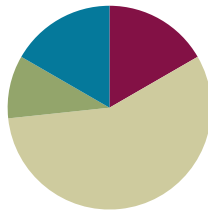


Lesson 9

Objective: Concrete to abstract: measure lengths of string using measurement tools; represent length with tape diagrams to represent and compare the lengths.

Suggested Lesson Structure

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



Fluency Practice (10 minutes)

- 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 strips (as pictured)

Note: Students apply knowledge of using the ruler as a number line to fluently add multiples of ten. 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: (Students 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 your students show mastery, advance to adding 20 centimeters.

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 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, 1m 50 cm (stop) 1 m 40 cm, 1 m 30 cm, 1 m 20 cm (stop) 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, 1 m 90 cm, 2 m, 2 m 10 cm, 2 m 20 cm, 2 m 10 cm, 2 m, 1 m 90 cm, etc.
- 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)

Mei's frog leaped several centimeters. Then it leaped 34 centimeters. In all, it leaped 50 centimeters. How far did Mei's frog leap at first? Draw a picture and write a number sentence to explain your thinking.

Note: This *add to with start unknown* situation may be challenging for students. After students share their solutions, the teacher may wish to model problem solving using a tape diagram. This is in anticipation of today's lesson, where students will be representing length using tape diagrams.

Concept Development (34 minutes)

Materials: (T) 2 lengths of string in 2 different colors (3 meters red and 5 meters blue), meter stick (S) 1 meter tape and 50-cm piece of string per pair of students, masking tape

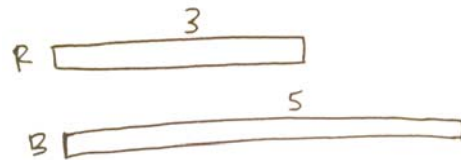
- T: (Use masking tape to make two lines on the floor before class begins. Make one line squiggly, that measures 3 meters, and one line zigzag that measures 5 meters. Convene students on the carpet, perhaps seated in a U-shape.)
- T: Make an estimate, how long is the zigzag line?
- S: (Students share estimates.)
- T: Make an estimate, how long is the squiggly line?
- S: (Students share estimates.)
- T: Which line do you think is longer?

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

To support ELLs, treat the student's first language as a resource. When drawing tape diagrams, students need to understand comparative language in order to represent and compare various lengths. The teacher can use the student's first language to foster understanding. For example,

- In Spanish, shorter = *mas corto*.
- In Spanish, longer = *mas largo*.

- S: We don't know because they aren't straight. → The squiggly line because it starts at the wall and goes past the rug. The other line starts at the wall and doesn't reach the rug. → You need to measure both to know.
- T: How can I find out the actual length of each line to check our estimates?
- S: Measure each part and add them together. → Measure each part and count on as you go.
- T: That may work for the zigzag line, but that won't work for the squiggly line.
- T: I have some string here. How do you think this string could help me measure both lines?
- S: Take the string and trace it along the line. → Hold it down with one hand and lay it down along the tape.
- T: (Use the red string to measure the squiggly line and the blue string to measure the zigzag line.)
- T: Now, how can I compare the lengths of the lines?
- S: Measure the strings.
- T: These strings are very 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 the 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. (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.
- 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.)



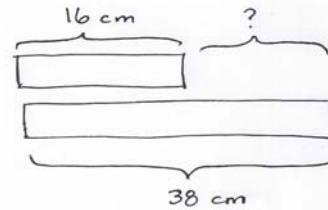
- S: Stop!
- T: Why should I stop here?
- S: Because the second bar should be longer than the first bar.
- T: Let's write the measurements of each string above.
- T: (Label both bars.) What number sentence could you use to describe the total length of these strings?
- S: $3 + 5 = \square$
- T: What number sentence could I use to describe the difference in length between these two strings?
- S: $5 - 3 = \square$
- T: This is called a tape diagram. It is helpful because I 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, 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

MP.5

head? (Repeat the demonstration process and record the length on the board.)

S: 38 centimeters.

T: Draw along with me as I draw the first bar on the board to represent my wrist measurement. We'll label this 16 centimeters. (Students draw.)



MP.5

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

S: Longer. (Students draw and label the second bar 38 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 38 centimeters is than 16 centimeters. → It's the difference between 16 centimeters and 38 centimeters. → It's the difference between the measurement of your wrist and your head.

T: What number sentences can we use to find the difference between 16 centimeters and 38 centimeters?

S: $38 - 16 = \square \rightarrow 16 + \square = 38$.

Check students' tape diagrams. Have them compare next the measurement around their thigh and the length of their arm, 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 solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Measure lengths of string 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. You may choose to use any combination of the questions below to lead the discussion.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 9 Worksheet 2•2

Name Thomas Date _____

1. Complete the chart by first estimating the measurement around a classmate's body part. Then find the actual measurement with a meter tape.

Student Name	Body Part Measured	Estimated Measurement in Centimeters	Actual Measurement in Centimeters
Samuel	Neck	20 cm	24 cm
Rebecca	Wrist	9 cm	14 cm
Spina	Head	30 cm	42 cm

a. Which was longer, your estimate or the actual measurement around your classmate's head? actual

b. Draw a tape diagram to compare two actual lengths from your chart.

2. Use a string to measure all three lines.

Line 1

Line 2

Line 3

Which line is the longest? 1

Which line is the shortest? 2

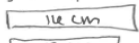
COMMON CORE Lesson 9: Measure lengths of string and use tape diagrams to represent and compare lengths. 4/25/13 engage^{ny} 2.D.6

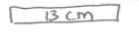
MP.5

- What estimation strategies did you use for Problem 1? How were they similar to or different from your partner’s strategies? (Teacher charts 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?
- Add to the application problem: Anthony’s frog leaped 28 centimeters. With a partner, students draw a tape diagram to compare the distances that the two frogs leapt. Teacher samples tape diagrams: What does this part represent in your solution number sentence?
- How did you show your thinking today?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 9 Worksheet 2•2

Draw a tape diagram to compare two of the lengths.

Line 1 

Line 2 

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

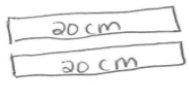


The line is about 20 cm.

Use your piece of string to measure the length of the line. Then measure the string with your ruler.

The actual length of the line is 20 cm.

Draw a tape diagram to compare your estimation and the actual length of the line.



COMMON CORE Lesson 9: Measure lengths of string and use tape diagrams to represent and compare lengths. Date: 4/25/13 engage^{ny} 2.D.7

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students’ understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.



NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

As students return to the application problem, adjust the difficulty level of the extension:

Choose challenging problem types, such as , “How would your tape diagram change if Mei’s frog leaped x centimeters more than Anthony’s?”

Invite students to write their own comparison word problem with an accompanying tape diagram.

Name _____

Date _____

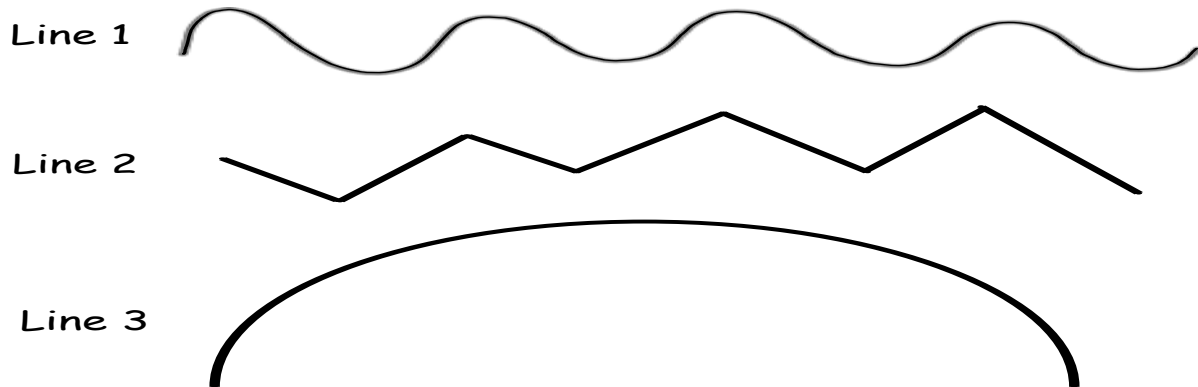
1. Complete the chart by first estimating the measurement around a classmate’s body part. Then find the actual measurement with a meter tape.

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 two actual lengths from your chart.

2. Use a string to measure all three lines.

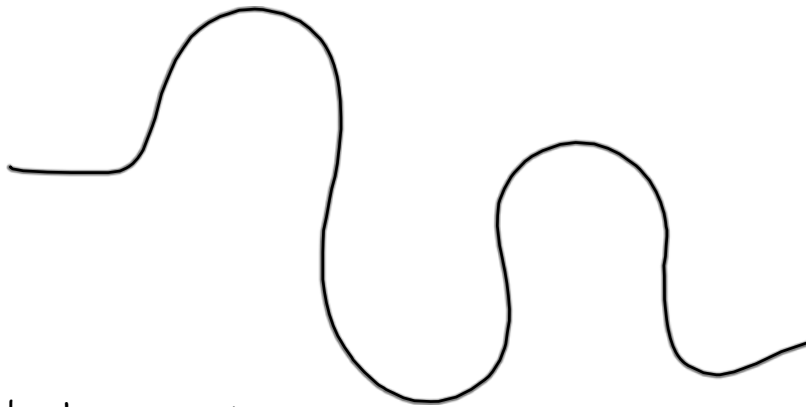


Which line is the longest? _____

Which line is the shortest? _____

Draw a tape diagram to compare two of the lengths.

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



The line is about _____ cm.

Use your piece of string to measure the length of the line. Then measure the string with your ruler.

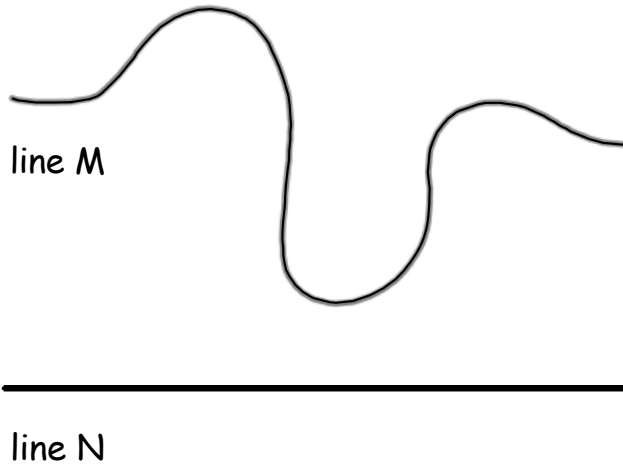
The actual length of the line is _____ cm.

Draw a tape diagram to compare your estimation and the actual length of the line.

Name _____

Date _____

1. Measure the two lines by using your string. Write the length in centimeters.



Line M is _____ cm long.

Line N is _____ cm long.

2. Mandy measured the lines and said both lines are the same length.

Is Mandy's answer correct? Yes or no. _____

Explain why or why not.

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

Name _____

Date _____

1. Find the measurement around three round objects in your house. Complete the chart below.

Object Name	Estimated Measurement in Centimeters	Actual Measurement in Centimeters

- a. What is the difference between the greatest and shortest measurements?
 _____ cm.

- b. Draw a tape diagram comparing the estimated measurements.

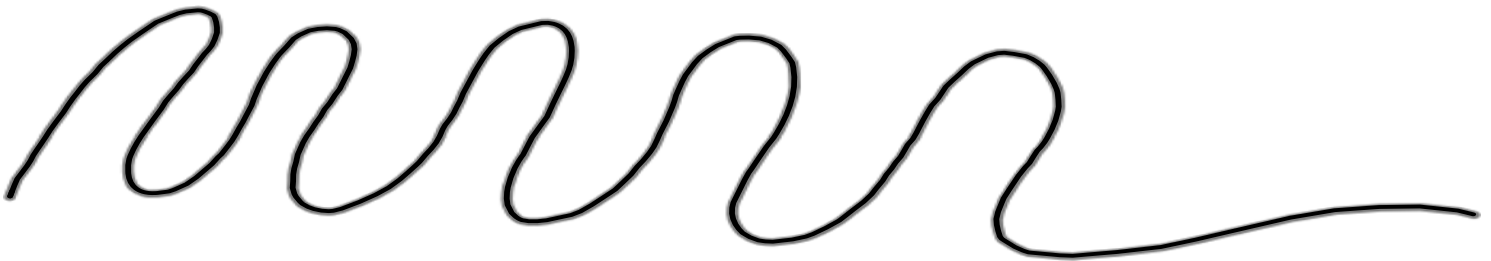
- c. Draw a tape diagram to compare the actual measurements.

2. Measure the two lines below.

line A 

line B 

- Line A is ____ cm.
 - Line B is ____ cm.
 - Together, lines A and B measure ____ cm.
 - Line A is ____ cm (shorter/longer) than line B.
3. Kim is decorating a table for a party. Measure the ribbon she is using to decorate.



The ribbon is ____ cm long.

Kim needs 1 meter of ribbon.

How much more ribbon does Kim need than what she has? ____ cm.

4. Shawn and Steven had a contest to see who could jump the furthest. Shawn jumped 75 centimeters. Steven jumped 23 more centimeters than Shawn.
- How far did Steven jump? _____ centimeters
 - How won the jumping contest? _____
 - Draw a tape diagram to compare the lengths that Shawn and Steven jumped.