Goals

Students will measure pictures of objects in centimeters using centimeter cubes and then a centimeter ruler.

PRIOR KNOWLEDGE REQUIRED

- Count beyond 20
- Compare lengths directly by placing objects side by side and aligning properly
- Measure length using non-standard units

MATERIALS

- 1 cm connecting cubes (at least 30 for each student)
- 30 cm rulers
- BLM Measuring in Centimeters (p. H-33)
- BLM Concrete Rulers (p. H-34)
- BLM Measuring with a Ruler (p. H-35)

Measuring by counting cubes in a long chain. Give each student at least 15 small connecting cubes, and tell them to make a chain using the cubes. Explain to students that they will use the chain to measure pictures. Help students recall how to measure correctly—one end of the picture should align with one end of the chain. Tell students to note the place on the chain where the picture ends and then count the cubes from the end of the chain to the place they noted. Demonstrate by using a picture on the board or an object that is an exact number of centimeters long. Have students use their chains to measure the pictures on BLM Measuring in Centimeters and then write the measurements in cubes. (1. 13 cubes, 2. 11 cubes, 3. 7 cubes, 4. 5 cubes, 5. 6 cubes)

Using a concrete ruler. Tell students that it is often inconvenient to use a chain of cubes to take measurements. SAY: I want to try using a picture of cubes instead. Show students a concrete ruler from BLM Concrete Rulers and then distribute concrete rulers to them. ASK: Are the units placed correctly on the ruler? Are the units placed so there are no spaces or overlaps? Are the units the same size? (yes, thumbs up to all) Have students check that the units on the concrete ruler and the connecting cubes are exactly the same size. ASK: How is the picture of the row of cubes different from an actual row of cubes? (e.g., picture is bendable, picture is flat, cubes have color) Make sure students notice that the picture of the row of cubes does not start at the end of the strip.

Demonstrate measuring an object incorrectly by aligning the end of the object with the end of the strip (instead of aligning it with the end of the picture of the cubes), as shown below. ASK: Is this a good way to measure? (no, thumbs down) Ask students to explain your mistake.
Letting rulers do the counting. Show students a concrete ruler. Discuss the meaning of the numbers above the cubes on the ruler. Ask: What is drawn above the picture of cubes? (a number line) What number do you see on the tick that matches the beginning of the row of cubes? (0)

Draw a line 5 cm long on the board and show how to measure the line using the cubes on the ruler. Write “5 cubes long” beside the line. Then place the number line side of the ruler below the line you drew, as shown.

Say: Look, this way the line is 6 units long! Is that correct? (no) Have students explain your mistake. Emphasize that the line is 5 spaces between the tick marks long. Ask: How should I place the number line so that I do not need to count spaces? (align with 0) Demonstrate doing so and show how the number line does the counting.

Have students measure the pictures on BLM Measuring in Centimeters again, this time using the number line. Emphasize the importance of starting at 0. Point out that since the distance between each pair of marks on the number line is exactly one cube long, it is like measuring the pictures in cubes. Beside each measurement in cubes, have students put a check mark if the answer is the same. Afterward, discuss if students got the same answers using the number line and the cubes. If not, ask why. Prompt: Did you forget to line up one end of the object with 0? Did you count the cubes correctly? Were there so many cubes that you got lost in the counting? Which way of measuring was easier? Which way was less work? (using the number line) Why? (because the number line does the counting for us)

Relating the length of small connecting cubes to spaces on a standard ruler. Ask: Do people usually use pictures of cubes to measure length? (no) What do they use? (rulers) Explain that a ruler is a tool to measure small lengths. Write “ruler” on the board.

Hand out a standard centimeter ruler and at least 30 small connecting cubes to each student. Have students look at the ruler. Ask: How is a ruler like a number line? (both have numbers in counting order; there are equal spaces between the markings) Have students line up the cubes on the ruler so that they fit in the markings. Ask: What do you notice? (the spaces between the markings are the same length as the cubes; the cubes fit exactly between the markings) Explain that the length of each small cube is called a centimeter. People often use centimeters to make rulers. Write “centimeter” on the board.
Centimeter and cm. Have a volunteer find and circle the letters “c” and “m” in the word “centimeter.” Tell students that people often write just “cm” for centimeter. Write “cm” on the board. Have students find the label “cm” on their ruler.

Have students practice measuring by completing BLM Measuring with a Ruler. (1. 4 cm, 2. 5 cm, 3. 6 cm, 4. 3 cm, 5. 7 cm, 6. 2 cm, 7. 2 cm, 8. 3 cm)

### ACTIVITY

Have students find classroom objects that are about 1 cm long, wide, or high.

### Extensions

1. Have students use a 30 cm ruler to measure objects that are between 20 cm and 30 cm long, such as a sheet of paper. Have students work in pairs, with each partner measuring the same objects, one at a time, and then comparing their results. Have them look for any discrepancies.

2. Amy measures the length of a pencil with small paper clips. Zara measures the same pencil using large paper clips.
   a) Rani says that Amy will get a smaller number of units than Zara because Amy uses a smaller unit of measurement. Do you agree with Rani? Explain.
   b) In pairs, explain your answers to part a). Do you agree with each other? Discuss why or why not.

Selected sample answers: a) I disagree with Rani. Amy will need a larger number of units to measure the same pencil. A smaller unit has a shorter length, so more are needed to match the length of the pencil.
MD2-4  Length and Subtraction
Pages 182–184

STANDARDS
2.MD.A.1

VOCABULARY
centimeter (cm)
length
measure
ruler
unit of measurement

Goals
Students will measure pictures of lines and objects in centimeters using centimeter cubes and a centimeter ruler.

PRIOR KNOWLEDGE REQUIRED
Count beyond 20
Subtract using a number line
Measure lines and objects that are exact numbers of centimeters long
Compare lengths directly by placing objects side by side and aligning properly
Measure length using non-standard units

MATERIALS
a ruler from BLM Concrete Rulers (p. H-34)
1 cm connecting cubes (at least 10)
measuring tape (see Extension)
BLM Subtraction Using a Measuring Tape (p. H-36, see Extension)

Review rulers and centimeters.
Remind students that a ruler is a tool to measure length. Although we can measure length using different units, some units are very common—people use them in many countries. One of the most common units is the centimeter, which is the same length as a small connecting cube. When we count units on a centimeter ruler, we count centimeters.

Counting centimeters as jumps to find the distance on a ruler. Draw a centimeter ruler on the board and add two arrows as shown below:

```
0 1 2 3 4 5
```

SAY: To find how far apart the arrows are, we can jump from one number on the ruler to the next number, and so on, and count the jumps. Draw the jumps as done on AP book 2.1 p. 182. Trace the arrows with a finger.

ASK: How long is each jump? (1 cm) How many jumps do you need to make from 0 to 3? (3 jumps) How far apart are the arrows? (3 cm)

Draw the arrows in several different positions on the ruler, including situations when the first arrow is not at zero. Have students show the number of fingers equal to the number of jumps needed to get from one arrow to the other. Record the answer on the board: “The arrows are ___ cm apart.” Have a volunteer fill in the number for each pair of arrows. Progress to a longer ruler and longer distances.
Point out that when students count jumps on the centimeter ruler, they are actually counting centimeters. Show the concrete ruler from BLM Concrete Rulers and emphasize that each jump on a number line is exactly the same as a small cube, so it is exactly 1 centimeter.

**Measuring length of lines and objects by counting centimeters.** Draw a line 5 cm long and place a concrete ruler above it as shown:

![Ruler](image)

**ASK:** How many cubes long is this line? (5 cubes) **SAY:** Instead of counting cubes, we can just count jumps (or centimeters) on the ruler. Move the ruler below the line so that the line starts at 2 and ends at 7. Show how to count centimeters on the ruler to find the length.

Draw several different lines (not starting at zero) above the ruler and have students find each length by counting centimeters. Use lines that are shorter than 10 cm so that students can signal the answer by holding up the correct number of fingers. Write on the board:

The line is ___ cm long.

Have a volunteer fill in the answer. Repeat the exercise using pictures of objects instead of lines.

**Counting jumps and subtracting on a number line.** Help students recall counting jumps when subtracting on a number line. For example, for 8 – 5, have students sketch a number line between 5 and 8, and count the jumps as shown. Have a volunteer write the subtraction.

![Number line](image)

**SAY:** We can use subtraction to find how far apart arrows are or how long an object is. Above a ruler, draw a line that starts at 5 and ends at 8, as shown below. **ASK:** How long is the line? (3 cm)

![Line with ruler](image)

Above the ruler, draw another line that starts at 2 and ends at 6. **SAY:** Write the subtraction to find the length of the line. (6 – 2 = 4; the line is 4 cm long) Repeat with other lines. Include lines that start at zero and longer lines.
Distance from zero. Draw two arrows, one at 0 and another at 7, as shown below:

```
0 1 2 3 4 5 6 7 8 9
```

ASK: How far apart are the arrows? (7 cm) SAY: The second arrow is 7 cm away from 0. Draw an arrow at 5. ASK: How far from 0 is the arrow? (5 cm) ASK: Do you need to count jumps or subtract to find how far away from zero an arrow is? (no) How else can you do it? (just look at the ruler) How do you know? (the second arrow points at the answer) SAY: We can count jumps to find a distance or we can let the ruler do the counting for us.

Extension

Explain that a measuring tape is like a very long ruler, rolled into a tight roll. Show students a measuring tape. Have students use BLM Subtraction Using a Measuring Tape to subtract two-digit numbers to find the length.

Answers:
2. $41 - 36 = 5$, 5 cm  
3. $67 - 61 = 6$, 6 cm  
4. $88 - 84 = 4$, 4 cm  
5. $73 - 69 = 4$, 4 cm  
6. $95 - 88 = 7$ cm, 7 cm  
7. $71 - 59 = 12$ cm, 12 cm  
8. $91 - 77 = 14$, 14 cm
Goals
Students will measure length to the closest centimeter.

PRIOR KNOWLEDGE REQUIRED
Count numbers beyond 20 in order
Subtract using a number line
Measure lines and objects that are exact numbers of centimeters long
Compare lengths directly
Measure length using non-standard units

MATERIALS
2 cm connecting cubes or 5 cm paper clips (10–15 for each student)
a pencil, a marker, a pencil case, and an eraser for each student
30 cm rulers
10 pattern block squares for each student (see Extension 1)
measuring tape (see Extension 2)
several small curved objects (e.g., cup, water bottle, see Extension 2)

Review measuring in different units. Help students recall what they know about units of measurement. ASK: What different units have you used to measure the length of objects? (connecting cubes, paper clips, centimeters) How do you measure objects correctly? (use units that are the same length; place units in the same position; leave no gaps or overlaps between units) Give each student 10–15 large connecting cubes or paper clips and ask them to make a chain. Remind students how to measure length using a chain, before having them find a classroom object that is an exact number of units long. ASK: How long is the object?

Length and “closer to.” Draw two rows of connecting cubes separated by a line that is between 5 and 6 connecting cubes long, as shown:

```
  O O O O O
  O O O O O
```

ASK: How long is the line? Is it longer or shorter than 5 cubes? (longer) Is it longer or shorter than 6 cubes? (shorter) SAY: We can see that the line is not exactly 5 cubes long and not exactly 6 cubes long—the line is between 5 and 6 cubes long. I would like to know if the line is closer to 5 cubes long or closer to 6 cubes long. Write the words “closer to” on the board. Highlight the distance between the end of the line and the last cube above and below it, as shown on the following page.
Explain that the line is closer to 5 cubes, so we say the line is about 5 cubes long. Write “about” on the board. Repeat with lines of different lengths. Record the length each time on the board: “The line is about ___ cubes long.” Have a volunteer fill in the number.

**Measuring to the closest unit.** Pick an object that is not an exact number of connecting cubes (or paper clips, depending on the units that students are using) long and demonstrate measuring it with large cubes as shown below:

![Diagram of large cubes measuring an object]

ASK: Which measurement is the length closest to, 4 cubes or 5 cubes? (4 cubes) ASK: Which cube is the pencil closest to? Show what you mean by tracing the horizontal distance from the end of the fourth cube to the end of the pencil; then trace the distance from the end of the pencil to the end of the fifth cube.

For the exercise, provide students with large connecting cubes to measure a variety of objects. Have them work in pairs to check each other’s answers by measuring the same objects and checking that the answers are the same.

**Exercises:** Use cubes to measure the object. About how many cubes long is the object?

a) pencil  b) marker  c) pencil case  d) eraser

**Sample answers:** a) 7 cubes, b) 5 cubes, c) 10 cubes, d) 1 cube

**Review using a ruler to measure.** ASK: What do people often use to measure an object? (ruler) Hold up a centimeter rule and ASK: What are the units on this ruler? (centimeters) Remind students to align the zero mark on a ruler with the end of the object they are measuring. ASK: How does the ruler count the centimeters for you? (the end of the object points to the answer on the ruler)

**Measuring to the closest centimeter.** Draw a ruler on the board and draw a line that ends between two centimeter marks. ASK: How many centimeters long is the line? Have students signal the answer by raising the correct number of fingers. Repeat several times by drawing lines slightly shorter and slightly longer than an exact number of centimeters. Then SAY: When a line is exactly halfway between two units, we use the longer measurement.
Draw or show the following pictures and then SAY: The line is about 6 cm long.

Have students use a centimeter ruler to measure the objects in the exercise. Have them work in pairs to check each other’s answers.

**Exercises:** Use a ruler to measure the object. About how many centimeters long is the object?

a) pencil   b) marker   c) pencil case   d) eraser

**Sample answers:** a) about 14 cm, b) about 10 cm, c) about 21 cm, d) about 2 cm

**Extensions**

1. Have students make a row of 10 pattern block squares and measure its length to the closest centimeter.

   **Answer:** 10 pattern block squares are about 25 cm long.

2. Teach students to measure round or curved objects, such as a cup or a water bottle, using a measuring tape.
MD2-6 Estimating in Centimeters
Page 188

STANDARDS
2.MD.A.1, 2.MD.A.3

VOCABULARY
about
centimeter (cm)
closer to
estimate
exactly
length
measure
predict
ruler
unit of measurement

Goals
Students will use finger width to estimate length in centimeters.
Students will compare their estimates to measurements made using a centimeter ruler.

PRIOR KNOWLEDGE REQUIRED
Count numbers beyond 20 in order
Measure length to the closest centimeter using a ruler

MATERIALS
30 cm rulers
small objects (e.g., small paper clips, play coins)
finger paint
cardboard rectangles
a pencil case
a pencil, a lunch bag, an eraser, and an index card
a stick or meter stick
1 m sparkly gift wrap ribbon for each student (see Extension)
BLM Table Template (p. H-37)
BLM Lights (p. H-38, see Extension)

NOTE: If you plan to do Activity 1, divide it into two parts. Have students complete the first part before recess, lunch, or another break in the day to allow time for fingerprints to dry.

Using finger width as a benchmark for 1 cm. Give each student a ruler. Have them place each finger in turn, including the thumb, between the grid marks on the ruler. ASK: Which finger is closest to 1 cm wide? Which finger is farthest from 1 cm wide? Students will need this information for Activity 1. SAY: One of your fingers is not exactly 1 cm wide but it is pretty close. So, you can use that finger to measure in centimeters when you need an answer that is close to an exact answer.

Measuring short objects using finger widths. SAY: We cannot use many copies of the same finger to measure something because we have only two copies of the finger we need. Your pointer, middle finger, and ring finger are all about the same width, so for small objects that are about 3 fingers long or less, you can use 2 or 3 fingers placed close beside each other. Have students use 2 or 3 fingers placed close beside each other to estimate the length of a small object, such as a small paper clip or a penny.

Using only one unit to measure. Draw a line 10 cm long on the board. ASK: Are 3 fingers enough to measure this? (no) Explain that a different technique is needed. Measure the line using both index fingers by placing one index finger on the line and alternating with the other one, as shown.
below (put chalk or ink on your finger to make fingerprints). Record the length. Then have a volunteer measure the line using his or her index fingers.

Explain that when you think and then guess about something, you predict. Predict means to guess based on what you know. Have the class predict which measurement will be closer to the measurement in centimeters (a student’s finger is closer to 1 cm in width, so the estimate using a student finger is better). Measure the line using a ruler. Then place your index finger and the volunteer’s index finger between the markings on a ruler to see whose finger is closer to 1 cm wide.

**ACTIVITY 1**

**Using fingerprints to measure.** Distribute paint and cardboard rectangles of various lengths. Have students use fingerprints (from the same finger) to measure the length of the rectangles. Make the rectangles wide enough so that students can write or finger-paint the number of fingerprints as well. Have students measure each length twice: using the finger closest to 1 cm wide and then using the finger farthest from 1 cm wide.

Wait until the fingerprints have dried to continue the activity.

Have students circle the measurement that they think will be closest to the actual measurement in centimeters. Then have them measure the length of the rectangle using a ruler. ASK: Was your prediction correct? How close was that fingerprint measurement to the actual centimeter measurement?

**Introduce estimate.** SAY: A guess based on what you know is called an estimate. The more you know, the closer an estimate will be to the correct answer. Write “estimate” on the board. Emphasize that an estimate is not just a guess; it is a guess based on information. To estimate means to think and then guess.
Explain that students can use finger width as an estimate for 1 cm. Have students estimate the length of their pencil cases.

**Recording information in a table.** Explain that when we need to record a lot of information that is similar, such as lengths of objects, it makes sense to use a table. Draw a table as shown below. SAY: This table has 2 columns (trace down each column with your finger).

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Provide students with [BLM Table Template](#). Have them write the labels in the first 2 columns of the top row. Explain to students that they will learn how to fill in the table. SAY: In the first column, you will write the name (or draw a picture) of an object you will measure (trace down the column with your finger). In the second column, you will write your estimate of its length. SAY: This is a row (trace across the row with your finger).

Demonstrate how to fill in the first row for a pencil case. In the first column, write "pencil case." Have students do the same. Ask a volunteer to use his or her finger width to measure the pencil case. In the second column, write "about ___ cm." Ask the volunteer to fill in the missing number. Have students do the same using their estimate of its length.

Fill in the first column of the table with the names of the objects in the exercises, and have students do the same in their table. Then point to a cell in the second column of the table. ASK: For which object will you write the length here? Repeat by pointing to each cell in the second column. Tell students to place the eraser on the cell that shows its length.

For the exercise, have students use the BLM to record their answers.

**Exercises:** Measure the longest side of the object. Use the finger that is closest to 1 cm wide.

- a) pencil
- b) lunch bag
- c) JUMP Math AP book
- d) eraser
- e) index card

**Sample answers:**
- a) about 18 cm
- b) about 24 cm
- c) about 28 cm
- d) about 4 cm
- e) about 12 cm

**Measuring to check the estimate.** Explain to students that they will check their estimate for each object and record the information. Point out that the table on the BLM has 3 columns. Add a column to the table on the board, and label it "Measurement."

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Have students label the third column on their copy of the BLM. Point to a cell in the third column of the table. **ASK:** For which object will you write the length here? Repeat by pointing to each cell in the third column. Tell students to place a paper clip in the cell that should show the actual length of their lunch bag. Demonstrate how to fill in the third column for the pencil case. Ask a volunteer to measure the pencil case. In the third column, write "___ cm." **Ask the volunteer to fill in the missing number.** Have students do the same.

Have students use a centimeter ruler to measure each object from the exercise and record the measurement in the table. Then have volunteers fill in the measurements in the table on the board. **Point to different cells in the second and third columns of the table and have students identify what each cell shows (for example, estimate for the length of a pencil case, measurement for the length of a pencil).**

**Estimating centimeters without using fingers.** Have students estimate how many centimeters long, tall, or wide objects are and then check using a ruler. Choose objects that are less than 30 cm long. To estimate, students should make educated guesses based on their experiences with centimeters thus far. Have students record their work on **BLM Table Template.**

### ACTIVITY 2

On a stick or on the back of a meter stick make markings of 10 cm, 20 cm, 30 cm, and so on from the end of the stick. **Label the marks clearly.** Explain that the markings show the distance from the end of the stick. Use the stick to play an estimation game with students. **Ask them to tell you to stop when your finger has reached 15 cm from the end of the stick.** Slide a finger slowly along the stick and then mark the place where students tell you to stop. **Have a volunteer measure the distance and check the guess.** Repeat with other distances. Students can play the game in pairs with one partner sliding a finger along the stick and the partner telling when to stop. **Have partners measure the distance from the end.** Have partners switch roles after each round.
Extensions

1. Give students **BLM Lights**. Tell students that they will decorate a picture of a house with ribbon. The ribbon will represent the outdoor lights that people use to decorate their house for a holiday. Explain that they will glue the ribbon on the thick lines of the house (and the door and window) but that you are not sure how much ribbon will be needed. To find the length needed for each feature, have students estimate the length of each thick line and then measure it. Have them add the lengths. Then give students a length of gift wrap ribbon and have them measure and cut the length needed for each feature.

   **Answer:** 77 cm of ribbon

2. Explain to a partner what regrouping tens and ones means using an example of subtraction with base ten blocks.

   **Sample answer:** Regrouping tens and ones means trading 10 ones blocks for 1 tens block or 1 tens block for 10 ones blocks. For example, if I’m subtracting 32 − 8, I start with 3 tens blocks and 2 ones blocks. In order to subtract 8 ones, I need to trade one of the tens blocks from 32 for 10 ones. Now I have 2 tens blocks and 12 ones. After subtracting 8 ones I’m left with 2 tens blocks and 4 ones, so 32 − 8 = 24.
### Goals

Students will estimate measurements in meters. They will compare their estimates to measurements made using a meter stick.

### PRIOR KNOWLEDGE REQUIRED

- Count numbers in order
- Measure length to the closest centimeter using a ruler
- Measure length to the closest unit
- Know that length can be measured in different units

### MATERIALS

- meter sticks
- several objects close to 1 m in length, including a baseball bat and a scarf or a piece of yarn
- 1 m length of string for each student
- newspapers
- masking tape
- scissors

### Introduce meters.

SAY: I would like to measure the length of the classroom. Do you think it would make sense to use connecting cubes? Why? Do you think we have enough cubes? How else could I measure the length in a faster and easier way? Explain that measuring a long distance, such as the classroom, requires hundreds of cubes, paper clips, or centimeters. SAY: We use meters to measure long distances. A meter is about the same length as a meter stick. Write “meter” on the board.

Show students a meter stick and ask them to think of other objects that are about the same length or height as a meter (e.g., a baseball bat, a child’s golf club, a 4-year-old child, a bus wheel). If available, show students some of these objects, including a baseball bat and a piece of yarn or a scarf 1 m long. If the meter stick has a small space between the end and the start of the number line, point that out, and explain that a meter is slightly shorter than the meter stick.

### Meter and m.

Have students recall the short form for centimeter (cm). SAY: You know that people often write just “cm” for centimeter. They also often write just “m” for meter.

Explain that 1 m is 100 cm long. Write on the board:

- 1 meter = 100 centimeters
- 1 m = 100 cm

Invite a volunteer to circle the common letter(s) in the whole word and the abbreviation for each unit (m and cm, respectively).
ACTIVITY 1

Finding benchmarks for a meter. Demonstrate how to check that a length of string is 1 m long (line up the string with a meter stick and check that the string starts at 0 and ends at 100 cm). Give each student a 1 m length of string. Have them verify that the string is 1 m long. Then have students use the string to find classroom objects that are about 1 m in length, width, or height, and objects that are more than and less than 1 m in length, width, or height. Suggest that students include distances, such as the distance around the seat of a chair or the distance from the floor to a door knob. Afterward, have students share the objects that are about 1 m long.

Using meters to measure. SAY: Predict how many meters long the blackboard is. Demonstrate how to measure the blackboard correctly using a meter stick. If the meter stick is slightly longer than 1 m, show making a mark at exactly 100 cm (not at the end of the stick). SAY: You make a mark at exactly 100 cm because that is how long a meter is. Then demonstrate measuring incorrectly by holding the stick diagonally and making a mark at 100 cm. Have a volunteer make the mark correctly by holding the stick straight along the board. (One way to ensure the stick is straight is to align it with the blackboard ledge.)

Review measuring to the closest unit. Point out that the blackboard is longer than, say, 3 m, but shorter than, say, 4 m. Compare the distance from the last marking. ASK: Is the leftover distance close to 1 m or much smaller than 1 m? Is the blackboard about 3 m long or about 4 m long?

ACTIVITY 2

Making a meter stick. Have students roll up a newspaper tightly and tape it with masking tape. Model rolling up newspaper diagonally so that the ends are only one layer thick and easier to cut. Help students cut the newspaper roll so that it is exactly 1 m long by lining up the roll with the 0 and 100 cm marks on a meter stick. As a class, use multiple meter sticks to determine how many meter sticks long the classroom is from side to side and from front to back.

At the point when an additional whole meter stick will not fit in the remaining space, show students how to estimate the remaining distance by placing another meter stick so that the last stick in the row and the additional stick overlap as shown.

Which is larger, the gap or the overlap? If the gap is larger than the overlap, the total distance is closer to, say, 7 m. If the overlap is larger than the gap, the total distance is closer to 6 m.
Measuring with only one meter stick. ASK: Is the hallway wider than the classroom? Is it wider than the classroom is long? Ask students to predict the width of the hallway. Then have students use their meter sticks to measure the width of the hallway. Have them use small pieces of masking tape to mark the end of each stick measurement. Students can verify their measurements by using multiple meter sticks to measure.

Using a benchmark to predict and then check. On the board, list the lengths of items that students have already measured (for example, blackboard: about 3 m wide). Pick an item not on the list (for example, a window). ASK: What item on the list is closest to the width of the window? Is the item larger or smaller than the window? SAY: The window is smaller than the blackboard, but larger than the door. The door is about 1 m wide and the board is about 3 m wide. What is a good estimate for the window? (about 2 m) Have students check the prediction. Repeat with several more items.

Using units that are about the same size to find approximate measurements. SAY: Remind me about what makes a good unit of measurement. (It is easy to find many units the same size.) SAY: I want to tell a friend how long the school hallway is. She does not need to know exactly how big it is; she just wants an idea. I plan to take big steps all the way down the hall to see how many steps it takes. Do you think my steps are good units? Can I take many steps that are all the same size? Will my steps be at least close to the same size? Even though steps are not all exactly the same size, they will all be close to the same size if I try to take big steps all the time. This will not tell me exactly how long the hallway is, but it will give me a good idea. Sometimes, that is all you need.

Large steps are about a meter long. Mark three long lines 1 m apart on the floor. Have students stand with their heels on one line, facing the second line, and take a step so that their toes touch the second line. Have students practice taking a step in this way several times. For multiple steps, show students how to lead off with the same foot each time: take one giant step (positions 1 and 2 below); bring the back foot forward and place it in front of and to the side of the first foot, with the heel directly in front of the front toe (position 3); bring the back foot forward beside the front foot (position 4), then take another giant step (position 5).

Have students take 5 steps that they think will be about 1 m each, and have a partner check using a meter stick. Emphasize that it is much harder to take 5 big steps all in a row than 5 steps walking normally.

SAY: I want to know about how many meters long the hallway is. Have students take giant steps along the hallway to help you find out. Remind them to take identical steps and to lead off with the same foot each time.
Then have a volunteer use a meter stick to measure the length of the hallway. **ASK:** Did we get the same answer both ways? Were our answers close? Which way was faster? Explain that when the answer does not have to be exact, we can save time using giant steps instead of meter sticks. Discuss situations where it is important to know exact measurements. Examples: competing in a race, ordering glass to fix a broken window, making a ruler to sell, making paper to put in a book, and making legs for a table.

**Estimating distances using a giant step.** Have students predict the distance in meters to, say, the school library. Have them measure the distance in giant steps to check predictions. Allow students to adjust their prediction after measuring part of the distance.

Repeat with another location at school. Have students think about whether the new location is farther or closer than the previous one. **ASK:** Should the estimate be larger or smaller than the distance just measured? Measure to check the estimates, allowing students to adjust their estimate after measuring part of the distance.

**Extensions**

1. **SAY:** Let’s estimate how many students with outstretched arms we will need to go all the way across the room. Will this give an exact measurement of how wide the classroom is? Why? (no, because the outstretched arms of students are not all the same length even though they are close) Will we need more or fewer students than meter sticks? What do you predict? Are outstretched arms longer or shorter than a meter stick? (longer, so we will need fewer students) Have students use outstretched arms to measure the width of the classroom as shown. Then have students measure the width using meter sticks and compare the actual width with their prediction. **ASK:** Was your prediction correct? Explain.

2. When students are not in the room, draw two lines on the board, both 1 m long, with arrows at the ends as shown. Ask students to predict which line is longer. (Ignore the arrows.) Then have a volunteer check by comparing both lines to a self-made meter stick.
Measuring in Centimeters

☐ Measure.

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Concrete Rulers
Measuring with a Ruler

☐ Use a ruler to measure.

1. ______ cm

2. ______ cm

3. ______ cm

4. ______ cm

5. ______ cm

6. ______ cm

7. ______ cm

8. ______ cm
Subtraction Using a Measuring Tape

☐ Subtract to find the length.

1. \[ \begin{array}{c}
20 & 21 & 22 & 23 & 24 & 25 & 26 & 27 \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

\[ 27 - 22 = 5 \]

The line is \( 5 \) cm long.

2. \[ \begin{array}{c}
34 & 35 & 36 & 37 & 38 & 39 & 40 & 41 \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

The line is \( \_\_\_ \) cm long.

3. \[ \begin{array}{c}
60 & 61 & 62 & 63 & 64 & 65 & 66 & 67 \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

The line is \( \_\_\_ \) cm long.

4. \[ \begin{array}{c}
82 & 83 & 84 & 85 & 86 & 87 & 88 & 89 \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

The line is \( \_\_\_ \) cm long.

5. \[ \begin{array}{c}
58 & 59 & 60 & 61 & 62 & 63 & 64 & 65 \text{ cm} \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

The line is \( \_\_\_ \) cm long.

6. \[ \begin{array}{c}
76 & 77 & 78 & 79 & 80 & 81 & 82 & 83 \text{ cm} \\
\hline
\text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} & \text{cm} \\
\end{array} \]

The line is \( \_\_\_ \) cm long.
# Table Template

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Blackline Master — Measurement and Data — Teacher Resource for Grade 2

H-37

Lights