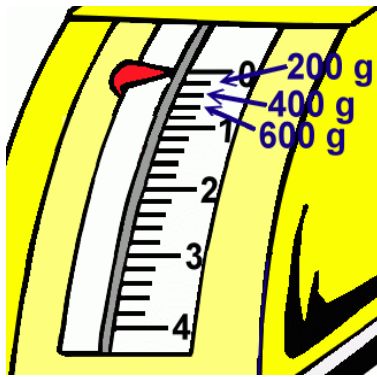
- a. an object with a mass of 50 grams;
- b. an object with a mass of 100 grams;
- c. a book or another object with a mass of 1,000 grams (1 kilogram).

3. Estimate (in grams) the mass of various small items your teacher presents to you. Then check their mass using a kitchen scale.

Item	Estimated mass	Mass
	_____ g	_____ g

4. Now use a bathroom scale that measures in kilograms. Estimate the mass of various things and people. Then check their mass using the bathroom scale.

Thing/person	Estimated mass	Mass
	_____ kg	_____ kg

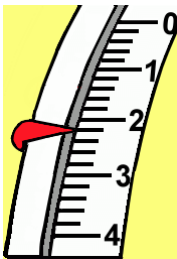


The numbers 0, 1, 2, 3, and 4 on this kitchen scale refer to whole kilograms. In between each two numbers there are four little lines. They divide each kilogram into *five* parts.

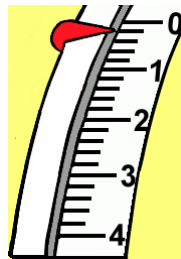
This means that each little line marks a 200-gram increment. (200 g + 200 g + 200 g + 200 g + 200 g = 1,000 g = 1 kg.)

The first little line after the 0-kg mark means 200 g. Each time, one little line more means 200 g more.

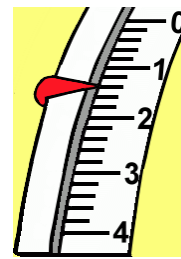
5. Write the amount of kilograms and grams that the scales are showing.



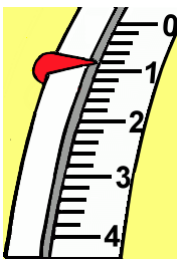
a. 2 kg 200 g



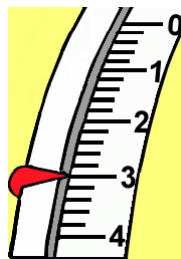
b. _____ kg _____ g



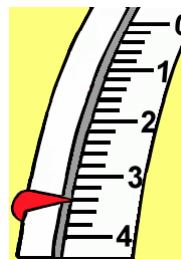
c. _____ kg _____ g



d. _____ kg _____ g



e. _____ kg _____ g



f. _____ kg _____ g





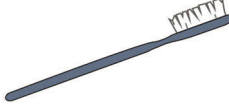
6. Amy read on a can of beans that its net weight was 415 grams. Yet, when she put it on the scale, it showed 481 g.

- What is the difference between the two masses?
- Why is there a difference?
- How many cans will Amy need to have at least 1 kg of beans?

7. Shaun put eight identical crayons on a scale and the scale showed 41 grams.

About how much is the mass of one crayon?

8. Which is the best estimate of how much each thing weighs?

<p>a. </p> <p>500 g 5 g</p>	<p>b. </p> <p>70 kg 7 kg</p>	<p>c. </p> <p>1 kg 200 g</p>	<p>d. </p> <p>1 kg 150 g</p>
<p>e. </p> <p>30 g 300 g</p>	<p>f. eyeglasses</p> <p>35 g 300 g</p>	<p>g. A car</p> <p>100 kg 2,000 kg</p>	<p>h. an apple</p> <p>1 kg 100 g</p>
<p>i. A bucket full of water</p> <p>10 kg 50 kg</p>	<p>j. A spoonful of sand</p> <p>10 g 100 g</p>	<p>k. a baby</p> <p>500 g 5 kg</p>	<p>l. flashlight</p> <p>300 g 2,000 g</p>

9. Match the things and their masses.

An adult woman	55 kg
A puppy	1 kg
A pencil	500 g
A school book	25 kg
A magazine	50 g
A 9-year-old boy	150 g

10. Fill in the blanks with a reasonable unit (either g or kg).

- Mom got a 3-_____ package in the mail. It had books in it.
- Jane got a 300-_____ package in the mail. It had a puzzle in it.
- Mark's dog is 30 _____.
- A cell phone is 300 _____.
- Mary bought 3 _____ of strawberries at the marketplace.
- Audrey steps on a scale, and it shows 60 _____ .
- The teddy bear is 250 _____.

Cups, Pints, Quarts, and Gallons

Volume has to do with how much space something takes. A sandcastle takes a certain amount of space. A bottle of water takes space. A book takes space. But how much?

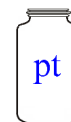
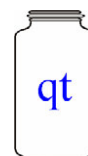
In this lesson you will learn to measure the volume of water (or other liquids) using cups, pints, quarts, and gallons.

You will need

- water in a bucket or other big container
- a few food containers
- a coffee cup
- a drinking glass



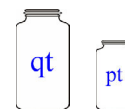
- a quart jar
- a pint jar



- a 1-cup measuring cup



1. Fill the pint jar with water. Pour it all into the quart jar. Then fill the pint jar again and pour it into the quart jar. Is it now full (or close to full)?



It should be. It takes _____ pints of water to fill 1 quart jar.

2. Pour out water from your full quart jar back into the pint jar until the pint jar is full.

Is your quart jar now half full? (It should be.)

How much water is left in the quart jar? _____ pint.

3. Find out how many times you need to fill the one-cup measuring cup with water and pour it into the pint jar until the pint jar is full. _____ times.

One pint is _____ cups.

4. Find out how many times you need to fill the one-cup measuring cup with water and pour it into the quart jar until the quart jar is full. _____ times.

One quart is _____ cups.

5. Find out if a coffee cup measures MORE or LESS than the 1-cup measuring cup—or exactly 1 cup. Do the same with a drinking glass.

6. (optional) At the next supper or breakfast time, do a little experiment. Before eating, measure exactly one cup of the food you are going to eat and then put it on your plate. Will it fill you up? Is it too much or too little food?

7. Find three different food containers. Measure water into them, cup by cup. Write how many whole cups of water fits into each. If you could still fit a little more, write YES.

	Volume in whole cups	Can you fit a little more?
Container 1		
Container 2		
Container 3		

We use **gallons** when measuring large amounts of liquid. You might have heard about these things. Fill in some more items that you have heard the word “gallon” used with.

- A 5-gallon bucket.
- A 1/2-gallon carton of milk.
- A bathtub can hold so many gallons.

- _____
- _____
- _____



One gallon of water is so much that you can fill FOUR quarts with it.



=



It would be a lot to drink!

8. Test yourself! Put one gallon of water into a bucket, preferably a 5-gallon bucket.
(Four quarts make one gallon.) Can you carry it?

Put another gallon of water into the same bucket. Can you still carry it?

Now put 1 gallon of water into another bucket, and try to carry a one-gallon bucket in each hand. Can you?

How many gallons of water can you carry using two buckets?

Water can be pretty heavy!

How many quarts of water fit into a 5-gallon bucket?

Puzzle Corner

Milliliters and Liters

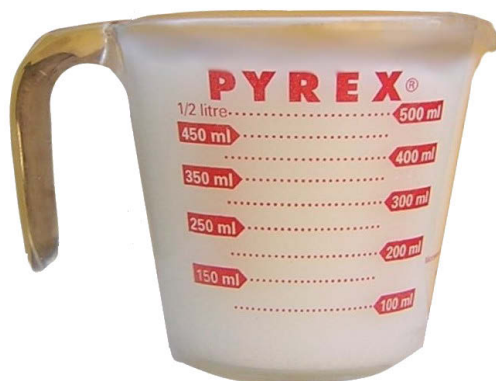
How much water is in a bottle? How much milk is in a glass? To answer these questions, we can measure the **liquid volume** of various liquids.

We can measure liquid volume using **liters (L)** and **milliliters (ml)**.

You may have seen a 1-liter water bottle or soda bottle. Also, one liter is very close to one quart.

One liter is divided into 1,000 milliliters. A fourth of a teaspoon contains about one milliliter. So, milliliters are very tiny units.

Here is a measuring cup that measures volume in milliliters. It goes up to 500 ml, which is exactly half a liter. You can see that printed near the top of the measuring cup.



For this lesson, you will need:

- A measuring cup that measures in milliliters.
- Measuring spoons for 1 teaspoon and for 1/4 teaspoon.
- An eyedropper.
- A few cups, glasses, jars, and other small containers.
- A few items with very small volume: a thimble, spoons, medicine cup, a 1/8 cup measuring cup, and so on.
- Two cooking pans/pots.

1. Use the eyedropper to fill the 1/4-teaspoon measuring spoon with water. It should take one dropperful. So, one dropperful and the 1/4 teaspoon each are about **one milliliter**.

Now, guess how many milliliters of water will fit into these small items:

- a measuring spoon measuring 1 tsp
- a spoon
- a thimble
- _____
- _____

Then check by filling them with water using the eyedropper.

2. Measure the volume of a few cups, glasses, jars, and other small containers. You will need a measuring cup that measures in milliliters.

Item	Volume in milliliters

3. Measure 1 liter of water into a pan or a pot. Then *guess* how many liters of water would fill it.

My Guess: the pan will hold _____ liters of water.

Now, measure another liter of water into the pan, and another, until it is full. In the end, pour in 100 ml of water at a time.

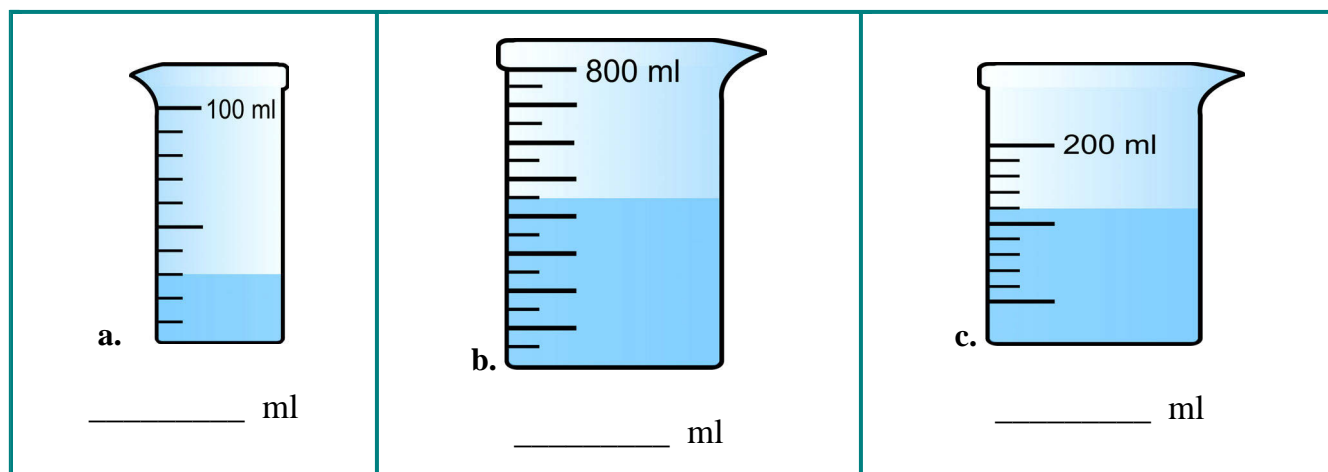
The pan holds _____ L _____ ml of water.

4. Measure the volume of another pan using the same method. First *guess* how many liters of water will fit into your pan.

My Guess: the pan will hold _____ liters of water.

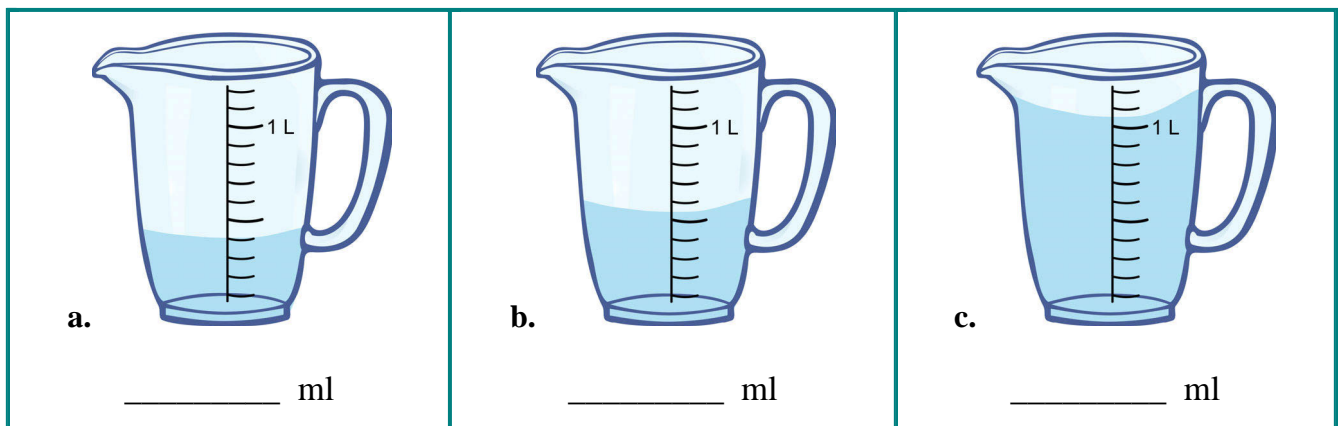
Measurement: the pan holds _____ L _____ ml of water.

5. How much liquid is in each pitcher?



Word Problems and More

1. One shampoo bottle contains 1,000 ml of shampoo.
Another one contains 478 ml.
How much more does the bigger one contain?
2. Mom held her baby and stepped on the scale. It showed 61 kg. Then she stepped on the scale by herself and it showed 56 kg. What was the baby's mass?
3. A package of crackers weighs 3 oz. How many of those do you need in order to have 1 pound of crackers? (1 lb is 16 oz.)
4. Olivia weighed a can of tomato sauce. The scale showed 730 g. The label on the can reads: "Net weight 660 g." (The net weight refers to the weight of the contents, not including the can itself.)
 - a. What is the mass of the can itself?
 - b. If Olivia uses half of the tomato sauce from the can, and then puts the can on the scale, what will it show?
5. How much liquid is in each pitcher?



6. **a.** How much liquid is in three bottles that contain 450 ml of water each?
- b.** Is this more or less than 1 liter? (1 liter = 1,000 ml) How much more/less?
7. A bottle contains one liter (1,000 ml) of juice.
How many 250-ml glasses could you fill from it?
8. The mass of an apple is 150 grams.
- a.** How many such apples do you need to have *at least* 500 g of apples?
- b.** What about 1 kg of apples? (1 kg = 1,000 g)
9. One day, Carol walked to school and back two different times.
Her home and school are 600 ft apart. What distance, in feet, did she walk?

12 inches makes 1 foot.



10. Emma is 4 ft tall. Since one foot is 12 inches, how tall is she in inches?
11. Alex has toy cars that are each 3 inches long.
- a.** How many of his cars will make a line that is 12 inches (1 foot) long?
- b.** How many will make a line that is 3 feet long?

Puzzle Corner

Roger is 5 ft 2 in tall and Rebecca is 52 inches tall.
Who is taller? How much taller?

Review 2

You will need:

- One small object that the student will weigh in #3.
- A kitchen scale that measures in grams and another that measures in pounds/ounces.
- One container that the student will fill with water, and then measure the volume, in #4.
- Measuring cup that measures in milliliters.
- A cm/mm ruler and also a ruler that measures in fourths of an inch.

1. Draw lines of these lengths:

a. $4 \frac{1}{4}$ in

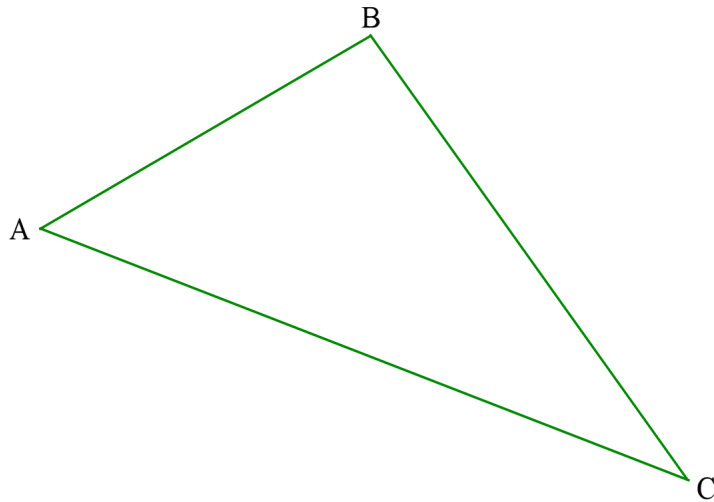
b. 5 cm 7 mm

2. Measure the sides of this triangle in millimeters.

AB: _____ mm

BC: _____ mm

CA: _____ mm



3. Your teacher gives you a small object. Use the scale to find out its mass in grams, and how much it weighs in pounds and ounces.

It is _____ g. It weighs _____ oz.

4. Your teacher gives you a small container and water. Use a measuring cup to find out how much water it can hold in milliliters.

It holds _____ ml.

5. **a.** Write or say in order from the smallest to the biggest unit: cm km m mm

b. Write or say in order from the smallest to the biggest unit: ft in yd mi

c. Write or say in order from the smallest to the biggest unit: gal pt C qt

6. Fill in the blanks with suitable units of length (mm, cm, m, km, in, ft, yd, mi).
Sometimes several units are possible.

a. A butterfly's wings were 6 _____ wide.

b. Sherry is 66 _____ tall.

c. Jessica jogged 5 _____ yesterday.

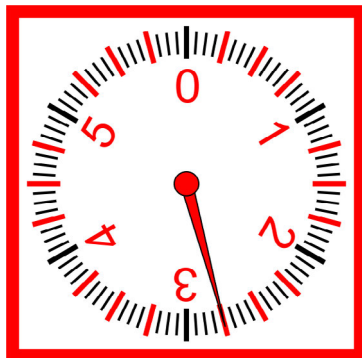
d. The box was 60 _____ tall.

e. The distance from the
city to the little town is 80 _____ .

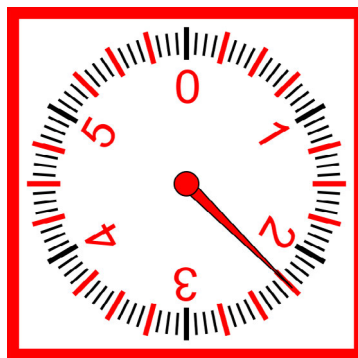
f. The room was 4 _____ wide.

g. The eraser is 3 _____ long

7. Write the weight the scales are showing.



a. _____ lb _____ oz



b. _____ lb _____ oz



c. _____ lb _____ oz

8. Fill in the blanks with suitable units of mass (weight) and volume (g, kg, lb, oz; ml, L, gal, qt, pt, oz). Sometimes several different units are possible.

a. Mom bought 5 _____ of apples.

b. Mary drank 350 _____ of juice.

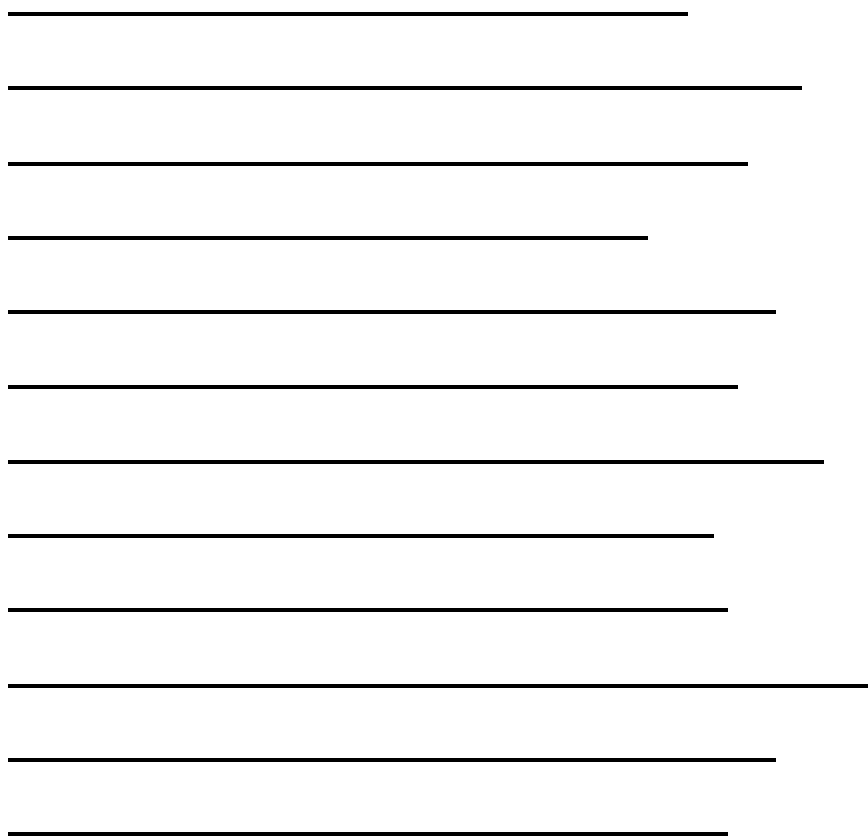
c. Dr. Smith weighs about 70 _____.

d. The banana weighed 3 _____.

e. The pan holds 2 _____ of water.

f. A cell phone weighs about 100 _____.

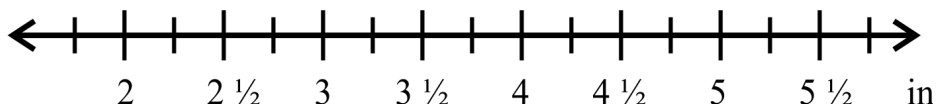
9. Samantha asked various people to draw a line that they thought was 4 inches long. Below you see the lines that the people drew.



- a. Measure each line to the nearest quarter inch, and write the lengths below.

_____ in _____ in _____ in _____ in _____ in
 _____ in _____ in _____ in _____ in _____ in
 _____ in _____ in

- b. Make a line plot.



Answer Key

Measuring Length, pp. 7-10

Page 7

- a. Please check the student's answers.
b. Please check the student's answers.
- The desk was about 12 baby shoes wide.

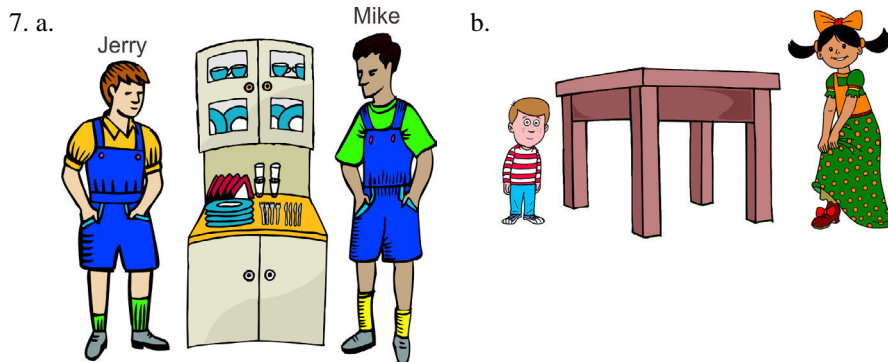
Page 8

- Ryan's room was 81 baby shoes wide.
Since baby shoes are smaller than daddy shoes, we know the number will be larger than 27.
- Answers will vary.
- pencil a. 5 crayons long; 10 paperclips long
pencil b. 6 crayons long; 12 paperclips long
pencil c. 4 crayons long; 8 paperclips long
pencil d. 3 crayons long; 6 paperclips long

Page 9

- a. The pen is longer than the measuring stick. The pencil is the same length as the stick.
b. The measuring stick is longer than the celery. The flashlight is longer than the stick.
c. The pink car is shorter than the measuring stick. The blue car is longer than the stick.
d. The toothbrush is longer than the measuring stick. The pencil is shorter than the stick.

Page 10



Exploring Measuring, pp. 11-12

Page 11

- Answers will vary. Check student's answers.
- a. sheep 1, car 2, dinosaur 3 b. crayon 1, carrot 2, celery 3 c. paperclip 1, toothbrush 2, flashlight 3

Page 12

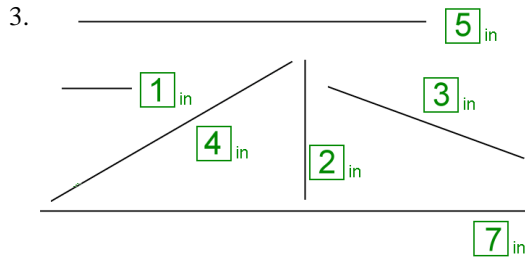
- Answers will vary.
- Answers will vary.
- Answers will vary.
- The bucket held 53 smaller drinking glasses. It will hold more small glassfuls than large ones.

Measuring Lines in Inches, pp. 13-15

Page 13

- a. 2 in. b. 4 in. c. 3 in. d. 5 in.
- 1 in., 5 in., 3 in., 6 in., 5 in.

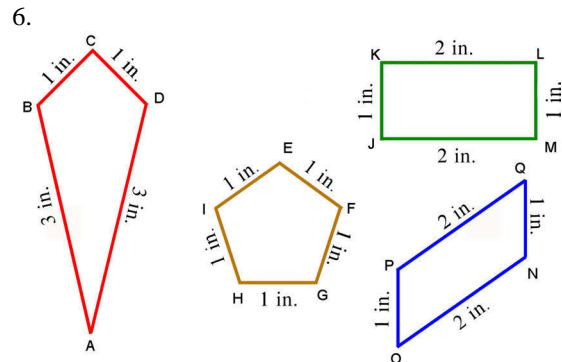
Page 14



- Triangle ABC: AB is 2 in., BC is 3 in., AC is 4 in.
Triangle DEF: DF is 5 in., DE is 4 in., EF is 3 in.

Page 15

- Check the student's lines.

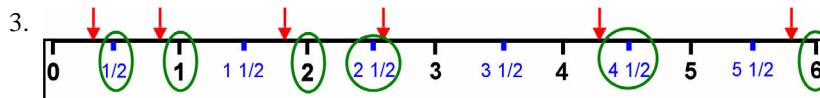


Inches and Half-Inches, pp. 16-18

Page 16

- a. 2 inches b. 1 1/2 inches c. 2 1/2 inches d. 4 1/2 inches
- a. 3 1/2 inches b. 1 1/2 inches c. 5 inches

Page 17



- a. 3 inches b. 3 1/2 inches c. 4 1/2 inches d. 5 inches

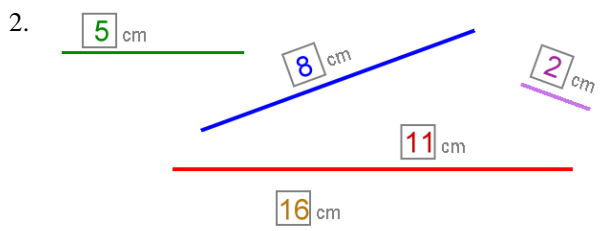
Page 18

- a. 3 1/2 inches b. 2 inches c. 5 1/2 inches
- Please check the student's work, as c. and d. are too long for the width of this page to show an example.
- a. Rectangle, Side AB 2 1/2 inches, Side BC 1 inch, Side CD 2 1/2 inches, Side DA 1 inch.
All the way around 7 inches.
b. Square, Side AB 1 1/2 inches, Side BC 1 1/2 inches, Side CD 1 1/2 inches, Side DA 1 1/2 inches.
All the way around 6 inches.

Measuring Lines in Centimeters, pp. 19-20

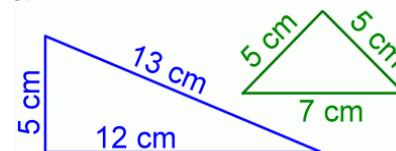
Page 19

- a. 5 cm b. 3 cm c. 9 cm d. 10 cm e. 12 cm



Page 20

-



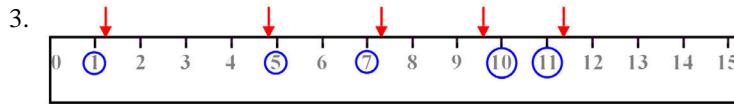
- Check the student's lines.

Measuring to the Nearest Centimeter, pp. 21-23

Page 21

1. a. 7 cm b. 3 cm c. 6 cm d. 11 cm
2. a. 8 cm b. 6 cm

Page 22



Page 22

4. a. about 7 cm b. about 4 cm c. about 8 cm
5. a. about 6 cm b. about 2 cm c. about 4 cm

Page 23

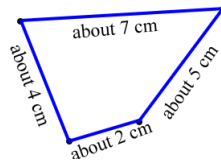
6. Answers will vary. Please check the student's work.

7. a. 
- b. 
- c. 
- d. 

Some More Measuring, pp. 24-26

Page 24

1. a. 2 pencils b. 4 pencils
c. 4 pencils d. 3 pencils
e. The shortest pencil is 3 cm and the longest pencil is 11 cm. The longest pencil is 8 cm longer than the shortest.
2. It is a quadrilateral. The perimeter is about 18 cm.



Page 25

3. Answers will vary.
4. Side AB about 1 1/2 in. Side BC 4 in.
Side CA 4 1/2 in. Perimeter about 10 in.

Page 26

5. a. the centimeter-amounts b. one inch c. less than 13 inches d. more than 3 cm
6. Answers will vary.

Measuring to the Nearest Fourth-Inch, pp. 27-29

Page 28

1. a. 1 1/4 inches b. 1 3/4 inches
c. 3 1/4 inches d. 4 3/4 inches
e. 5 1/2 inches f. 4 1/4 inches
g. 3 3/4 inches

Measuring to the Nearest Fourth-Inch, cont.

Page 29

2. Check the student's answers. The answers below may not be the right length when printed from the download version, because many printers will print with "shrink to fit" or "fit to printable area."
- a. _____
- b. _____
- c. _____
- d. _____
3. Answers will vary.

Centimeters and Millimeters, pp. 30-33

Page 30

1. a. 3 cm 4 mm = 34 mm
b. 7 cm 7 mm = 77 mm

Page 31

1. c. 11 cm 6 mm = 116 mm
d. 12 cm 9 mm = 129 mm
e. 6 cm 1 mm = 61 mm
f. 5 cm 3 mm = 53 mm
2. Check student's answers. The answers below may not be the right length when printed from the download version, because many printers will print with "shrink to fit" or "fit to printable area."
- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

Page 32

3. Answers will vary. Check the student's work.
4. a. 20 mm b. 11 mm c. 45 mm
50 mm 18 mm 78 mm
80 mm 23 mm 104 mm
5. The answers below may not match what you measure, if you have printed from the download version, because many printers will print with "shrink to fit" or "fit to printable area."
- side AB 53 or 54 mm
side BC 110 mm
side CA 117 mm
6. 280 or 281 mm

Line Plots and More Measuring, pp. 33-34

Page 33

1. a. Two pencils
b. 3 1/4 in
c. 1 3/4 in
2. Answers will vary. Please check the student's work.

Page 34

3. Answers will vary. Please check the student's work.
4. Answers will vary.

Feet and Miles, pp. 35-37

Page 35

1. Answers will vary.

Page 36

2-4. Answers will vary.

5. 1 foot is longer than 1 cm. It was about 150 cm tall.

6. It was about 2 feet tall.

7. c. 12 feet.

Page 37

8. Answers will vary.

9. a. 390 miles b. 120 miles

10.

Distance	Unit
from New York to Los Angeles	mi
from a house to a neighbor's house	ft
the width of a notebook	in.
the distance around the earth	mi
how tall a refrigerator is	ft. in.
the width of a porch	ft
the length of a board	ft. in.

Distance	Unit
the length of a train	ft
the length of a playground	ft
from a train station to the next	mi
the width of a computer screen	in.

Feet, Yards, and Miles, pp. 38-39

Page 38

1. Answers will vary.

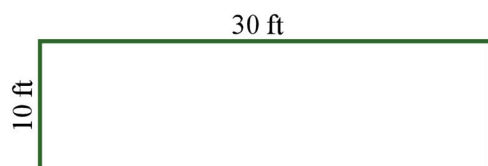
2. inch, foot, yard, mile

3. Answers will vary.

Page 39

4. a. mi. b. in. c. ft. d. in. e. ft. f. mi.

5. perimeter = $30\text{ ft} + 30\text{ ft} + 10\text{ ft} + 10\text{ ft} = 80\text{ ft}$; area = $10\text{ ft} \times 30\text{ ft} = 300\text{ ft}^2$



6.

a. 1 ft = 12 in. 3 ft = 36 in. 5 ft = 60 in.	b. 1 ft 2 in. = 14 in. 1 ft 8 in. = 20 in. 1 ft 11 in. = 23 in.	c. 2 ft 4 in. = 28 in. 2 ft 6 in. = 30 in. 3 ft 3 in. = 39 in.
--	---	--

Feet, Yards, and Miles, cont.

Page 39

7. Emma is 50 inches tall.
8. Rebecca is three inches taller.
9. His train of pencils is two feet long.
10. The perimeter of the rectangle is 11 ft 8 in.

Meters and Kilometers, pp. 40-41

Page 40

1. a. You might not be able to, but the teacher can. b. Answers will vary.
- 2-3. Answers will vary.

Page 41

4. Answers will vary.
5. a. $20\text{ m} + 20\text{ m} = 40\text{ m}$ b. $20\text{ m} + 39\text{ m} + 1\text{ m} = 60\text{ m}$ c. $20\text{ m} + 39\text{ m} + 42\text{ m} + 18\text{ m} + 25\text{ m} = 144\text{ m}$
- 6.

Distance	Unit
the length of a park	m
from Miami to the North Pole	km
the length of a cell phone	cm
the length of a bus	m & cm

Distance	Unit
around your wrist	cm
the height of a room	m & cm
the length of an airplane trip	km
the length of a grasshopper	cm

Common Metric Units of Length, pp. 42-43

Page 42

1. Answers will vary.
2. Answers will vary.
3. a. m b. mm c. cm d. km e. m f. cm

Page 43

4. Answers will vary.
5. mm, cm, m, km
- 6.

a. $1\text{ m} = 100\text{ cm}$ $2\text{ m} = 200\text{ cm}$ $5\text{ m} = 500\text{ cm}$	b. $1\text{ m } 20\text{ cm} = 120\text{ cm}$ $1\text{ m } 14\text{ cm} = 114\text{ cm}$ $1\text{ m } 58\text{ cm} = 158\text{ cm}$	c. $5\text{ m } 85\text{ cm} = 585\text{ cm}$ $2\text{ m } 17\text{ cm} = 217\text{ cm}$ $3\text{ m } 8\text{ cm} = 308\text{ cm}$
---	---	--

7. The train of pillows would be two meters long.
8. Ellie is 7 cm taller.
9. The perimeter is 5 m 60 cm.

Review 1, p. 44

Page 44

1.

Distance	Unit or units
from your house to the grocery store	mi or km
from Miami to New York	mi or km
the distance across the room	m or ft
the height of a bookcase	ft, in, m, or cm

2. About 6 cm or about 2 1/2 in.

3. a. 

b. 

4. The longer pencil is about 7 cm longer than the shorter one.
The longer pencil is about 2.5 inches longer than the shorter one.

5. Answers will vary.

Weight in Pounds, pp. 45-46

Page 45

1. a. 70 pounds b. 88 pounds c. 76 pounds d. 34 pounds e. 98 pounds f. 192 pounds

Page 46

2-6. Answers will vary.

Pounds and Ounces, pp. 47-49

Page 47

1. Answers will vary.

Page 48

2. Answers will vary.

3. a. 4 lb 0oz b. 0 lb 9 oz c. 1 lb 1 oz
d. 1 lb 11oz e. 2 lb 4 oz f. 5 lb 3 oz

4. The liquid weighs five ounces.

Page 49

5. a. 2 lb b. 160 lb c. 2 oz
d. 70 lb e. 600 lb f. 6 oz

6. a. 3 lb b. 8 lb
c. 12 oz
d. 3 oz e. 170 lb

7. Answers will vary.

Puzzle Corner:

The total weight of the cards, in ounces, was
 $3 \times 16 = 48$ ounces. Since each card weighed 2 oz,
there were $48 \div 2 = 24$ people who attended her party.

Weight in Kilograms, pp. 50-51

Page 50

1. a. 45 kilograms b. 93 kilograms c. 69 kilograms

2-4. Answers will vary.

Page 51

5-7. Answers will vary.

Grams and Kilograms, pp. 52-55

Page 52

1. Answers will vary.

Page 53

2. Answers will vary.

3. Answers will vary.

4. Answers will vary.

Page 54

5. a. 2 kg 200 g b. 0 kg 200 g c. 1 kg 400 g
d. 0 kg 800 g e. 3 kg 0g f. 3 kg 400 g
6. a. The difference is 66 grams.
b. The net weight is that of only the beans and water in the can. The additional 66 g is the weight of the can.
c. $415\text{ g} + 415\text{ g} = 830\text{ g}$. A third can makes it
 $830\text{ g} + 415\text{ g} = 1,245\text{ g}$. So she needs three cans to have at least 1 kg of beans.
7. Its mass is about 5 g.

Page 55

8. a. 5 g b. 70 kg c. 1 kg d. 1 kg
e. 30 g f. 35 g g. 2,000 kg h. 100 g
i. 10 kg j. 10 g k. 5 kg l. 300 g
9. An adult woman - 55 kg
A puppy - 1 kg
A pencil - 50 g
A school book - 500 g
A magazine - 150 g
A 9-year-old boy - 25 kg
10. a. 3 kg
b. 300 g
c. 30 kg
d. 300 g
e. 3 kg
f. 60 kg
g. 250 g

Cups, Pints, Quarts, and Gallons, pp. 56-57

Page 56

1. It takes 2 pints of water to fill one quart jar.
2. How much water is left in the quart jar? 1 pint.
3. Two times. One pint is two cups.
4. Four times. One quart is four cups.
5. Answers will vary, as there are different size coffee cups and drinking glasses.
6. Answers will vary.

Page 57

7. Answers will vary.
8. Answers will vary.
- Puzzle corner: 20 quarts

Milliliters and Liters, pp. 58-59

Page 58

1. Answers will vary.

Page 59

2. - 4. Student activities. Answers will vary.
5. a. 30 ml b. 450 ml c. 1,200 ml

Word Problems and More, pp. 60-61

Page 60

1. It contains 522 ml more of shampoo.
2. The baby's mass was 5 kg.
3. Five packages is only 15 oz, so you will need six packages to have at least a pound.
4. a. The can is 70 grams.
b. $330\text{ g} + 70\text{ g} = 400\text{ g}$
5. a. 400 ml b. 550 ml c. 1,050 ml

Page 61

6. a. They contain 1,350 ml of water.
b. It is 350 ml more than 1 liter.

Page 61

7. You can fill four 250 ml glasses from one liter.
8. a. $4 \times 150\text{ g} = 600\text{ g}$; You need four apples.
b. $7 \times 150\text{ g} = 1,050\text{ g}$; You need seven apples.
9. $2 \times 2 \times 600 = 2,400$; She walked 2,400 ft.
10. She is 48 inches tall.
11. a. A 12-inch line will have four cars.
b. It will take 12 cars to make a line 3 feet long.

Puzzle Corner:

5 ft is 60 inches, so Roger is 62 inches tall. He is 10 inches taller than Rebecca.

Review 2, pp. 62-64

Page 62

1. a. _____
b. _____
2. AB: 51 mm
BC: 72 mm
CA: 92 mm

However, if you printed the lesson yourself, and didn't print at 100% but with "shrink to fit," "print to fit," or similar, the measurements will be smaller numbers than those given above. Please check the student's answers. For example, the student might get:

AB: 47 mm
BC: 68 mm
CA: 86 mm

3. Answers will vary.
4. Answers will vary.

Page 63

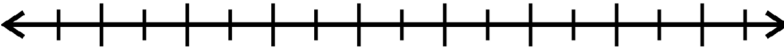
5. a. mm, cm, m, km
b. in, ft, yd, mi
c. C, pt, qt, gal
6. a. A butterfly's wings were 6 cm wide.
c. Jessica jogged 5 km or mi yesterday.
e. The distance from the city to the little town is 80 km or mi.
7. a. 2 lb 12 oz b. 2 lb 4 oz c. 5 lb 12 oz
8. a. Mom bought 5 kg or lb of apples.
c. Dr. Smith weighs about 70 kg.
e. The pan holds 2 qt or L of water.
- b. Sherry is 66 in or cm tall.
d. The box was 60 cm tall.
f. The room was 4 m or yd wide.
g. The eraser is 3 cm long
- b. Mary drank 350 ml of juice.
d. The banana weighed 3 oz.
f. A cell phone weighs about 100 g.

Review 2, cont.

Page 64

9. a. $\frac{3 \frac{1}{2}}{\frac{3 \frac{3}{4}}{4}}$ in $\frac{4}{\frac{4 \frac{1}{4}}{3 \frac{3}{4}}}$ in $\frac{3 \frac{3}{4}}{\frac{3 \frac{3}{4}}{3 \frac{3}{4}}}$ in $\frac{3 \frac{1}{4}}{\frac{3 \frac{3}{4}}{3 \frac{3}{4}}}$ in $\frac{4}{\frac{4 \frac{1}{2}}{3 \frac{3}{4}}}$ in

X
X
X X
X X
X X X X X X

b.  in

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