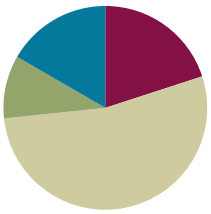
Lesson 8

Objective: Solve addition and subtraction word problems using the ruler as a number line.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(6 minutes)
Concept Development	(32 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- How Many More to Make a Meter? **2.MD.4** (3 minutes)
- Sprint: Making a Meter **2.MD.4** (9 minutes)

How Many More to Make a Meter? (3 minutes)

Note: This activity extends upon the make a ten strategy within the metric system in preparation for the Sprint. It also reinforces that 1 meter is composed of 100 centimeters.

T: For every number of centimeters I say, you say the number needed to make a meter. If I say 70 centimeters, you say 30 centimeters. Ready?
T: 70 centimeters.
S: 30 centimeters.
T: Number sentence.
S: 70 cm + 30 cm = 1 m.
T: 40 centimeters.
S: 60 centimeters.
T: Number sentence.
S: 40 cm + 60 cm = 1 m.

Continue with the following possible sequence: 20 cm, 90 cm, 10 cm, 9 cm, 11 cm, 50 cm, 49 cm, and 51 cm.

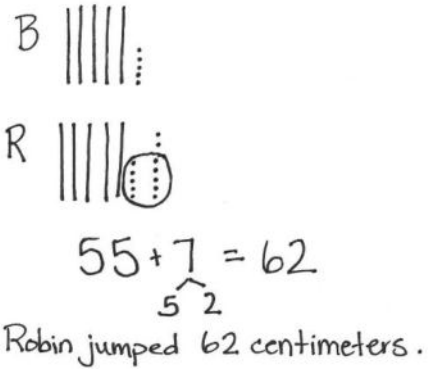
Sprint: Making a Meter (9 minutes)

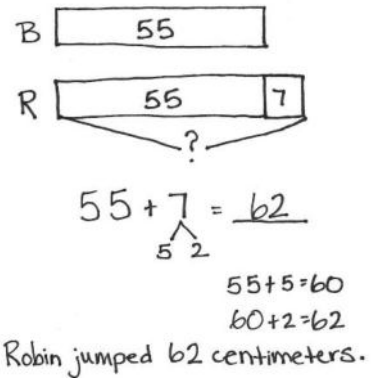
Materials: (S) Making a Meter Sprint

Note: Students use the make a ten strategy to compose 1 meter.

Application Problem (6 minutes)

Bill the frog jumped 7 centimeters less than Robin the frog. Bill jumped 55 centimeters. How far did Robin jump?





Note: This *compare with bigger unknown* problem uses the word *less*, which presents an opportunity for students to work through the easy mistake that *less* or *less than* means to subtract. Ask guiding questions such as, who jumped farther? This, along with a tape diagram, helps students recognize that Robin jumped farther and helps them determine the operation, addition.

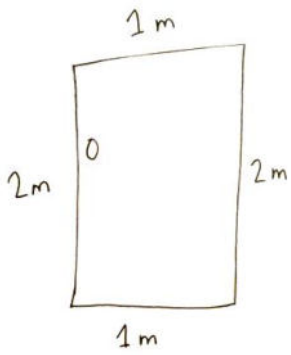
Concept Development (32 minutes)

Materials: (T) 1 piece of 12" × 18" construction paper, torn meter strip (Lesson 6 Template) (S) Meter strip (Lesson 6 Template), 1 piece of 12" × 18" construction paper, personal white board

T: I am throwing a party and want to decorate my house. I will start with my front door and put some ribbon around its edges. How can we figure out how long the ribbon should be?

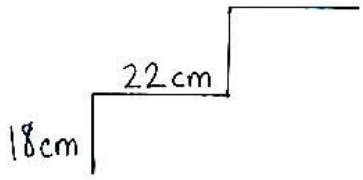
S: Figure out the length around the door using benchmarks like the height of the knob. → Measure around the door with a meter stick and make the ribbon the same length.

T: That is what I did. I used a meter stick to find the measurements. (Draw the door and label each side. The top is 1 meter, the left side is 2 meters, the bottom is 1 meter, and the right side is 2 meters.) How long does the ribbon need to be to go all the way around my door? Share with a partner.



S: 6 m. → I added all four sides and got 6 meters. → I added 2 + 2 + 1 + 1 = 6.

T: I also want to string lights up one side of the steps leading to my front door. Help me figure out the length of the string of lights if they line the edges of the steps.



T: There are two steps. (Draw and label the diagram as shown above.) How many centimeters of lights do I need to line the entire length of both steps? Put your finger on 0 on your meter strip. Slide your finger up to 18 centimeters.

T: To add 22 centimeters, we can think of this meter strip like a **number line**. To make a ten, what part of 22 should we add to 18 first?

S: 2 centimeters.

T: Yes! Slide your finger up 2 more. Where are we on the number line?

S: We are at 20 centimeters.

T: How many more centimeters do we need to slide our finger on the number line?

S: 20 centimeters.

T: Where will our finger stop?

S: At 40 centimeters.

T: Where will we be on the meter strip when we add the second stair? How do you know?

S: We'll be at 80 centimeters, because you need to add 18 + 22 again. → We'll be at 80 centimeters. You just have to double 40 centimeters.

T: I have a string of lights that is 1 meter long. Is it long enough to reach the top of the steps?

S: Yes, because a meter is longer than 80 centimeters. → Yes, because 1 meter is 100 centimeters, and you only need 80 centimeters. → 100 cm – 80 cm = 20 cm left over.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Get students up and moving by using a number line floor mat to illustrate the idea of moving the zero point.

- Invite a student to begin at 4 and jump 25 length units. Students can count on chorally, starting at 4. Encourage them to add 1 to make 5, then count up by tens.
- Ask, "Do you notice a relationship between 0, 4, 25, 29?"

T: I also want to hang a party sign with this piece of string. I want to know the length of the string, but I tore my meter strip, and now it starts at 4 centimeters. (Show torn meter strip.) Can I still use it to measure?

S: Yes. Count the number of length units. → Line the object up and measure from 4 centimeters to the end of the object, then subtract 4 centimeters.

T: Yes! (Guide students to tear their meter strip at 4 centimeters.) Let's try that. Line up your string with the torn meter strip. Where does the string end?

MP.2 S: At 29 centimeters.

T: Now, let's take away 4 centimeters from 29 centimeters. What is the length of the string?

S: The string is 25 centimeters long.

T: Yes! I also ordered a cake, which is the same size as this piece of construction paper. The table I want to put it on is the same size as your desks. Can you figure out the length of the cake and the desk to see how much extra space there will be?

T: With your partner, measure the length of the cake and desk, and then find the difference. Record your answers on your personal white boards.

Students measure and return to the carpet to share their answers.

T: What strategy did you and your partner use to measure the lengths with the torn meter strip?

S: We started at the beginning of our meter strip and counted on. → We lined up the meter strip with the lengths and subtracted 4 centimeters from where the object stopped.

T: What is the difference between the length of the table and the length of the cake? (For this example, assume the cake is 45 centimeters and the desk is 60 centimeters.) Give a complete number sentence.

S: 60 cm – 45 cm = 15 cm.
→ 45 cm + 15 cm = 60 cm.

T: So, we know we have 15 centimeters next to the cake. I'm going to put the cake at the bottom of the table. Let's repeat the process to see how much space we will have above it. Measure the width of the cake and table and find the difference.

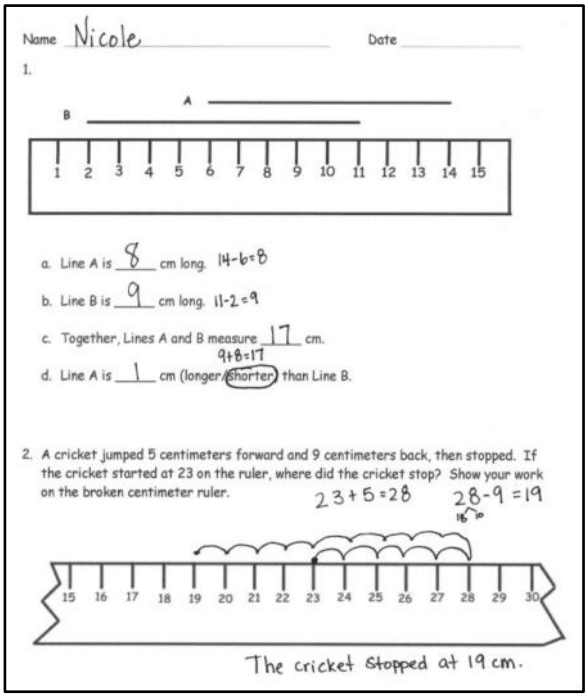
If necessary, repeat the above process with a few more examples:

- Students measure an envelope and an invitation (index card) to see if the envelopes are the right size.
- Students measure 80 centimeters of streamer to see if it will fit across the width of the door, the width of the door being about a meter.

Otherwise, invite students to begin the Problem Set.

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.


Name Nicole Date

1.

a. Line A is 8 cm long. 14-6=8

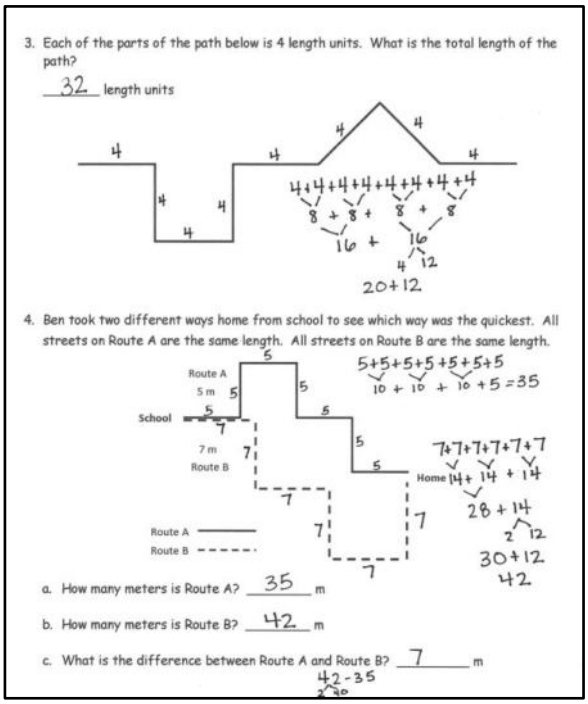
b. Line B is 9 cm long. 11-2=9

c. Together, Lines A and B measure 17 cm. 9+8=17

d. Line A is 1 cm (longer/shorter) than Line B.

2. A cricket jumped 5 centimeters forward and 9 centimeters back, then stopped. If the cricket started at 23 on the ruler, where did the cricket stop? Show your work on the broken centimeter ruler. 23+5=28 28-9=19

The cricket stopped at 19 cm.


3. Each of the parts of the path below is 4 length units. What is the total length of the path?

32 length units

4+4+4+4+4+4+4+4
8 + 8 + 8 + 8
16 + 16
20+12

4. Ben took two different ways home from school to see which way was the quickest. All streets on Route A are the same length. All streets on Route B are the same length.

5+5+5+5+5+5+5
10 + 10 + 10 + 5 = 35

7+7+7+7+7
14 + 14 + 14
28 + 14
30+12
42

a. How many meters is Route A? 35 m

b. How many meters is Route B? 42 m

c. What is the difference between Route A and Route B? 7 m
42-35

Student Debrief (10 minutes)

Lesson Objective: Solve addition and subtraction word problems using the ruler as a number line.

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.

- Explain to your partner how you solved Problem 1. What similarities or differences were there in your solution methods?
- What strategies did you use to solve Problem 2? Invite students to compare their drawings.
- How can you solve a problem with a ruler that does not start at zero?
- How is a ruler similar to a **number line**?
- Look at Problem 4. What math strategies did you need to know in order to solve this problem? (Counting on, skip counting, adding, and subtracting.)
- How did we use addition and subtraction today?

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Invite students to come forward and model differing solution methods for Problem 4(c) on the class board.

Did anyone arrive at the same solution but in a different way? Can you explain how you solved it?

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.

A

Number Correct: _____

Making a Meter

1.	10 cm + ____ = 100 cm	
2.	30 cm + ____ = 100 cm	
3.	50 cm + ____ = 100 cm	
4.	70 cm + ____ = 100 cm	
5.	90 cm + ____ = 100 cm	
6.	80 cm + ____ = 100 cm	
7.	60 cm + ____ = 100 cm	
8.	40 cm + ____ = 100 cm	
9.	20 cm + ____ = 100 cm	
10.	21 cm + ____ = 100 cm	
11.	23 cm + ____ = 100 cm	
12.	25 cm + ____ = 100 cm	
13.	27 cm + ____ = 100 cm	
14.	37 cm + ____ = 100 cm	
15.	38 cm + ____ = 100 cm	
16.	39 cm + ____ = 100 cm	
17.	49 cm + ____ = 100 cm	
18.	50 cm + ____ = 100 cm	
19.	52 cm + ____ = 100 cm	
20.	56 cm + ____ = 100 cm	
21.	58 cm + ____ = 100 cm	
22.	62 cm + ____ = 100 cm	

23.	____ + 62 cm = 1 m	
24.	____ + 72 cm = 1 m	
25.	____ + 92 cm = 1 m	
26.	____ + 29 cm = 1 m	
27.	____ + 39 cm = 1 m	
28.	____ + 59 cm = 1 m	
29.	____ + 89 cm = 1 m	
30.	____ + 88 cm = 1 m	
31.	____ + 68 cm = 1 m	
32.	____ + 18 cm = 1 m	
33.	____ + 15 cm = 1 m	
34.	____ + 55 cm = 1 m	
35.	44 cm + ____ = 1 m	
36.	55 cm + ____ = 1 m	
37.	88 cm + ____ = 1 m	
38.	1 m = ____ + 33 cm	
39.	1 m = ____ + 66 cm	
40.	1 m = ____ + 99 cm	
41.	1 m – 11 cm = ____	
42.	1 m – 15 cm = ____	
43.	1 m – 17 cm = ____	
44.	1 m – 19 cm = ____	

B

Number Correct: _____

Improvement: _____

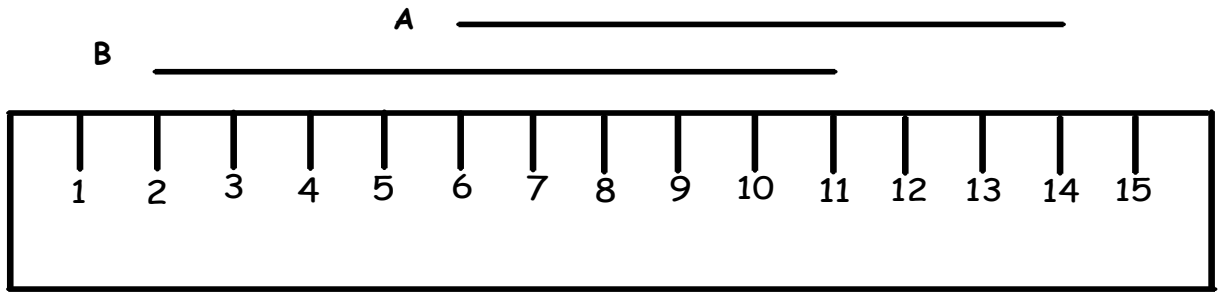
Making a Meter

1.	1 cm + ____ = 100 cm	
2.	10 cm + ____ = 100 cm	
3.	20 cm + ____ = 100 cm	
4.	40 cm + ____ = 100 cm	
5.	60 cm + ____ = 100 cm	
6.	80 cm + ____ = 100 cm	
7.	90 cm + ____ = 100 cm	
8.	70 cm + ____ = 100 cm	
9.	50 cm + ____ = 100 cm	
10.	30 cm + ____ = 100 cm	
11.	31 cm + ____ = 100 cm	
12.	33 cm + ____ = 100 cm	
13.	35 cm + ____ = 100 cm	
14.	37 cm + ____ = 100 cm	
15.	39 cm + ____ = 100 cm	
16.	49 cm + ____ = 100 cm	
17.	59 cm + ____ = 100 cm	
18.	60 cm + ____ = 100 cm	
19.	62 cm + ____ = 100 cm	
20.	66 cm + ____ = 100 cm	
21.	68 cm + ____ = 100 cm	
22.	72 cm + ____ = 100 cm	

23.	____ + 72 cm = 1 m	
24.	____ + 82 cm = 1 m	
25.	____ + 28 cm = 1 m	
26.	____ + 38 cm = 1 m	
27.	____ + 48 cm = 1 m	
28.	____ + 45 cm = 1 m	
29.	____ + 43 cm = 1 m	
30.	____ + 34 cm = 1 m	
31.	____ + 24 cm = 1 m	
32.	____ + 14 cm = 1 m	
33.	____ + 12 cm = 1 m	
34.	____ + 10 cm = 1 m	
35.	11 cm + ____ = 1 m	
36.	33 cm + ____ = 1 m	
37.	55 cm + ____ = 1 m	
38.	1 m = ____ + 22 cm	
39.	1 m = ____ + 88 cm	
40.	1 m = ____ + 99 cm	
41.	1 m – 1 cm = ____	
42.	1 m – 5 cm = ____	
43.	1 m – 7 cm = ____	
44.	1 m – 17 cm = ____	

Name _____ Date _____

1.



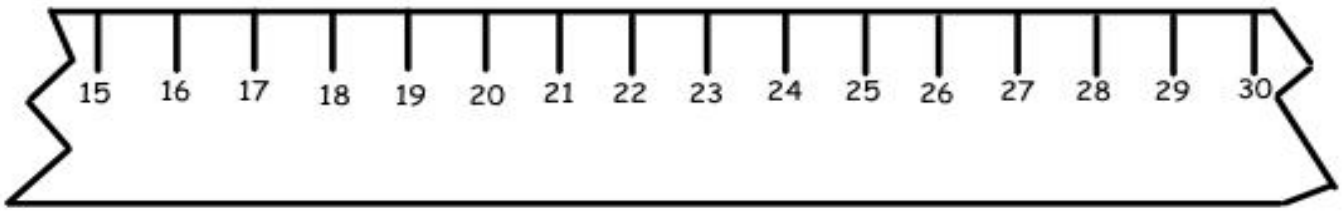
a. Line A is _____ cm long.

b. Line B is _____ cm long.

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

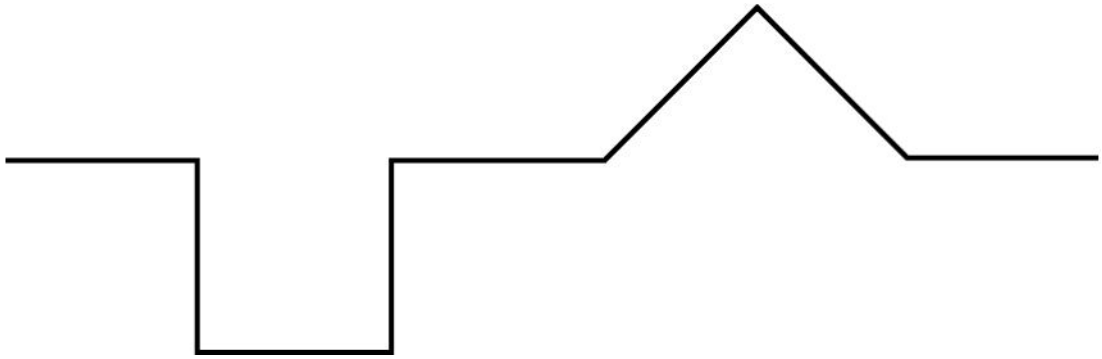
d. Line A is _____ cm (longer/shorter) than Line B.

2. A cricket jumped 5 centimeters forward and 9 centimeters back, and then stopped. If the cricket started at 23 on the ruler, where did the cricket stop? Show your work on the broken centimeter ruler.

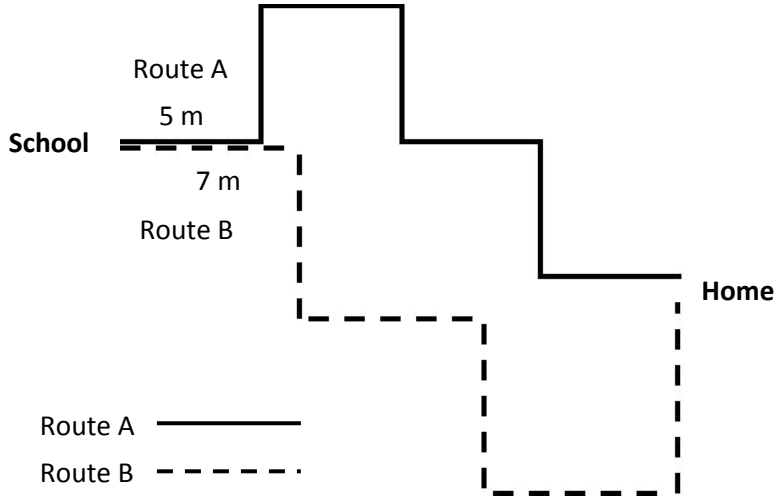


3. Each of the parts of the path below is 4 length units. What is the total length of the path?

_____ length units



4. Ben took two different ways home from school to see which way was the quickest. All streets on Route A are the same length. All streets on Route B are the same length.



a. How many meters is Route A? _____ m

b. How many meters is Route B? _____ m

c. What is the difference between Route A and Route B? _____ m

Name _____ Date _____

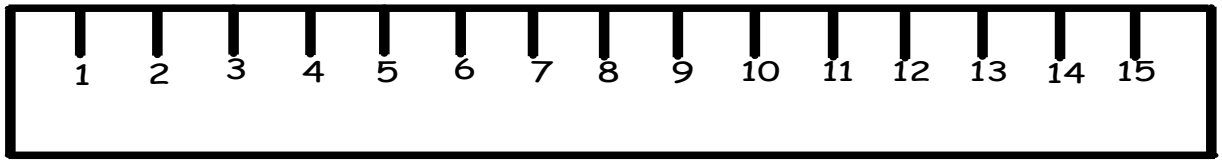
1. Use the ruler below to draw one line that begins at 2 cm and ends at 12 cm. Label that line R. Draw another line that begins at 5 cm and ends at 11 cm. Label that line S.

   a. Add 3 cm to Line R and 4 cm to Line S.

   b. How long is Line R now? _____ cm

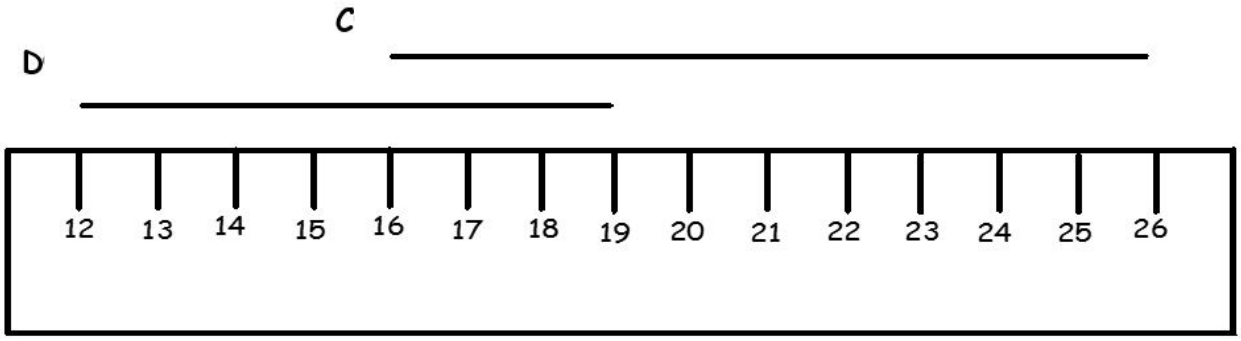
   c. How long is Line S now? _____ cm

   d. The new Line S is _____ cm (shorter/longer) than the new Line R.



Name _____ Date _____

1.



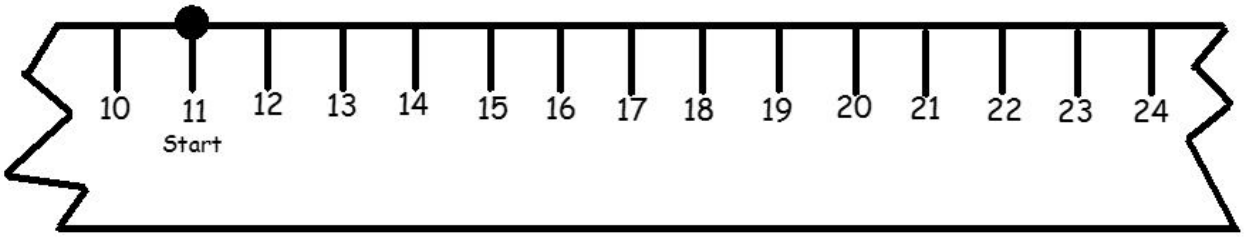
a. Line C is _____ cm.

b. Line D is _____ cm.

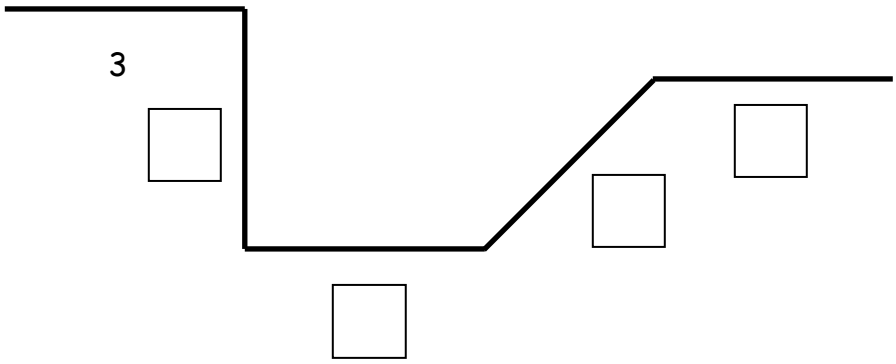
c. Lines C and D are _____ cm.

d. Line C is _____ cm (longer/shorter) than Line D.

2. An ant walked 12 centimeters to the right on the ruler and then turned around and walked 5 centimeters to the left. His starting point is marked on the ruler. Where is the ant now? Show your work on the broken ruler.



3. All of the parts of the path below are equal length units.



a. Fill in the empty boxes with the lengths of each side.

b. The path is _____ length units long.

c. How many more parts would you need to add for the path to be 21 length units long?

_____ parts

4. The length of a picture is 67 centimeters. The width of the picture is 40 centimeters. How many more centimeters is the length than the width?