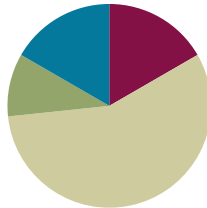# Lesson 9

Objective: Measure lengths of string using measurement tools, and use tape diagrams to represent and compare lengths.

Suggested Lesson Structure

■ Fluency Practice   (10 minutes)
■ Application Problem   (6 minutes)
■ Concept Development   (34 minutes)
■ Student Debrief   (10 minutes)
    Total Time   **(60 minutes)**

## Fluency Practice (10 minutes)

- Meter Strip Addition: Adding Multiples of 10 to Numbers **2.NBT.5**   (6 minutes)
- Happy Counting by Centimeters **2.NBT.2**   (4 minutes)

Meter Strip Addition: Adding Multiples of 10 to Numbers (6 minutes)

Materials: (S) Meter strip (Lesson 6 Template) (as pictured)

Note: Students apply knowledge of using the ruler as a number line to fluently add multiples of 10. The meter strip solidifies the process for visual and tactile learners and creates the groundwork for students to make tape diagrams in the lesson.

T: (Each student has a meter strip.) Put your finger on 0 to start. I'll say the whole measurement. Slide up to that number. Add 10 centimeters and tell me how many centimeters your finger is from 0.

T: Let's try one. Fingers at 0 centimeters! (Pause.) 30 centimeters.

S: (Slide their fingers to 30.)

T: Remember to add 10. (Pause.) How far is your finger from 0?

S: 40 centimeters.
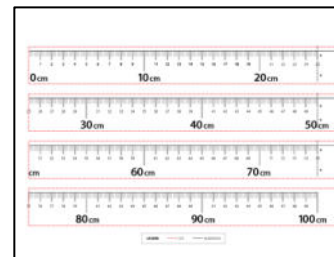
Continue with the following possible sequence: 45 cm, 51 cm, 63 cm, 76 cm, 87 cm, and 98 cm. As students show mastery, advance to adding 20 centimeters.

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Happy Counting by Centimeters (4 minutes)

Note: Students practice counting by 10 centimeters and exchanging centimeters for meters. This activity relates to Say Ten counting, where ones are exchanged for tens. It can be demonstrated on a Rekenrek, with each bead representing 10 centimeters.

T: Let's count by 10 centimeters, starting at 80 centimeters. When we get to 100 centimeters, we say 1 meter, and then we will count by meters and centimeters. Ready? (Rhythmically point up until a change is desired. Show a closed hand, and then point down. Continue, mixing it up.)

S: 80 cm, 90 cm, 1m, 1m 10 cm, 1 m 20 cm, 1 m 30 cm, 1 m 40 cm, 1 m 50 cm. (Switch direction.) 1 m 40 cm, 1 m 30 cm, 1 m 20 cm. (Switch direction.) 1 m 30 cm, 1 m 40 cm, 1 m 50 cm, 1 m 60 cm, 1 m 70 cm, 1 m 80 cm, 1 m 90 cm, 2 m. (Switch direction.) 1 m 90 cm. (Switch direction.) 2 m, 2 m 10 cm, 2 m 20 cm. (Switch direction.) 2 m 10 cm, 2 m, 1 m 90 cm.

T: Excellent! Try it for 30 seconds with your partner starting at 80 centimeters. Partner B, you are the teacher today.

Application Problem (6 minutes)

Richard's sunflower is 9 centimeters shorter than Oscar's. Richard's sunflower is 75 centimeters tall. How tall is Oscar's sunflower?
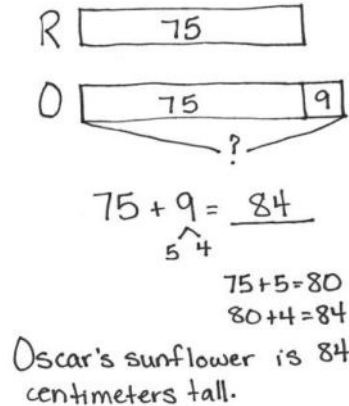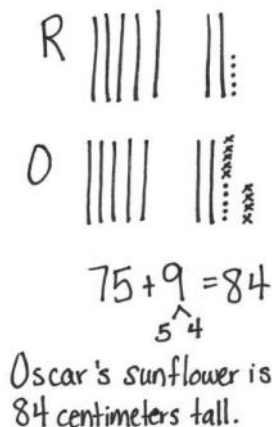
This *compare with bigger unknown* problem is similar to the problem in Lesson 8, but here the word "shorter" relates to measurement. This is in anticipation of today's Concept Development, wherein students measure lengths of strings and use tape diagrams to represent and compare lengths.

Concept Development (34 minutes)

Materials: (T) 2 lengths of string in two different colors (3 meters red and 5 meters blue), meter stick, masking tape (S) 1 meter strip, 50 cm piece of string, personal white board

Note: Students take the string and meter strip home to complete the Homework.

T: (Before class begins, use masking tape to make two tape paths on the floor. Make one path that measures 3 meters squiggly and one path that measures 5 meters zigzaggy. Convene students on the carpet, perhaps seated in a U-shape.)

T: Make an estimate. How long is the zigzag path?

S: (Share estimates.)

T: Make an estimate. How long is the squiggly path?

S: (Share estimates.)

T: Which path do you think is longer?

S: (Share thoughts.)

T: I have some string here. How do you think this string could help me to check our estimates?

S: Take some string and put it straight on each path. → Hold it down with one hand and lay it down along the tape.

T: (Use the red string to measure the squiggly path and the blue string to measure the zigzag path.)

T: Now, I compare the lengths of the paths by measuring these strings. Because the strings are so long, let's tape them on the floor and see how long they are.

T: (Lay the red and blue strings parallel on the floor and horizontal to students.)

T: Use a benchmark to estimate the length of each string. Share your estimates with your neighbor.

T: What measurement tool could we use to check the estimates?

S: A meter tape. → A meter stick.

T: (Call two volunteers to measure.)

S: The red string is 3 meters. The blue string is 5 meters.

T: I don't have enough space on the board to tape these long strings. What could I do instead?

S: Draw a picture. → Write the numbers.

MP.5

T: (Draw a horizontal rectangular bar to represent the length of the red string.) This represents the red string. Tell me when to stop to show the blue string. (Start at the left end of the red bar and move to the right, making a second bar underneath the first.)
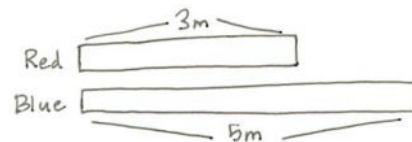
S: Stop!

T: Why should I stop here?

S: Because the second bar should be longer than the first bar.

T: Let's write the measurements of each string above.

T: (Label both bars.) What expression could you use to describe the total length of these strings?

S: 3 + 5.

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MP.5

T: What expression could I use to describe the difference in length between these two strings?

S: 5 – 3.

T: Remember, this is called a tape diagram. It is helpful because we can draw a small picture to represent any length.

T: Let's practice making a tape diagram.

T: What is the measurement around my wrist? (Demonstrate wrapping the string around your wrist and pinching the end point, and then lay the string along a meter stick to determine the length.)

S: 16 centimeters.

T: Let's compare the length around my wrist to the length around my head. What's the length around my head? (Repeat the demonstration process, and record the length on the board.)

S: 57 centimeters.

T: Draw along with me as I draw the first bar on the board to represent my head measurement. We'll label this 57 centimeters.

S: (Draw.)

T: Right below that, draw the second bar to show my wrist measurement. Should the bar be longer or shorter?

S: Shorter. (Draw and label the second bar 16 centimeters.)

T: Look at your diagram. Talk with your neighbor: What is this open space between the end of the first and second bars?

S: It's how much longer 57 centimeters is than 16 centimeters. → It's the difference between 16 centimeters and 57 centimeters. → It's the difference between the measurement of your wrist and your head.

T: How can we find the difference between 16 centimeters and 57 centimeters?

S: 57 – 16 = ___. → 16 + ___ = 57.
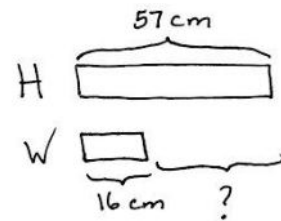
Check students' tape diagrams. Have them compare the measurement around their thigh and the length of their arm, and the length around their neck and the length around their head.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

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Student Debrief (10 minutes)

Lesson Objective: Measure lengths of string using measurement tools, and use tape diagrams to represent and compare lengths.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- What estimation strategies did you use for Problem 1? How were they similar to or different from your partner's strategies? (Chart benchmark strategies.)

- Look at Problems 2 and 3. What steps did you take to draw an accurate tape diagram? How do your drawings compare to your partner's?

- What do you think the math goal of this lesson was? What would be a good name for this lesson?

- How did you show your thinking today?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

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Name _____   Date _____

1. Complete the chart by first estimating the measurement around a classmate's body part and then finding the actual measurement with a meter strip.

Student Name	Body Part Measured	Estimated Measurement in Centimeters	Actual Measurement in Centimeters
	Neck		
	Wrist		
	Head		

a. Which was longer, your estimate or the actual measurement around your

classmate's head? _____

b. Draw a tape diagram to compare the lengths of two different body parts.

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2. Use a string to measure all three paths.

Path 1

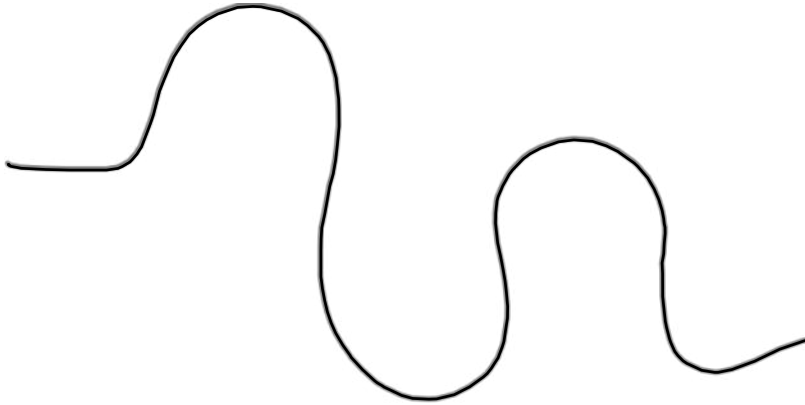**Path 2**

Path 3

a. Which path is the longest? _____

b. Which path in the shortest? _____

c. Draw a tape diagram to compare two of the lengths.

3. Estimate the length of the path below in centimeters.

a. The path is about _____ cm long.
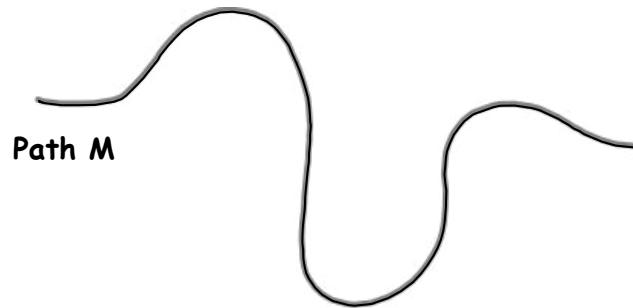
Use your piece of string to measure the length of the path. Then, measure the string with your meter strip.

b. The actual length of the path is _____ cm.

c. Draw a tape diagram to compare your estimate and the actual length of the path.

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Name _____   Date _____

1. Use your string to measure the two paths. Write the length in centimeters.

Path M

Path N

Path M is _____ cm long.

Path N is _____ cm long.

2. Mandy measured the paths and said both paths are the same length.
   Is Mandy correct? Yes or No? _____

   Explain why or why not.

   _____

   _____

3. Draw a tape diagram to compare the two lengths.

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Name _____   Date _____

1. Mia completed the chart by first estimating the measurement around three objects
    in her house and then finding the actual measurement with her meter strip.

Object Name	Estimated Measurement in Centimeters	Actual Measurement in Centimeters
Orange	40 cm	36 cm
Mini Basketball	30 cm	41 cm
Bottom of a glue bottle	10 cm	8 cm

a. What is the difference between the longest and shortest measurements?

_____ cm

b. Draw a tape diagram comparing the measurements of the orange and the bottom
    of the glue bottle.

c. Draw a tape diagram comparing the measurements of the basketball and the
    bottom of the glue bottle.

2. Measure the two paths below with your meter strip and string.

Path A _____

Path B

a. Path A is _____ cm long.

b. Path B is _____ cm long.

c. Together, Paths A and B measure _____ cm.

d. Path A is _____ cm (shorter/longer) than Path B.

3. Shawn and Steven had a contest to see who could jump farther. Shawn jumped 75 centimeters. Steven jumped 9 more centimeters than Shawn.

a. How far did Steven jump? _____ centimeters

b. Who won the jumping contest? _____

c. Draw a tape diagram to compare the lengths that Shawn and Steven jump.