Lesson Overview

LESSON 23

Estimate and Measure Length

Lesson Objectives

Content Objectives

- Estimate length in inches, centimeters, feet, and meters.
- Use benchmark objects when estimating.

Language Objectives

- Define the key vocabulary term *estimate* when discussing measurement with a partner.
- Justify conclusions and communicate conclusions to others.

Prerequisite Skills

- Measure length in inches and centimeters.
- Add numbers less than 10.

Standards for Mathematical Practice (SMP)

SMPs 1, 2, 3, 4, 5, and 6 are integrated in every lesson through the *Try-Discuss-Connect* routine.*

In addition, this lesson particularly emphasizes the following SMPs:

5 Use appropriate tools strategically.

6 Attend to precision.

*See page 303k to see how every lesson includes these SMPs.

Lesson Vocabulary

- **estimate (noun)** a close guess made using mathematical thinking.
- **estimate (verb)** to make a close guess based on mathematical thinking.

Learning Progression

In Grade 1 students develop their understanding of measuring by measuring the length of objects in inches. This prepares them to make reasonable estimates of lengths in inches.

In Grade 2 students learn more about measuring in standard units as they measure the lengths of objects to the nearest inch, foot, centimeter, yard, and meter. They select and use appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes in order to measure the lengths of objects. They describe the inverse relationship between the size of a unit and the number of units needed to measure an object.

In this lesson students estimate the lengths of objects using the standard units of inches, feet, centimeters, and meters. They compare their estimates to actual measurements to determine if their estimates are reasonable. They learn that being able to estimate lengths is good practice for estimating the solutions to many types of math problems.

In Grade 3 estimating in appropriate units continues to be important as students begin to measure liquid volume and mass in addition to lengths. Students apply what they know about measuring lengths to problems involving area. Students extend their estimation skills by estimating liquid volume, mass, and intervals of time.

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Lesson Pacing Guide

Whole Class Instruction

SESSION 1 **Explore** *45–60 min*	**Interactive Tutorial*** *(Optional)* *Prerequisite Review:* Measure Lengths in Centimeters **Estimating and Measuring Length** • Start *5 min* • Try It *10 min* • Discuss It *10 min* • Connect It *15 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 553–554
SESSION 2 **Develop** *45–60 min*	**Using Different Units to Estimate Length** • Start *5 min* • Try It *10 min* • Discuss It *10 min* • Picture It *5 min* • Connect It *10 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 559–560 **Fluency** Using Different Units to Estimate Length
SESSION 3 **Refine** *45–60 min*	**Estimating and Measuring Length** • Start *5 min* • Example *10 min* • Apply It *25 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 563–564
SESSION 4 **Refine** *45–60 min*	**Estimating and Measuring Length** • Start *5 min* • Apply It *15 min* • Small Group Differentiation *20 min* • Close: Exit Ticket *5 min*	**Lesson Quiz** or **Digital Comprehension Check**

Lesson Materials

Lesson *(Required)*	*Per student:* inch ruler, centimeter ruler
Activities	*Per student:* inch ruler; centimeter ruler; 6 strips of paper cut to different lengths; meter stick, or measuring tape *Per group:* cards with different measurements on them, inch ruler, centimeter ruler, meter stick
Math Toolkit	play quarters, centimeter cubes

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

Teacher Toolbox

Small Group Differentiation

PREPARE

Ready Prerequisite Lesson

Grade 1
- Lesson 32 Understand Length Measurement

RETEACH

Tools for Instruction

Grade 1
- Lesson 32 Measuring Length

Grade 2
- Lesson 23 Estimate and Measure Lengths

REINFORCE

Math Center Activities

Grade 2
- Lesson 23 Estimate Lengths
- Lesson 23 Estimated and Actual Lengths

EXTEND

Enrichment Activity

Grade 2
- Lesson 23 Tall Towers

i-Ready

Independent Learning

PERSONALIZE

i-Ready Lessons*

Grade 2
- Estimate Lengths in Inches
- Estimate Lengths in Centimeters
- Practice: Estimate Lengths

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LESSON 23

Connect to Family, Community, and Language Development

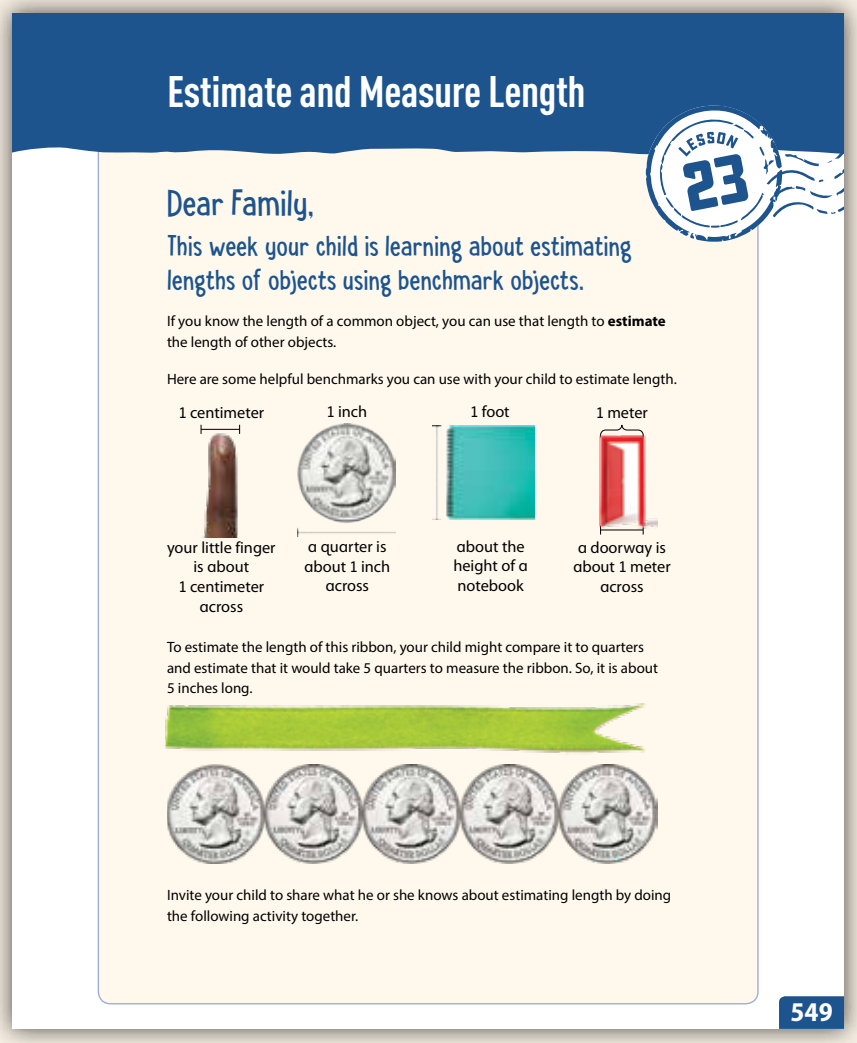
The following activities and instructional supports provide opportunities to foster school, family, and community involvement and partnerships.

Connect to Family

Use the **Family Letter**—which provides background information, math vocabulary, and an activity—to keep families apprised of what their child is learning and to encourage family involvement.

Available in Spanish

Teacher Toolbox



Estimate and Measure Length

LESSON 23

Dear Family,

This week your child is learning about estimating lengths of objects using benchmark objects.

If you know the length of a common object, you can use that length to **estimate** the length of other objects.

Here are some helpful benchmarks you can use with your child to estimate length.

1 centimeter — your little finger is about 1 centimeter across

1 inch — a quarter is about 1 inch across

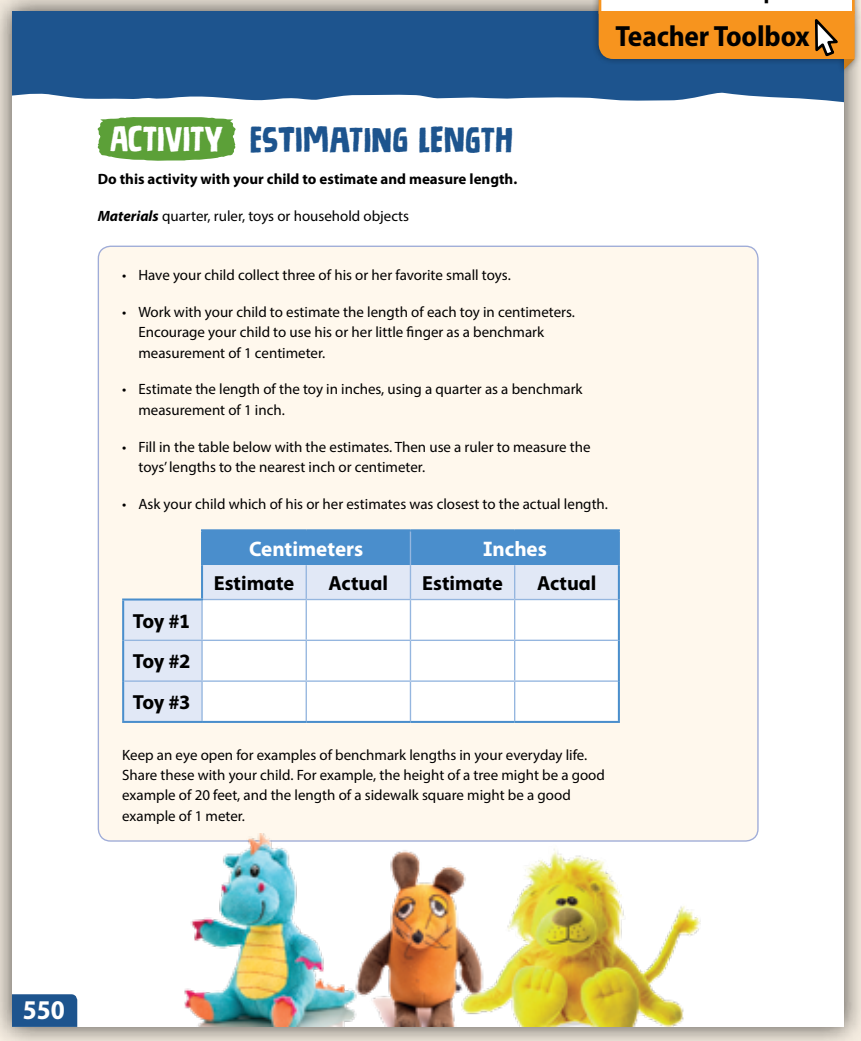
1 foot — about the height of a notebook

1 meter — a doorway is about 1 meter across

To estimate the length of this ribbon, your child might compare it to quarters and estimate that it would take 5 quarters to measure the ribbon. So, it is about 5 inches long.

Invite your child to share what he or she knows about estimating length by doing the following activity together.

549



ACTIVITY ESTIMATING LENGTH

Do this activity with your child to estimate and measure length.

Materials quarter, ruler, toys or household objects

- Have your child collect three of his or her favorite small toys.
- Work with your child to estimate the length of each toy in centimeters. Encourage your child to use his or her little finger as a benchmark measurement of 1 centimeter.
- Estimate the length of the toy in inches, using a quarter as a benchmark measurement of 1 inch.
- Fill in the table below with the estimates. Then use a ruler to measure the toys' lengths to the nearest inch or centimeter.
- Ask your child which of his or her estimates was closest to the actual length.

	Centimeters		Inches	
	Estimate	Actual	Estimate	Actual
Toy #1				
Toy #2				
Toy #3				

Keep an eye open for examples of benchmark lengths in your everyday life. Share these with your child. For example, the height of a tree might be a good example of 20 feet, and the length of a sidewalk square might be a good example of 1 meter.

550

Goal

The goal of the Family Letter is to help students explore estimating lengths of objects by using other commonly used objects as a benchmark.

Activity

Understanding how to apply what they know about units of measurement when measuring common objects will help students estimate the length of other objects. Look at the *Estimating Length* activity and adjust it if necessary to connect with your students.

Math Talk at Home

Encourage students and their family members to think of situations in which they can estimate the length of a household object by using another common object as a benchmark.

Conversation Starters Below are additional conversation starters students can write in their Family Letter or math journal to engage family members:

- *Have you ever used any of the benchmarks in this activity to estimate the length of an object?*
- *In what types of situations have you used these benchmarks?*
- *What are some benchmarks you use to estimate the length of an object?*

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Connect to Community and Cultural Responsiveness

Use these activities to connect with and leverage the diverse backgrounds and experiences of all students.

Sessions 1 and 2 **Use anytime during the sessions.**

- Have students make a class collection of favorite personal objects. Ask students to identify small objects that they would like to include in the collection. While looking at their objects, have students provide an estimate of the measurement of their objects in inches and centimeters. Instruct them to use their finger and quarters as benchmarks.
- Encourage students to use the term *estimate* to express their findings. Provide the following sentence frame: *I estimate the length of* _____ *is* _____.

  Then have students verify their estimates by measuring their objects using a ruler. Record students' findings. Have them add their objects to the class collection. Point out that, as the collection becomes fuller, knowing the measurements of additional objects is important in order to make sure the objects will fit within the allotted space.

Session 3 **Use anytime during the session.**

- Ask students to create a question about estimates on an index card. On one side of the card, have them write an object that can be found in the classroom. On the other side, have them write the following question: *Which is the best estimate for the length?*

  Under the question, have students provide two answer options, such as: *the distance across your little finger, the distance across a quarter, the height of a math book,* or *the distance across a door*.

  When students are finished with their cards, collect all of the cards and mix them up. Give each pair of students two cards. Have students take turns using the cards to ask each other questions. Have the student answering each question justify his or her answer.

Connect to Language Development

For ELLs, use the Differentiated Instruction chart to plan and prepare for specific activities in every session.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 1
Use with *Try It*.

Levels 1–3	Levels 2–4	Levels 3–5
Listening/Speaking Have students chorally read the ***Try It*** problem. Ask them to work with a partner to place one quarter on the car. Ask: *Is one quarter enough to estimate the length of the car? How many more do you think you will need?* Have students complete this sentence frame: __2__ *quarters is a good estimate.*	**Speaking/Writing** Have students chorally read the ***Try It*** problem. Ask them to work with a partner to brainstorm the first step for solving the problem. Instruct students to write down the first step that helped them get started. Have them work together to solve the problem and come up with an oral explanation using the term *estimate*. Once they have completed the problem, direct each set of partners to pair up with another set of partners. Each set of partners will take turns sharing their answer using the term *estimate* and reading aloud the sentence they wrote explaining their first step.	**Reading/Writing** Have students take turns reading the ***Try It*** problem with a partner. Encourage them to generate a written response using one or two sentences that support their answer. Responses should include the terms *estimate* and *inches*. Have students read aloud their sentences to another set of partners.

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LESSON 23

SESSION 1 Explore

Purpose In this session, students connect their previous knowledge about measuring length in standard units to estimating length using those units. They explore and share solution strategies for estimating the length of a toy car in inches. They look ahead to using centimeters to estimate the length of other objects.

Start

Connect to Prior Knowledge

Materials For each student: inch ruler

Why Support students' knowledge of measuring length in inches, foreshadowing using a benchmark unit for an inch to estimate the length of objects.

How Have students measure the length of their shoe in inches.

Use the inch ruler.

Measure the length of your shoe to the nearest inch.

Solutions

Answers will vary; Possible answer: 7 inches

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that a quarter is about 1 inch across.

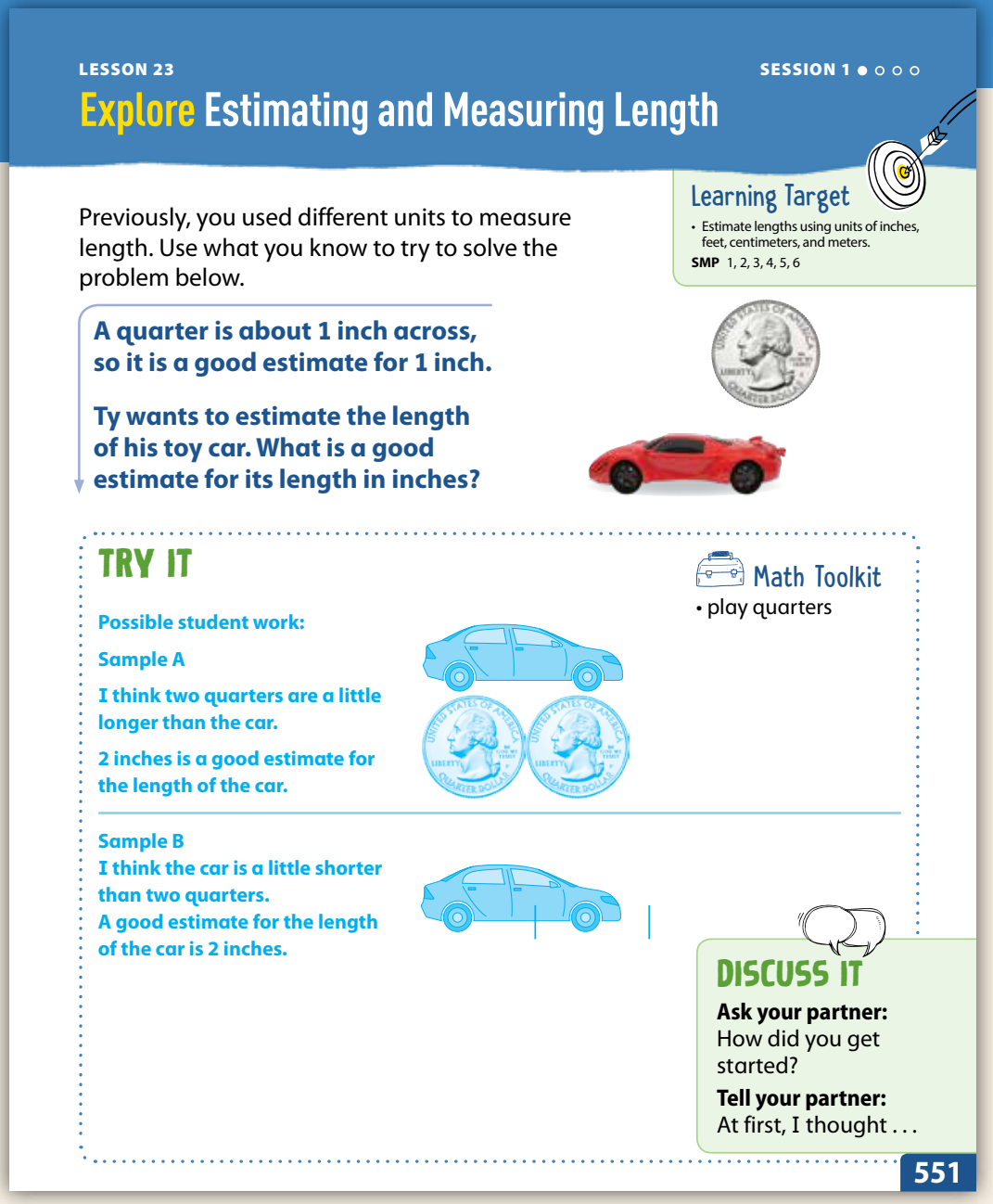
DISCUSS IT

Support Partner Discussion

To reinforce the concept of estimation, encourage students to use the word *estimate* as they talk to each other.

Look for, and prompt as necessary, understanding that:

- a quarter is a reasonable estimate of 1 inch
- the length of the toy car is greater than one quarter
- a quarter may be used to estimate length in inches



LESSON 23 SESSION 1 ● ○ ○ ○

Explore Estimating and Measuring Length

Learning Target
- Estimate lengths using units of inches, feet, centimeters, and meters.

SMP 1, 2, 3, 4, 5, 6

Previously, you used different units to measure length. Use what you know to try to solve the problem below.

A quarter is about 1 inch across, so it is a good estimate for 1 inch.

Ty wants to estimate the length of his toy car. What is a good estimate for its length in inches?

TRY IT

Possible student work:

Sample A

I think two quarters are a little longer than the car.

2 inches is a good estimate for the length of the car.

Sample B

I think the car is a little shorter than two quarters.
A good estimate for the length of the car is 2 inches.

Math Toolkit
- play quarters

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: At first, I thought . . .

551

Common Misconception Look for students who are not comfortable with finding an estimate rather than an exact measurement. As they present solutions, have students specify how their solutions are close to, but not the exact length of, the toy car.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- using quarters lined up next to one another to represent the length
- using one quarter to make consecutive hash marks to represent the length
- drawing a line segment the length of the car and estimating its length using quarters or hash marks
- making a ruler by using a quarter to mark inches and then estimating the length of the car using the ruler

Support Whole Class Discussion

Prompt students to note the relationship between the units of length used in each model and the units of length given in the problem.

Ask *How do [student name]'s and [student name]'s models each show the estimate for an inch? The estimate for the length of the car?*

Listen for The quarter estimates each inch; lining up the inches and counting gives an estimate for the length of the car.

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CONNECT IT

1 LOOK BACK

Look for understanding that by using the fact that a quarter is 1 inch across, the length of Ty's car can be estimated as 2 inches.

Hands-On Activity

Estimating and measuring lengths in inches.

If . . . *students are unsure about the concept of estimating length in inches,*

Then . . . *use this activity to have them estimate lengths and compare estimates to actual lengths.*

Materials For each student: inch ruler and 6 strips of paper cut to different lengths

- Have students estimate the length of the smallest strip of paper in inches. Then students should measure the strip with a ruler and write its actual length on the strip.
- Guide students to use the first strip of paper to estimate the length of a longer strip of paper. They should measure the second strip and write its length on it.
- Students continue estimating, measuring, and recording with all the strips of paper.
- Have volunteers share how they estimated and how close their estimates were to actual lengths.
- If time permits, have students work in pairs to exchange their 2 longest paper strips and estimate their lengths. The written measurements on the strips should be facedown.

2 LOOK AHEAD

Point out that there may be other objects that have lengths close to standard units of 1 centimeter, 1 foot, or 1 meter and that these objects can be used to estimate the lengths.

Students should be able to recognize that since the marker is about 14 centimeters long and the pencil box is much longer than the marker, the length of the pencil box is greater than 14 centimeters.

CONNECT IT

1 LOOK BACK

What is a good **estimate** for the length of Ty's car? 2 inches

2 LOOK AHEAD

You can use other objects to help you **estimate** lengths.

1 centimeter

your little finger is about 1 centimeter across

1 inch

a quarter is about 1 inch across

1 foot

about the length of a loaf of bread

1 meter

a door is about 1 meter across

Julia knows a marker is about 14 centimeters long. Is the length of the pencil case more or less than 14 centimeters? Explain how you know.

More; Possible explanation: The marker is about 14 centimeters. The pencil case is much longer than the marker, so it is longer than 14 centimeters.

3 REFLECT

Hannah estimates that Julia's pencil case is 28 centimeters long. Is this a good estimate? Explain.

No; Possible explanation: Two markers would be about 28 cm long. Two markers would be much longer than the pencil case.

Close: Exit Ticket

3 REFLECT

Look for understanding that 28 centimeters would be the length of two markers placed end to end. The length of the two markers would be much greater than the length of the pencil box, so 28 centimeters is not a good estimate for the length of the pencil box.

Common Misconception **If** students say 28 centimeters is a good estimate for the length of Julia's pencil box, **then** have them use a ruler to draw a 28-centimeter line segment next to the pencil box, lined up from the bottom of the pencil box, to illustrate that 28 centimeters is not close to the length of the pencil box.

Real-World Connection

Ask students if they can think of any situations in which estimates of lengths might be made. Have volunteers share their ideas. Examples include estimating how long a table is, estimating the distance from the classroom door to the drinking fountain, and estimating the length of a piece of string from which students' art drawings are hanging in the classroom.

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Solutions

Support Vocabulary Development

1 Ask students to review the problems they have worked on during this session by circling the word *estimate* each time it appears in a problem. Remind them that they have not used a ruler to find the answer to any problem during this session. Based on that, what do they think the term *estimate* could mean? Have them discuss possible answers with their partners. Use think-pair-share to have students share their responses. If needed, clarify that the word *estimate* means *a close guess*.

2 Have students circle the term *about* in the problem. Ask: *Is the word* about *similar to the word* exact*? Is it similar to the word* estimate*?* Provide students an opportunity to share their answers. Clarify that the word *about* is related to the word *estimate*.

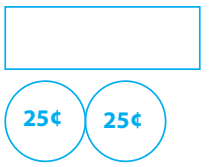
Supplemental Math Vocabulary

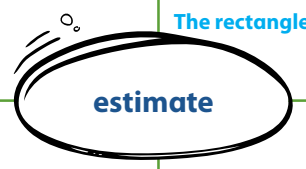
- *benchmark object*
- *compare*

Name: _____ LESSON 23 SESSION 1

Prepare for Estimating and Measuring Length

1 Think about what you know about estimating. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can. **Possible answers:**

In My Own Words	My Illustrations
to make a close guess using math thinking	 The rectangle is about 2 inches long.
Examples	**Non-Examples**
A quarter is about one inch across. My foot is a little bit longer than 8 quarters, so my foot is about 8 inches long.	An exact measurement is not an estimate.



2 Balin knows the stapler is about 15 centimeters long. Is the length of the glasses more or less than 15 centimeters? Explain.

Less; Possible explanation: The stapler is about 15 centimeters. The glasses are not as long as the stapler, so a good estimate is that they are less than 15 centimeters long.

553

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3 Assign problem 3 to provide another look at estimating length.

This problem is very similar to the problem about estimating the length of a toy car. In both problems, students are given a picture showing the actual size of a quarter and a picture of another object. They are asked to find a good estimate for the length of the second object in inches. This question asks students to find a good estimate for the length of a toy boat.

Students may want to use quarters or inch tiles.

Suggest that students read the problem three times, asking themselves one of the following questions each time:

- *What is this problem about?*
- *What is the question I am trying to answer?*
- *What information is important?*

Solution: The length of the toy boat is a little less than the length of 3 quarters. So, 3 inches is a good estimate for the length of the boat.
Medium

4 Have students solve the problem a different way to check their answer.

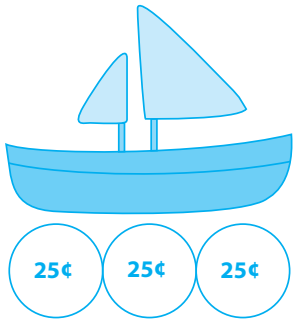
3 Solve the problem. Show your work.

Since a quarter is about 1 inch across, it is a good estimate for 1 inch.

Gena wants to estimate the length of the toy boat. What is a good estimate for its length in inches?

Possible student work using pictures:

I think three quarters are a little longer than the boat.



Solution **3 inches is a good estimate for the length of the boat.**

4 Check your answer. Show your work.

Possible student work:

I lined up 3 quarters from one end of the boat to the other.

A good estimate for the length of the boat is 3 inches.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 2
Use with *Try It*.

Levels 1–3

Speaking/Writing Have students chorally read the ***Try It*** problem. Ask them to write the unit they will use to estimate the length of the stamp.

Encourage students to work together to talk through each step using the words *first*, *next*, and *then*. When complete, instruct students to write their answers using the following sentence frames:

- *My little finger fits* ___2___ *times across the stamp.*
- *A good estimate is* ___2___ centimeters.
- ___1___ *quarter is longer, so* ___1___ *inch is a good estimate.*

Levels 2–4

Speaking/Writing Have students chorally read the ***Try It*** problem. Ask them to write the unit they will use to estimate the length of the stamp.

Encourage students to write out the steps using the words *first*, *next*, and *then*. Ask students to include the words *estimate* and *length* at least once in their written work.

When finished, have students read aloud their sentences to a partner.

Levels 3–5

Reading/Writing Have students take turns reading the ***Try It*** problem with a partner. Ask them to decide who will estimate using centimeters, and who will estimate using inches. Have each student write out the steps using the words *first*, *next*, and *then*. Ask students to include the words *estimate*, *length,* and *centimeters* or *inches* at least once in their written work.

When finished, instruct students to share their work with another set of partners and revise their writing if necessary.

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LESSON 23

SESSION 2 Develop

Purpose In this session, students solve a problem that requires them to estimate the length of a postage stamp. Students share strategies and model estimation of length using benchmark objects they choose. The purpose of this problem is to have students develop strategies for estimating length.

Start

Connect to Prior Knowledge

Materials For each student: centimeter ruler

Why Support students' knowledge of estimating and measuring the length of objects to the nearest centimeter.

How Have students estimate and measure the length of their thumb to the nearest centimeter.

Estimate the length of your thumb in centimeters. Write the estimate.

Measure the length of your thumb in centimeters. Write the length.

Solutions

Answers will vary; possible estimate: 3 centimeters; Possible measurement: 4 centimeters

Develop Language

Why Clarify the meaning of the term *estimate*.

How Say: *When you estimate, you make a close guess based on information.* On the board write this sentence frame: *A/An* ___*benchmark*___ *is a good estimate for a/an* ___*unit of length*___ . Have students chorally read aloud the sentence frame with a variety of examples using benchmarks shown throughout the lesson such as the distance across a little finger or a quarter, the height of a math book, or the distance across a door. Students should include the unit of length for which each benchmark is a good estimate.

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, help them define the word *estimate*.

Ask *About how far across is your little finger? What makes a good estimate?*

Develop Using Different Units to Estimate Length

Read and try to solve the problem below.

1 centimeter is a good estimate for the distance across your little finger.

What is a good estimate for the length of this stamp?

TRY IT

Possible student work:

Sample A

My little finger fits a little more than 2 times across the stamp.

A good estimate for the length of the stamp is 2 centimeters.

Sample B

I can use a quarter.

The quarter is about an inch across, and the stamp is about the same as the quarter. So, 1 inch is a good estimate for the length of the stamp.

Math Toolkit
- play quarters
- centimeter cubes

DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: I'm not sure how to find the answer because . . .

DISCUSS IT

Support Partner Discussion

Encourage students to explain the strategy they used as they discuss their estimates.

Support as needed with questions such as:

- *Which object did you choose to estimate with? Why?*
- *How is your partner's way of estimating length different from yours?*

Common Misconception Look for students who use a benchmark object to estimate but use an incorrect standard unit for the benchmark object when they give the estimated length for the stamp.

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Select and Sequence Student Solutions

One possible order for whole class discussion:

- placing their little finger repeatedly under the length of the stamp
- placing a quarter under the length of the stamp
- writing hash marks to mark the distance across their little finger in order to show an estimate that is less than the length of the stamp
- writing hash marks to mark the distance across each quarter in order to show an estimate that is greater than the length of the stamp

Support Whole Class Discussion

Compare and connect the estimates of the length of the stamp and the benchmark objects used to make the estimates.

Ask *Is it easier to use a larger benchmark object or a smaller one? Why?*

Listen for With the quarter, you only have to line it up one time. With my finger, I have to keep track of where it starts and the number of times I use it. Using a larger benchmark object is easier because I only have to place it once.

PICTURE IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- benchmark objects measured in standard units
- lining up benchmark objects to measure
- estimating the total length in standard units

Ask *Which object do you think would be easiest to use to estimate the length of the stamp? Why?*

Listen for I think the quarter would be the easiest to use. The quarter is 1 inch and since the stamp is almost as long as the quarter when they are lined up, I know that 1 inch is a good estimate for the length of the stamp.

For using other known objects to estimate length, prompt students to describe how each object was used to estimate the length of the stamp.

- *Is the length of the stamp less than or greater than the the quarter's distance across? Does your answer affect the estimate for the length of the stamp? Explain.*
- *How many times is the little finger placed to estimate the length of the stamp? How do you find the estimate for the length of the stamp?*

Explore different ways to understand estimating length.

1 centimeter is a good estimate for the distance across your little finger.

What is a good estimate for the length of this stamp?

PICTURE IT

You can use other objects you know to estimate lengths.

Think about the distance across the middle of the quarter and the length of the stamp.

Think about the distance across your little finger and the length of the stamp.

Deepen Understanding

Use Objects to Estimate Length

SMP 5 Use appropriate tools strategically.

When discussing objects to estimate the length of the stamp, prompt students to consider how the quarter and the little finger help to estimate length.

Ask *What units do each of the benchmark objects represent?*

Listen for The quarter is about 1 inch across. The little finger is about 1 centimeter across.

Ask *Which object would be best for estimating the number of inches between 2 plates on a table? For estimating the side of a rectangle that is 4 centimeters long?*

Listen for I could mark inches with quarters to estimate the space between the plates. I could use my little finger to estimate the length of a side of a rectangle that is 4 centimeters long.

Ask *Would you use more or fewer quarters than little fingers when estimating the length of the stamp? Why?*

Listen for The quarter is farther across, so I would use fewer of them.

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CONNECT IT

- Remind students that one thing that is alike about the representations is that they all can be used to estimate the length of the stamp.
- Explain that on this page, students will use those representations to learn how to estimate length.

Monitor and Confirm

1 – 2 Check for understanding that:

- using a benchmark object measured in inches can be used to estimate the length of a postage stamp as 1 inch
- using a benchmark object measured in centimeters can be used to estimate the length of a postage stamp as 2 centimeters

Support Whole Class Discussion

3 Be sure students understand that this problem is asking them to check their estimate of the length of the stamp by measuring the stamp with a ruler.

Ask *How can you use a centimeter ruler to check your estimate for the length of the stamp?*

Listen for I know how to measure the stamp using a ruler. When I line up one end of the stamp with the 0 mark on the ruler, the other end of the stamp lines up with 2 centimeters. My estimate in centimeters also was 2 centimeters.

4 REFLECT Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to estimate length.

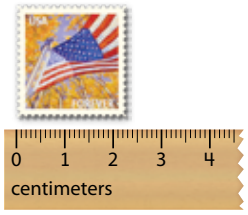
1 Look at **Picture It** on the previous page. What is a good estimate of the length of the stamp in inches?

The stamp is about 1 inch(es) long.

2 Look at **Picture It** on the previous page. What is a good estimate of the length of the stamp in centimeters?

The stamp is about 2 centimeter(s) long.

3 You can use a ruler to measure the length. What is the length of the stamp to the nearest centimeter? 2 centimeters



4 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It**. Which models or strategies do you like best for estimating length? Explain.

Possible answer: I like to use my finger to estimate in centimeters. I know it is about 1 cm across. I can think of that length to estimate the length of an object.

Hands-On Activity

Estimate and measure lengths in centimeters.

If . . . *students are unsure about the concept of estimating length in centimeters,*

Then . . . *use this activity to have them estimate lengths and compare estimates to actual lengths.*

Materials For each student: centimeter ruler and strips of paper cut to different lengths

- Have students estimate the length of one of the strips of paper in centimeters. Then students should measure the strip and write its actual length on the strip.
- Guide students to use the first strip of paper to estimate the length of another strip of paper. They should measure the second strip and write its length on it.
- Students continue estimating, measuring, and recording with all the strips of paper.
- When all the strips of paper have been labeled, ask: *How did this activity help you practice making reasonable estimates?*

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APPLY IT

For all problems, encourage students to record how they found their estimate or measurement for the length of each object.

5 4 or 5 inches; Students could estimate the length of the ribbon by indicating that the ribbon is a little longer than 2 hair clips. Since each hair clip is 2 inches long, the ribbon is about 2 inches + 2 inches = 4 inches or 2 inches + 2 inches + 1 inch = 5 inches long.

6 5 inches; Students should measure the length of the ribbon by lining up the left end of the ribbon above the zero mark on the ruler and then reading the number of inches shown on the ruler above the right side of the ribbon.

7 Answers will vary; Students can estimate the length of their teacher's desk by thinking about a benchmark item for a foot, such as a loaf of bread, and then estimate the number of that benchmark object that would fit across the length of the desk.

Close: Exit Ticket

8 Answers will vary.

Students' solutions should indicate understanding of:

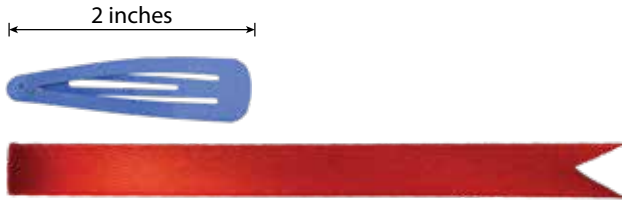
- using a benchmark item for a meter, such as the opening of a doorway, to estimate length in meters
- measuring length using a meter stick

Error Alert **If** students have difficulty keeping track of the number of meters that they have measured for their classroom wall, **then** suggest that they make tally marks or put a sticky note on the wall for each time they place the meter stick.

APPLY IT

Use what you just learned to solve these problems.

Use the hair clip and ribbon to answer problems 5 and 6.



5 Estimate the length of the ribbon.

The ribbon is about 4 or 5 inches long.

6 Use an inch ruler to measure the length of the ribbon.

What is the actual length? 5 inches long

7 Estimate the length of your teacher's desk in feet. Then find its actual length. Answers will vary.

Estimate: about _____ feet Actual: _____ feet

8 Estimate the length of a classroom wall in meters. Then find its actual length. Answers will vary.

Estimate: about _____ meters Actual: _____ meters

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Solutions

1. The marker is about 4 inches long. Estimates will vary.
Medium

2. 4 inches
Medium

Name: _____ LESSON 23 SESSION 2

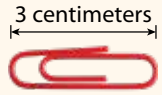
Practice Using Different Units to Estimate Length

Study the Example showing how to estimate length.
Then solve problems 1–8.

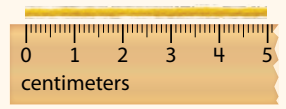
EXAMPLE

Estimate the length of the yarn. Then find the actual length.

Use the paper clip to estimate the length of the yarn. It looks like about 2 paper clips would fit above the yarn. So, the estimate is about 6 centimeters.



Then use the ruler to measure the actual length of the yarn. So, the actual length is 5 centimeters.



1. Use the eraser to estimate the length of the marker.

The marker is about 4 inches long.
Estimates will vary.

2. Use a ruler to find the actual length of the marker.

What is the actual length? 4 inches

Vocabulary

estimate (noun)
a close guess made using mathematical thinking.

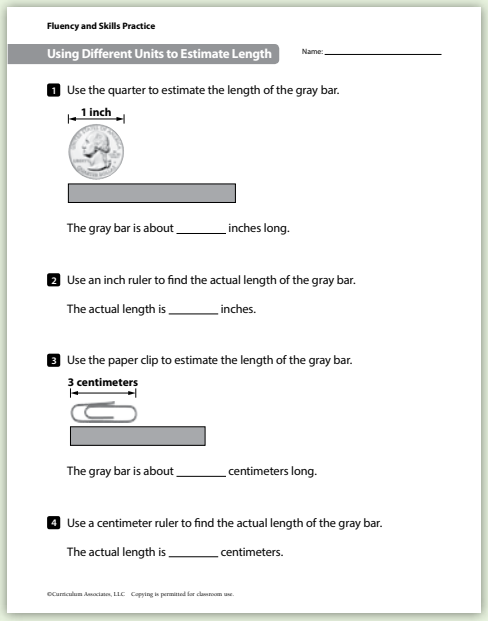
estimate (verb)
to make a close guess based on mathematical thinking.

559

Fluency & Skills Practice Teacher Toolbox

Assign *Using Different Units to Estimate Length*

Students will need an inch ruler and a centimeter ruler. In this activity students practice estimating and measuring the length of objects. They practice using the length of a common object to help them estimate the length of another object. Students may find it helpful in real-world situations to estimate length using a common object with a known measurement as a benchmark when a measuring tool is not available.



Fluency and Skills Practice

Using Different Units to Estimate Length Name: _____

1 Use the quarter to estimate the length of the gray bar.

1 inch

The gray bar is about _____ inches long.

2 Use an inch ruler to find the actual length of the gray bar.

The actual length is _____ inches.

3 Use the paper clip to estimate the length of the gray bar.

3 centimeters

The gray bar is about _____ centimeters long.

4 Use a centimeter ruler to find the actual length of the gray bar.

The actual length is _____ centimeters.

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3 The sticker is about 5 centimeters long. Estimates will vary.
Medium

4 4 centimeters
Medium

5 Estimates will vary. Possible answer: 7 feet
Medium

6 Estimates will vary. Possible answer: 10 meters
Medium

7 2 meters
Medium

8 5 feet
Medium

3 Use your little finger to estimate the length of the sticker.
Estimates will vary.
The sticker is about 5 centimeters long.

4 Use the centimeter ruler to measure the length of the sticker.

What is the actual length? 4 centimeters

5 Estimate the height of your front door in feet.

For problems 5 and 6, estimates will vary.

7 feet

6 Estimate the length of a wall in your home in meters.

10 meters

7 Which is the best estimate for the length of a park bench?

10 inches 24 feet (2 meters)

8 Which is the best estimate for the length of a piano keyboard?

12 inches (5 feet) 20 centimeters

ELL English Language Learners: Differentiated Instruction

Prepare for Session 3
Use with *Apply It*.

Levels 1–3

Speaking/Writing Have students chorally read ***Apply It*** problem 1. With a partner, have students identify an object to measure using the sticky note. Have them write down their responses to the two questions using these sentence starters:

We measured _____.

We estimated _____.

Then guide them to say the steps they took in order to solve the problem.

Levels 2–4

Speaking/Writing Have students chorally read ***Apply It*** problem 1. With a partner, have students identify an object to measure using the sticky note. Have them state their responses to the two questions using these sentence starters:

We measured _____.

We estimated _____.

Then ask them to state the steps they took in order to solve the problem using the sequence words *first*, *next*, and *then*.

Direct students to write their own response to all parts of the problem. Instruct them to take turns reading aloud their responses to their partners.

Levels 3–5

Speaking/Reading Have students take turns reading ***Apply It*** problem 1 with a partner. Instruct them to identify an object to measure using the sticky note. Ask students to state the steps they will use to solve the problem using the sequence words *first*, *next*, and *then*.

Direct students to write a response to all parts of the question and take turns reading it aloud to their partners.

When finished, ask each student to find a new partner. Have students read aloud their responses to problem 1 and revise their work as needed.

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LESSON 23

SESSION 3 Refine

Purpose In this session, students use different objects as benchmarks to estimate the length of different objects.

Start

Connect to Prior Knowledge

Materials For each student: inch ruler

Why Support students' knowledge of estimating and measuring the length of objects to the nearest inch.

How Have students estimate and then measure the length of their pencil to the nearest inch.

Estimate the length of your pencil in inches.
Write the estimate.

Measure the length of your pencil in inches.
Write the length.

Possible Solutions

Answers will vary; possible estimate: 6 inches; possible measurement: 7 inches

EXAMPLE

The best estimate is 4 meters; The example shown is one way to solve the problem. Students also could solve the problem by using measurement tools such as a ruler or a meter stick to visualize the lengths of 30 inches, 100 meters, and 4 meters and then identify which of these measurements would make sense as an estimate for the length of a seesaw.

Look for Students identify 30 inches as a length that is much shorter than the length of a seesaw and 100 meters as a length that is much longer than the length of a seesaw.

APPLY IT

1. Answers will vary. Students could solve the problem by repeatedly placing the sticky note along the length of the object and then counting how many times they placed it. Then they could add 3 inches for each time they placed the sticky note.
   DOK 2

   Look for After students place the first sticky note, they place the left side of the next one at the point where the right side of the previous sticky note ended.

Refine Estimating and Measuring Length

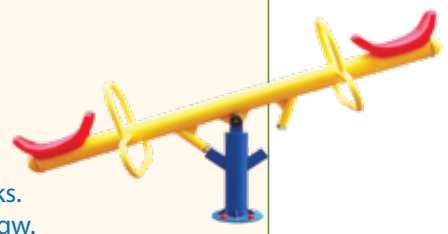
Complete the Example below. Then solve problems 1–3.

EXAMPLE

Which is the best estimate for the length of a seesaw?

30 inches 100 meters 4 meters

30 inches is between 2 and 3 feet.
100 meters is longer than a football field.
4 meters is the length of 4 meter sticks.
A seesaw is about as long as 4 meter sticks.
So, 4 meters is a good estimate for a seesaw.



Solution The best estimate is 4 meters.

APPLY IT

1. A sticky note is about 3 inches long. Use a sticky note to estimate the length of an object you see in your classroom.

   What did you measure? What is your estimate?

   Answers will vary.

   Explain how you found your estimate.

   Possible answer: I put the sticky note along the length of the table. I counted how many times I used the sticky note. I added 3 inches for each sticky note to find the total length.

How can you use a sticky note to estimate?

2. Answers will vary. Students could measure their object using an inch ruler or a measuring tape.
   DOK 2

   Look for Reasonable estimates and actual lengths are nearly the same.

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3 **B**; Students could solve the problem by using an inch ruler and a meter stick to visualize which length given in the answer choices would be the closest to the length of an actual car.

Explain why the other two answer choices are not correct:

C is not correct because 50 meters is similar to half of the length of a football field and a car is much shorter than that.

D is not correct because 100 is the number of centimeters on a meter stick, and a car is much longer than a meter stick.
DOK 3

Close: Exit Ticket

Check for Understanding

Materials For each student: inch ruler

For remediation: benchmarks items that measure about an inch, such as a quarter or small paper clip; inch ruler; centimeter ruler

Ask students to solve the following problem:

Estimate the length of your math book in inches. Then use an inch ruler to measure its actual length. [Estimates may vary; 11 inches.]

For students who are still struggling, use the table below to guide remediation.

After providing remediation, check students' understanding using the following problem:

Choose an object on your desk. Estimate the length of the object in centimeters. Then use a centimeter ruler to measure its actual length.

2 Measure the actual length of your object in problem 1.

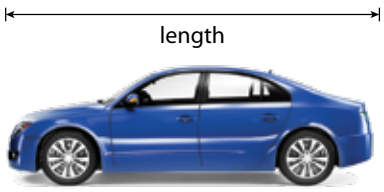
What is the actual length of your object?

How does the actual length compare with your estimate?

Answers will vary. Possible answer: My estimate is 1 inch less than the actual measurement.

How will you choose a tool to use for finding the actual length?

3 Which is the best estimate for the length of a car in the school parking lot?



Ⓐ 20 inches
Ⓑ 15 feet
Ⓒ 50 meters
Ⓓ 100 centimeters

Kyle chose Ⓐ as an answer. How did Kyle get his answer?

Possible answer: Kyle confused inches with feet and thought that the car was 20 feet long.

How does each measurement compare to the length of an actual car?

Error Alert

If the error is . . .	*Students may . . .*	*To support understanding . . .*
that the estimate is unreasonably high, such as 18 inches	have not used a benchmark item for 1 inch to help them estimate the length.	Have students identify benchmark items that measure about an inch, such as a quarter or a small paper clip, and then use them to measure the length of their math book.
that the estimate is unreasonably low, such as 3 inches	have used an incorrect benchmark item for 1 inch.	Have students use benchmark items that measure about an inch, such as a quarter or a small paper clip, and use them to measure shorter objects such as the length of a crayon.
that the actual length measures 28 inches	have measured the length of their math book in centimeters instead of inches.	Have students identify a ruler or a scale on a ruler with inches as well as a ruler or a scale on a ruler with centimeters.

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Solutions

1. Possible answer: The string is about 6 inches long.
Basic

2. 6 inches; Possible explanation: My estimate was a good estimate because it is the same as the actual length of the string in inches.
Medium

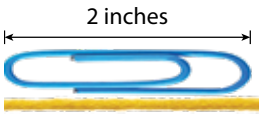
3. **A, D**
Challenge

Name: _____ LESSON 23 SESSION 3

Practice Estimating and Measuring Length

1. Use the paper clip to estimate the length of the string.

About how many paper clips would fit above the length of the string?



Possible answer:
The string is about 6 inches long.

2. Use the ruler to find the actual length of the string in inches. Was your estimate in problem 1 a good estimate for the length of the string? Explain.

How can you use the ruler to find the actual length?

6 inches; Possible answer: My estimate was a good estimate because it is the same as the actual length of the string.

3. Pedro's science book is about a foot long. Which of these objects are about a foot long?

How many inches are equal to 1 foot?

- Ⓐ a sheet of notebook paper
- Ⓑ a desk
- Ⓒ a stamp
- Ⓓ an egg carton
- Ⓔ a finger

563

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4 **A** (Yes);
D (No);
E (Yes);
H (No)
Challenge

5 **D**
Challenge

4 Choose *Yes* or *No* to tell if each measurement is a good estimate for the length of a second-grader's shoe.

length

	Yes	No
8 inches	Ⓐ	Ⓑ
2 inches	Ⓒ	Ⓓ
20 centimeters	Ⓔ	Ⓕ
2 feet	Ⓖ	Ⓗ

Which units would be good to use for measuring the length of a shoe?

5 Which is the best estimate for the length of a dog?

length

Ⓐ 8 feet
Ⓑ 15 inches
Ⓒ 3 meters
Ⓓ 95 centimeters

How does each measurement compare to the length of a dog?

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LESSON 23

SESSION 4 Refine

Purpose In this session, students gain fluency with strategies for estimating and measuring length.

Start

Develop Fluency

Why Support students' knowledge of choosing an appropriate unit for estimating length.

How Have students choose appropriate units for estimating the length or height of familiar objects or people.

Would you use centimeters, inches, feet, or meters to estimate …

- the length of an index card?
- the height of your teacher?
- the length of the playground?

Possible Solutions

Index card: centimeters or inches

Teacher: feet or meters

Playground: meters

APPLY IT

1. Answers may vary. 2 feet; Possible explanation: The length from my hand to my elbow is about the same as the length from my elbow to my shoulder. Both are about the length of my math book, which is about 1 foot long.
DOK 2

2. **B, D**
DOK 2

Refine Estimating and Measuring Length

APPLY IT

Solve the problems.

1. Estimate the length of your arm. Use centimeters, inches, feet, or meters to make your estimate. Explain how you made your estimate.

Possible answer: I estimate the length of my arm to be about 2 feet. The length from my hand to my elbow is about the same as the length from my elbow to my shoulder. Both are about the length of my math book, or 1 foot.

2. The length of a license plate is about a foot. Which of these objects have a length that is about a foot?

Ⓐ a house
Ⓑ a newspaper
Ⓒ a hand
Ⓓ a loaf of bread
Ⓔ a quarter

Differentiated Instruction

RETEACH

Hands-On Activity

Find an object with a given measure.

Students struggling with estimating and measuring the lengths of objects

Will benefit from additional work with matching the lengths of objects in the classroom with given lengths.

Materials For each group: cards with different measurements on them; an inch ruler, a centimeter ruler, and meter stick; classroom objects

- Before beginning the activity, prepare cards with lengths of different classroom objects on them, such as 8 inches, 30 centimeters, 4 feet, and 2 meters.
- Students place the cards facedown. One student turns over the top card and uses estimation to find an object in the classroom whose length is about the same as the one on the card. The student measures the object to check the estimate.
- The next student selects a card and repeats the process. Students take turns until all of the cards have been used.

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3 **B** (No);
C (Yes);
F (No);
H (No)
DOK 2

4 **D**
DOK 2

Close: Exit Ticket

5 MATH JOURNAL

Student responses should indicate understanding that an estimate of length may be used when an exact measurement is not needed and that an estimate might be made when a measuring tool is unavailable.

Error Alert **If** students are unable to explain why they might estimate a length instead of measuring it, **then** give them a situation in which only an estimate is needed and discuss why they would not need to make an exact measurement.

SELF CHECK Have students consider whether they feel they are ready to check off any new skills on the Unit 4 Opener page.

3 Choose *Yes* or *No* to tell if each measurement is a good estimate for the height of a door.

	Yes	No
10 inches	Ⓐ	Ⓑ
2 meters	Ⓒ	Ⓓ
20 centimeters	Ⓔ	Ⓕ
3 feet	Ⓖ	Ⓗ

4 What is the best estimate for the length of a desk?

Ⓐ 10 inches
Ⓑ 20 centimeters
Ⓒ 3 meters
Ⓓ 3 feet

5 MATH JOURNAL

Explain why you might estimate a length rather than measuring it.

Possible answer: I might estimate a length if I do not need to know its actual length or if I do not have a tool such as a ruler to measure the length.

SELF CHECK Go back to the Unit 4 Opener and see what you can check off.

EXTEND

Challenge Activity

Estimate a distance in the classroom.

Students who have achieved proficiency in estimating the lengths of objects

Will benefit from estimating and measuring the length of a distance in the classroom and then comparing their estimate with the actual measurement.

Materials For each student: meter stick or measuring tape

- Have students estimate the distance between two locations in the classroom. To make this estimate, they should use the benchmark that 1 foot is a little greater than the length of their foot. Ask students to write their estimates.
- Then have students walk the distance they estimated, leaving a little space between their feet in each step. Ask them to write the number of steps they took and then compare that number with their estimate to determine if their estimate was reasonable.
- Finally, have students measure the actual distance, write the measurement, and then compare it with their estimate and with the number of steps walked.

PERSONALIZE

i-Ready

Provide students with opportunities to work on their personalized instruction path with *i-Ready* Online Instruction to:

- fill prerequisite gaps
- build up grade-level skills

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Lesson Overview

LESSON 24

Compare Lengths

Lesson Objectives

Content Objectives

- Compare the length of objects by determining which measure is greater than or less than the other.
- Use addition and subtraction to compare lengths, finding how much greater or less the measure of one object is than the other.

Language Objectives

- Tell how to compare the lengths of two objects that are not lined up next to each other.
- Record the lengths of two objects and subtract to tell how much longer or shorter one is than the other.

Prerequisite Skills

- Add and subtract within 20.
- Measure in standard units of measure.
- Use measuring tools to measure to the nearest unit.

Standards for Mathematical Practice (SMP)

SMPs 1, 2, 3, 4, 5, and 6 are integrated in every lesson through the *Try-Discuss-Connect* routine.*

In addition, this lesson particularly emphasizes the following SMPs:

2 Reason abstractly and quantitatively.

4 Model with mathematics.

5 Use appropriate tools strategically.

6 Attend to precision.

*See page 303k to see how every lesson includes these SMPs.

Lesson Vocabulary

There is no new vocabulary. Review the following key terms.

- **difference** the result of subtraction.
- **length** measurement that tells the distance from one point to another, or how long something is.
- **longer** having a length that is greater than that of another object.
- **shorter** having a length or height that is less than that of another object.

Learning Progression

In Grade 1 students explore measurement as the process of comparing and ordering lengths. They measure the lengths of objects in inches.

In Grade 2 students expand on the concept of unit of measure as they measure the length of an object using two different units of measure in whole number units. At this level, they use tools to measure standard units, estimate lengths, and determine the appropriate tool to use in measuring.

In this lesson students compare lengths of objects within a specific unit and use addition and subtraction to find differences in length.

In Grade 3 students increase accuracy by measuring lengths in fractions of an inch. They recognize that the lengths of the sides of a figure can be measured in units and combined to find the perimeter of the figure.

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Lesson Pacing Guide

Whole Class Instruction

SESSION 1 Explore *45–60 min*	**Comparing Lengths** • Start *5 min* • Try It *10 min* • Discuss It *10 min* • Connect It *15 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 571–572
SESSION 2 Develop *45–60 min*	**Finding Differences Between Lengths** • Start *5 min* • Try It *10 min* • Discuss It *10 min* • Measure It & Model It *5 min* • Connect It *10 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 577–578 **Fluency** Finding Differences Between Lengths
SESSION 3 Develop *45–60 min*	**Ways to Compare Lengths** • Start *5 min* • Try It 10 *min* • Discuss It *10 min* • Measure It & Model It *5 min* • Connect It *10 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 583–584 **Fluency** Ways to Compare Lengths
SESSION 4 Refine *45–60 min*	**Comparing Lengths** • Start *5 min* • Example *10 min* • Apply It *25 min* • Close: Exit Ticket *5 min*	**Additional Practice** Lesson pages 587–588
SESSION 5 Refine *45–60 min*	**Comparing Lengths** • Start *5 min* • Apply It *15 min* • Small Group Differentiation *20 min* • Close: Exit Ticket *5 min*	**Lesson Quiz** or **Digital Comprehension Check**

Lesson Materials

Lesson *(Required)*
Per student: centimeter ruler, two strips of paper (one 12 centimeters long and one 7 centimeters long)
Activity Sheet: Shell Measurements

Activities
Per student: centimeter tiles, inch ruler, inch/centimeter ruler or yardstick and meter stick, crayons or colored pencils, scissors
Activity Sheets: 1-Centimeter Grid Paper, 1-Inch Grid Paper

Math Toolkit centimeter ruler

Teacher Toolbox

Small Group Differentiation

PREPARE

Ready Prerequisite Lessons

Grade 1
- Lesson 30 Order Objects by Length
- Lesson 31 Compare Lengths

RETEACH

Tools for Instruction

Grade 1
- Lesson 30 Order by Length
- Lesson 31 Compare Lengths

Grade 2
- Lesson 24 Compare Lengths

REINFORCE

Math Center Activities

Grade 2
- Lesson 24 Compare Centimeter Lengths
- Lesson 24 Compare Lengths

EXTEND

Enrichment Activity

Grade 2
- Lesson 24 Building Walls

Independent Learning

PERSONALIZE

i-Ready Lesson*

Grade 2
- Compare Lengths

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

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Connect to Family, Community, and Language Development

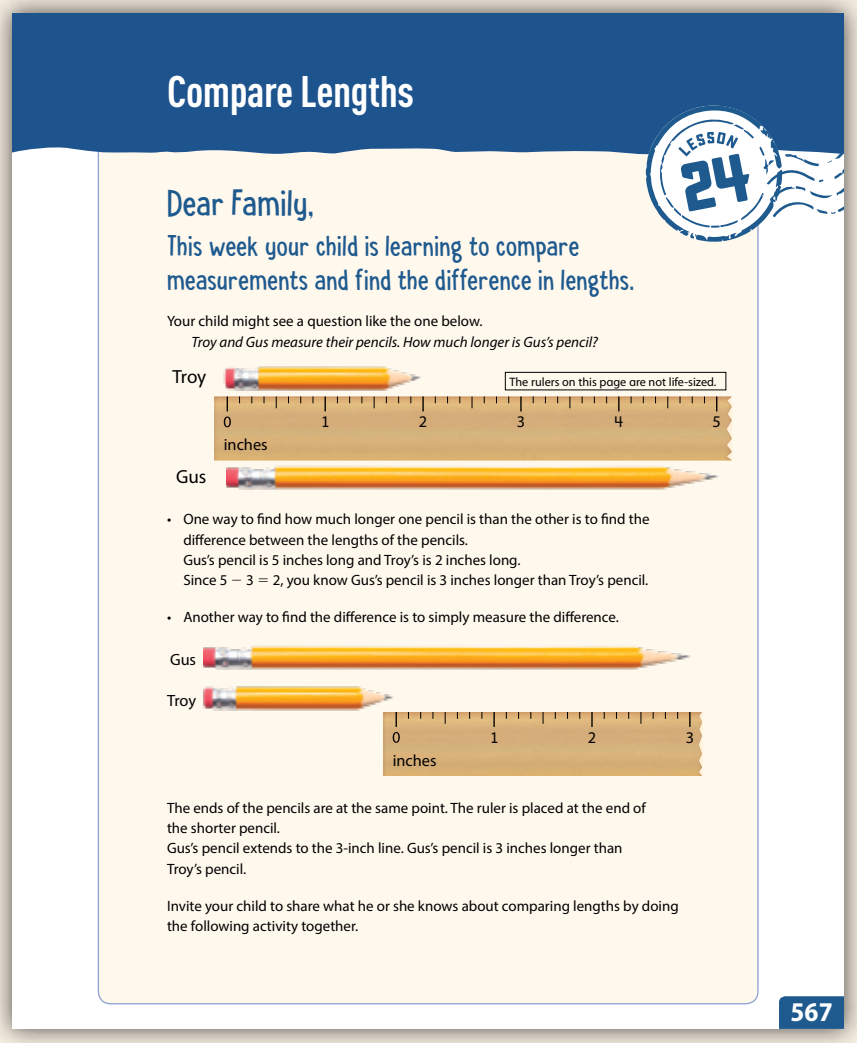
The following activities and instructional supports provide opportunities to foster school, family, and community involvement and partnerships.

Connect to Family

Use the **Family Letter**—which provides background information, math vocabulary, and an activity—to keep families apprised of what their child is learning and to encourage family involvement.

Available in Spanish

Teacher Toolbox



Compare Lengths

LESSON 24

Dear Family,

This week your child is learning to compare measurements and find the difference in lengths.

Your child might see a question like the one below.

Troy and Gus measure their pencils. How much longer is Gus's pencil?

Troy

The rulers on this page are not life-sized.

0 1 2 3 4 5

inches

Gus

- One way to find how much longer one pencil is than the other is to find the difference between the lengths of the pencils.
  Gus's pencil is 5 inches long and Troy's is 2 inches long.
  Since 5 − 3 = 2, you know Gus's pencil is 3 inches longer than Troy's pencil.
- Another way to find the difference is to simply measure the difference.

Gus

Troy

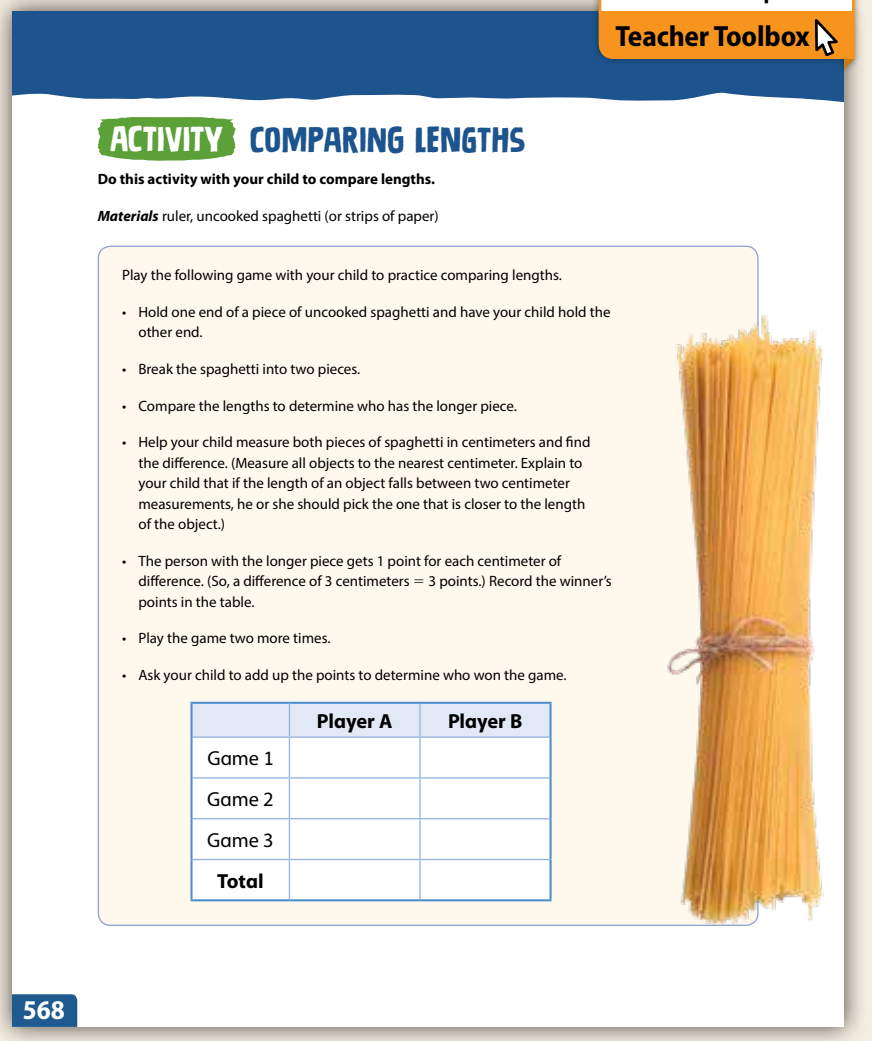
0 1 2 3

inches

The ends of the pencils are at the same point. The ruler is placed at the end of the shorter pencil.
Gus's pencil extends to the 3-inch line. Gus's pencil is 3 inches longer than Troy's pencil.

Invite your child to share what he or she knows about comparing lengths by doing the following activity together.

567



ACTIVITY COMPARING LENGTHS

Do this activity with your child to compare lengths.

Materials ruler, uncooked spaghetti (or strips of paper)

Play the following game with your child to practice comparing lengths.

- Hold one end of a piece of uncooked spaghetti and have your child hold the other end.
- Break the spaghetti into two pieces.
- Compare the lengths to determine who has the longer piece.
- Help your child measure both pieces of spaghetti in centimeters and find the difference. (Measure all objects to the nearest centimeter. Explain to your child that if the length of an object falls between two centimeter measurements, he or she should pick the one that is closer to the length of the object.)
- The person with the longer piece gets 1 point for each centimeter of difference. (So, a difference of 3 centimeters = 3 points.) Record the winner's points in the table.
- Play the game two more times.
- Ask your child to add up the points to determine who won the game.

	Player A	Player B
Game 1		
Game 2		
Game 3		
Total		

568

Goal

The goal of the Family Letter is to help students practice comparing measurements and finding the difference in lengths.

Activity

Understanding how to find the difference in lengths will help students reinforce what they have learned about comparisons. Look at the *Comparing Lengths* activity and adjust it if necessary to connect with your students.

Math Talk at Home

Encourage students and their family members to think of common household objects that are similar but have different lengths, such as used crayons, cooking utensils, silverware, drinking glasses, the shoes of different family members, and so on.

Conversation Starters Below are additional conversation starters students can write in their Family Letter or math journal to engage family members.

- *Which measuring tool will you use to measure the lengths of the objects?*
- *Did you use subtraction or addition to find the difference in lengths? Why?*
- *How else can we find the difference in lengths of two objects?*

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Connect to Community and Cultural Responsiveness

Use these activities to connect with and leverage the diverse backgrounds and experiences of all students.

Session 1 Use with *Try It*.

- Encourage students to find objects around the classroom that are similar but with varying lengths, such as used crayons, used erasers, different students' shoes, books, and extension cords. Ask students to use index cards to write their own problem inspired by these classroom objects. Encourage students to work in pairs. Each set of partners should generate one or two word problems. Each problem must provide two different lengths (in inches or centimeters) of a pair of similar objects. Have students take turns solving each other's problems throughout the session. Save these cards for Session 2.

Session 2 Use with *Try It*.

- Have students work with the same problems they wrote in the Session 1 activity. Have students read aloud a problem and practice solving the problem with their partners by using a bar model.

Session 3 Use with *Try It*.

- Encourage students to find four different objects that are smaller than 12 inches. Using index cards, ask them to write two problems similar to the *Try It* problem. Each problem must identify two objects by name. Challenge students to write one problem that asks for the lengths of the objects to be compared using inches and another problem that asks for the lengths of the objects to be compared using centimeters. Throughout the session, have students take turns solving each other's problems using a bar model and the term *shorter than*.

Connect to Language Development

For ELLs, use the Differentiated Instruction chart to plan and prepare for specific activities in every session.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 1
Use with *Try It*.

Levels 1–3	Levels 2–4	Levels 3–5
Speaking/Writing Have students chorally read the ***Try It*** problem. Encourage them to apply what they know about measuring the length of an object in centimeters and finding the difference between two lengths. Ask: *What will you measure first? What will you measure next? What operation will you use to find the difference?* Instruct students to work with their partners to complete the problem using the following sentence frames in writing: • *The length of the fork is about* __8__ *centimeters.* • *The spoon is about* __6__ *centimeters.* • *The difference is* __2__ *centimeters.*	**Listening/Speaking** Have students chorally read the ***Try It*** problem. Ask them to work in pairs to negotiate a strategy they will use to find the difference between the length of the fork and the length of spoon. Instruct students to complete the problem using the following sentence frames: • *The length of the fork is about* __8__ *centimeters and the length of the spoon is about* __6__ *centimeters.* • *The difference is* __2__ *centimeters.* When complete, have partners describe what they did to find the difference between the lengths: *To find the difference, I* _____.	**Reading/Writing** Have students read the ***Try It*** problem. Have them identify a strategy to find the difference between the length of the fork and the length of the spoon. Then ask them to solve the problem. Have students share their answers with partners and have partners ask each other questions about their strategies.

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LESSON 24

SESSION 1 Explore

Purpose In this session, students connect their previous knowledge about measuring length in order to compare the lengths of two objects. They explore and share solution strategies for finding the difference between the length of a spoon and the length of a fork. They look ahead to measuring the difference between two lengths in order to find out how much longer or shorter one object is than the other.

Start

Connect to Prior Knowledge

Materials For each student: centimeter ruler

Why Support students' knowledge of measuring length in centimeters, foreshadowing comparing the lengths of two objects in centimeters.

How Have students measure the length of a marker and sheet of paper in centimeters.

Use a centimeter ruler.

Find the length of a marker to the nearest centimeter.

Find the length of a sheet of paper to the nearest centimeter.

Solutions

Answers may vary;
marker: about 12 cm
paper: about 28 cm

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that the spoon and fork have different lengths.

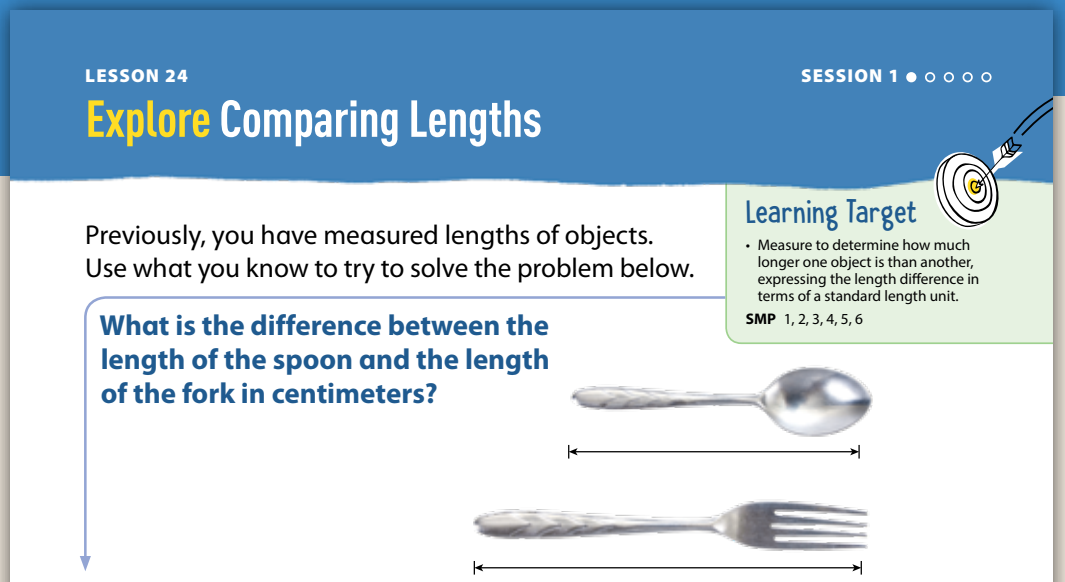
DISCUSS IT

Support Partner Discussion

Encourage students to use the term *difference* as they discuss their solutions.

Look for, and prompt as necessary, understanding of:

- the length of the spoon is 6 centimeters
- the length of the fork is 8 centimeters
- the difference between the two lengths is 2 centimeters



LESSON 24 SESSION 1 ● ○ ○ ○ ○

Explore Comparing Lengths

Learning Target

- Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

SMP 1, 2, 3, 4, 5, 6

Previously, you have measured lengths of objects. Use what you know to try to solve the problem below.

What is the difference between the length of the spoon and the length of the fork in centimeters?

TRY IT

Math Toolkit
- centimeter ruler

Possible student work:

Sample A

I used a centimeter ruler to measure the lengths.

The length of the fork is about 8 centimeters.

The length of the spoon is about 6 centimeters.

6 + 2 = 8, so the difference between the lengths is 2 centimeters.

Sample B

I measured the difference from the end of the spoon to the end of the fork.

The difference between the lengths is 2 centimeters.

DISCUSS IT

Ask your partner: Can you explain that again?

Tell your partner: I don't understand how . . .

569

Common Misconception Look for students who are not comfortable with using a ruler to find length. As students present solutions, have them specify how they used the ruler with the pictures or the line segments to measure the two lengths.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- measuring the spoon and the fork and subtracting the shorter length from the longer one
- measuring the line segments and subtracting the shorter length from the longer one
- measuring the spoon and fork and adding up from 6 to 8 to find the difference
- measuring the length of the difference shown between the spoon and fork

Support Whole Class Discussion

Prompt students to note the relationship between the units of length used in each model and the units of length given in the problem.

Ask *How do [student name]'s and [student name]'s solutions each show the difference between the length of the spoon and the length of the fork?*

Listen for One solution shows the difference is 2 by finding $6 + 2 = 8$ and the other solution shows the difference of 2 by finding $8 - 2 = 6$.

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CONNECT IT

1 LOOK BACK

Look for understanding that the difference between the length of the fork and the length of the spoon can be found by measuring the length of each object using a centimeter ruler and then subtracting the length of the spoon from the length of the fork.

Hands-On Activity

Measure and compare lengths with centimeter tiles.

If . . . *students are unsure about measuring and comparing the lengths of objects in centimeters,*

Then . . . *use this activity to have them measure and compare the lengths of objects using centimeter tiles.*

Materials For each student: centimeter tiles or centimeter tiles cut from Activity Sheet *1-Centimeter Grid Paper*

- Have students line up the cubes beneath the pictures of the spoon and the fork.
- Ask: *What is the length of the spoon?* [6 centimeters] *What is the length of the fork?* [8 centimeters]
- Ask: *How can you find the difference between the length of the spoon and the length of the fork?* [Possible answer: I can subtract 6, the length of the spoon, from 8, the length of the fork.] *What is the difference in their lengths?* [$8 - 6 = 2$, so the difference is 2 centimeters.]

2 LOOK AHEAD

Point out that the difference between the lengths of two objects can be found by first aligning the left end of both objects above the 0 mark on the ruler. Then the difference in the lengths can be measured.

Students should be able to recognize that the space between the end of the red piece of yarn and the blue piece of yarn is the difference between the lengths. Since there are 3 jumps from 6 to 9 in that space, the difference in length is 3 centimeters.

CONNECT IT

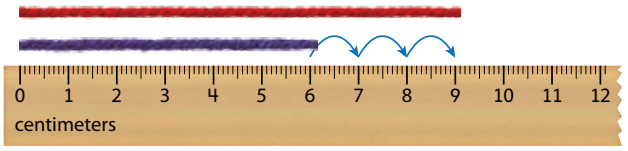
1 LOOK BACK

Explain how to find the difference between the length of the spoon and the length of the fork in centimeters.

Possible answer: I can measure the fork and the spoon using a centimeter ruler. Then I can subtract the length of the spoon from the length of the fork to find the difference.

2 LOOK AHEAD

You can find how much longer or shorter one object is than the other by lining up the objects above a ruler. Then you can measure the difference.



The **red** piece of yarn is **3** centimeters longer than the **blue** piece of yarn.

3 REFLECT

How does measuring help you find the difference between two lengths?

Possible answer: If I know how long each length is, I can subtract the shorter length from the longer length to find the difference.

Close: Exit Ticket

3 REFLECT

Look for understanding that each length can be measured to find how long it is. Then the shorter length can be subtracted from the longer length to find the difference between the two lengths.

Common Misconception **If** students say that the measurements of the two lengths should be added, **then** have them look at the picture of the two pieces of yarn above the ruler, identify the section of the red piece of yarn that is the difference between the two lengths, and connect *difference* to subtraction.

Real-World Connection

Discuss with students that in daily life, sometimes it is important to be able to tell how much longer one object is than another. Have volunteers share their ideas about situations where comparing lengths is needed. Examples include deciding if a piece of ribbon is long enough for an art project that requires 6 inches of ribbon, identifying how many feet longer the gym is than the library, and finding how many inches a plant grew in a month.

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Solutions

Support Vocabulary Development

1 Ask students to define the word *compare* and to discuss their thoughts with a partner. Have them share words they think of when comparing (for example, *bigger, smaller, taller, shorter, longer,* and so on). Then have them define the word *length*. Select two objects and have students explain different ways they could compare their lengths. Have them think about the words they would use such as *shorter* and *longer*.

2 Review the meaning of *difference*. Ask: *What operation can you use to find the difference between the length of the crayon and the length of the pencil?*

Supplemental Math Vocabulary

- *longer*
- *shorter*

Name: _____ LESSON 24 SESSION 1

Prepare for Comparing Lengths

1 Think about what you know about comparing lengths. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can. **Possible answers:**

What Is It?

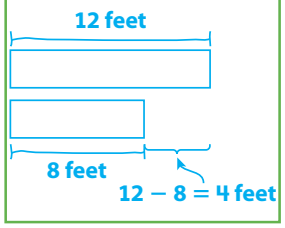
deciding if an object is longer than, shorter than, or the same length as another object

What I Know About It

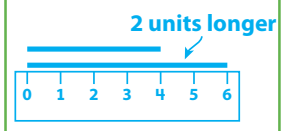
To compare lengths, I should measure the objects.

compare lengths

Examples



Examples



Examples

A pen is 6 inches long.

A pencil is 4 inches long.

6 − 4 = 2

The pen is 2 inches longer than the pencil.

2 A pencil is 5 inches long. A crayon is 4 inches long. What is the difference between their lengths?

Possible answer: 5 − 4 = 1, so the difference between their lengths is 1 inch.

571

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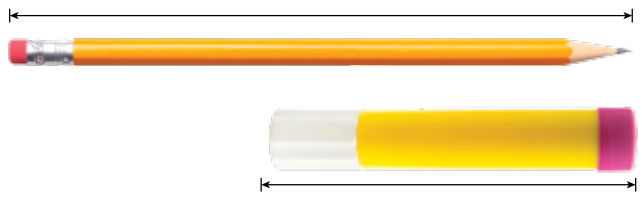
3 Solve the problem. Show your work.

Boone found this pencil and glue stick in his desk.



What is the difference between the length of the pencil and the length of the glue stick in centimeters?

Possible student work using a ruler:

I used a ruler to measure the length of each object.

The pencil is 13 centimeters long.

The glue stick is 8 centimeters long.

$13 - 8 = 5$

Solution **The difference between the lengths is 5 centimeters.**

4 Check your answer. Show your work.

Possible student work:

I used my little finger to estimate the lengths of the pencil and glue stick.

The length of the pencil is about 13 centimeters.

The length of the glue stick is about 8 centimeters.

$8 + 5 = 13$, so the difference between the lengths is about 5 centimeters.

3 Assign problem 3 to provide another look at comparing lengths.

This problem is very similar to the problem about comparing the lengths of a spoon and a fork. In both problems, students are given pictures of two objects and they must find the difference between the lengths of the objects in centimeters. This question asks students to find the difference between the length of a pencil and the length of a glue stick.

Students may want to use centimeter cubes or a centimeter ruler.

Suggest that students read the problem three times, asking themselves one of the following questions each time:

- *What is this problem about?*
- *What is the question I am trying to answer?*
- *What information is important?*

Solution: The pencil is 13 centimeters long. The glue stick is 8 centimeters long; $13 - 8 = 5$. The difference between the length of the pencil and the length of the glue stick is 5 centimeters.
Medium

4 Have students solve the problem another way to check their answer.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 2
Use with *Try It*.

Levels 1–3

Reading/Writing Have students chorally read the ***Try It*** problem. Have students work with partners to write the steps for solving the problem. Provide the following sentence frames:

First, we measure the length of _____.

Next, we measure the length of _____.

Then we compare _____ and _____ to find the difference between the lengths of _____ and _____.

When finished, encourage students to complete this sentence frame:

_____'s piece is _____ centimeters longer than _____'s piece.

Provide support with possessive adjectives as needed.

Levels 2–4

Reading/Writing Have students read the ***Try It*** problem with partners. Then have them work together to write the steps for solving the problem, using the sequence words *first, next,* and *then*.

When finished, have partners discuss whether Nate's or Jen's piece of tape is longer, and how they know that this is true.

Levels 3–5

Listening/Speaking Have students chorally read the ***Try It*** problem. Ask them to write their steps for solving the problem using the sequence terms *first, next* and *then*.

Pair students and encourage them to orally explain the strategy they used to find the difference in the lengths of the two pieces of tape. First have Partner A share his or her sentences. Then have Partner B rephrase what Partner A said, using the phrases *First you said . . .* and *Then you said . . .*.

Students reverse roles and repeat.

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LESSON 24

SESSION 2 Develop

Purpose In this session, students solve a problem that requires them to identify the longer of two pieces of tape and then find the difference in length between them in centimeters. Students measure the lengths using a centimeter ruler and then make a bar model to compare the lengths. The purpose of this problem is to help students develop strategies for comparing lengths.

Start

Connect to Prior Knowledge

Why Support students' knowledge of bar models, foreshadowing finding the difference between lengths using a bar model.

How Have students complete two bar models.

Make a bar model that can be used to find the difference between each pair of numbers.

Complete each bar model by finding the unknown number.

5 and 14 16 and 9

Solutions

Bar model: 14 above bracket, 5 and 9 in boxes below;

Bar model: 16 above bracket; 7 and 9 in boxes below

Develop Language

Why Clarify the meaning of the term *longer* and provide practice using the term in context.

How Explain that the word *long* means *having a large distance from one end to the other*. Then explain that *longer* is the comparative form of *long*, and that it is used to compare the lengths of two objects. Provide students with practice using the term by showing two similar objects of different lengths, such as two used crayons of different colors. Have students compare the crayons, using the word *longer*. For example: *The blue crayon is longer than the red crayon.*

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that the two pieces of tape have different lengths.

Ask *What are you trying to find out? What do you know?*

Develop Finding Differences Between Lengths

Read and try to solve the problem below.

Nate and Jen each have a piece of tape.

Who has the longer piece of tape?
How many centimeters longer is it?

TRY IT

Possible student work

Sample A

8 > 3, so Nate's piece of tape is longer.
8 − 3 = 5, so Nate's piece of tape is 5 centimeters longer than Jen's.

Sample B

I can measure with a ruler.

Jen's tape is 3 centimeters. _____

Nate's tape is 8 centimeters.

_____

3 + 5 = 8, so Nate's tape is 5 centimeters longer than Jen's.

Math Toolkit
- centimeter ruler

DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: The strategy I used to find the answer was . . .

DISCUSS IT

Support Partner Discussion

Encourage students to name the model or strategy they used as they discuss their solutions.

Support as needed with questions such as:

- *How is your strategy like your partner's? How is it different?*
- *How did your partner help you?*

Common Misconception Look for students who may not align the pieces of tape correctly above the ruler to measure.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- identifying the longer piece of tape
- measuring both pieces of tape and subtracting to find the difference
- measuring both pieces of tape and adding to find the difference
- measuring the difference between the lengths of the two pieces of tape

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Support Whole Class Discussion

Compare and connect the lengths of the pieces of tape and how the difference was found between their lengths.

Ask *How was the length of each piece of tape used to find the difference?*

Listen for I found the lengths by measuring them with a centimeter ruler or by lining up centimeter cubes under them; I found the difference by solving the equation $8 - 3 = ?$ or $3 + ? = 8$.

MEASURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the piece of tape that is longer
- the lengths of the two pieces of tape
- the difference between the lengths of tape

Ask *How do the models show the steps needed to solve the problem?*

Listen for First, I need to find the lengths of the two pieces of tape, so I measure each length with a ruler. Then I need to find the difference between the lengths, and I can use a bar model to help by showing the lengths and the difference.

For measuring each piece of tape, prompt students to describe how the rulers can be used to find the difference.

- *Why is it important to line up the pieces of tape the same way?*
- *How can you find the difference in two different ways?*

For making a bar model, prompt students to connect the bar model with the problem.

- *What numbers could you put in the bar model for the words that are shown?*
- *How could you use the bar model to find the difference between the lengths of the pieces of tape?*

Explore different ways to understand finding differences between lengths.

Nate and Jen each have a piece of tape.

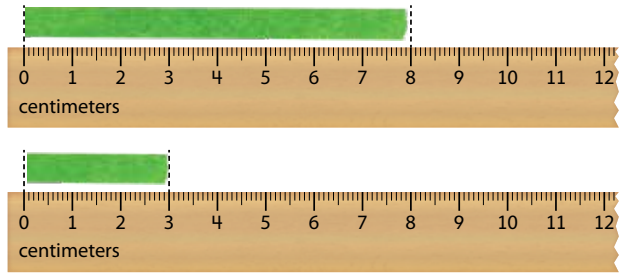
Nate **Jen**

Who has the longer piece of tape? How many centimeters longer is it?

MEASURE IT

You can measure each piece of tape.

Measure each piece of tape using centimeters.



MODEL IT

You can make a bar model.

You can make a bar model to compare the lengths.

Length of Nate's tape	
Length of Jen's tape	?

Deepen Understanding

Making a Bar Model to Compare Length

SMP 2 Reason abstractly and quantitatively.

When discussing making a bar model to compare the lengths, prompt students to consider how the lengths of the pieces and their difference can be shown.

Ask *Why is Nate's piece of tape in the box at the top? Why is Jen's piece of tape in one of the bottom boxes? What does the question mark represent?*

Listen for Nate's piece of tape is at the top because it is the longest. Jen's piece and the difference, ?, make up the length of Nate's piece and are in the two boxes at the bottom.

Ask *How could you use the bar model to find the difference between the lengths?*

Listen for I can write 8, the length of Nate's piece, in the top box and write 3, the length of Jen's piece, in the left box at the bottom. Then I can solve $8 - 3 = ?$ or $3 + ? = 8$ in order to find the difference between the lengths and write the difference, 5, in the box with the question mark.

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CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page, students will use the problem from the previous page to learn how to compare two lengths.

Monitor and Confirm

1 – 2 Check for understanding that:

- the length of Nate's piece of tape is 8 centimeters
- the length of Jen's piece of tape is 3 centimeters
- Nate has the longer piece of tape because 8 is greater than 3

Support Whole Class Discussion

3 Be sure students understand that this problem is asking them to write and solve an equation in order to determine the difference.

Ask *What addition equation could you write to find the difference? What subtraction equation could you write? What is the difference between the lengths?*

Listen for I could write the addition equation $3 + ? = 8$ or $? + 3 = 8$. I could write the subtraction equation $8 - 3 = ?$ or $8 - ? = 3$. The difference is 5.

4 Look for understanding that Nate's tape is 5 centimeters longer than Jen's tape.

5 REFLECT Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to find differences between lengths.

1 Write the lengths in the bar model.

2 Who has the longer piece of tape? Explain how you know.

Nate; Possible answer: 8 centimeters is more than 3 centimeters.

Nate's tape	
8 centimeters	
Jen's tape	?
3 centimeters	

3 Write an equation you can use to find the difference in the lengths. Then find the difference.

3 + ? = 8 or 8 − 3 = ?; The difference is 5.

4 Complete the sentence to compare the lengths.

Nate's tape is 5 centimeters longer than Jen's tape.

5 REFLECT

Look back at your **Try It**, strategies by classmates, **Measure It** and **Model It**. Which models or strategies do you like best for finding differences between lengths? Explain.

Possible answer: I like to make a bar model of the lengths because it helps me to recognize how I can write an addition or subtraction equation to find the difference in the lengths.

575

Hands-On Activity

Use centimeter grid paper to compare lengths.

If . . . *students are unsure about measuring and comparing lengths in centimeters,*

Then . . . *use this activity to have them measure and compare lengths in a more concrete way.*

Materials For each student: 2-row section cut from Activity Sheet *1-Centimeter Grid Paper*, crayons or colored pencils, and scissors

- Have students shade one row of 8 squares to represent Nate's piece of tape.
- In the row below, students should shade 3 squares to represent Jen's piece of tape.
- Prompt students to recognize that the unshaded squares in the bottom row represent the difference between the lengths. Discuss with students that adding shading from the number of squares representing Jen's tape to the end of the squares representing Nate's tape would give a length equal to that of Nate's tape.

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APPLY IT

For all problems, encourage students to use a bar model or write an equation to support their thinking.

6 The sticker on the left is longer, so it should be circled.

7 The blue sticker is 2 centimeters longer than the yellow sticker; $5 - 3 = 2$.

Close: Exit Ticket

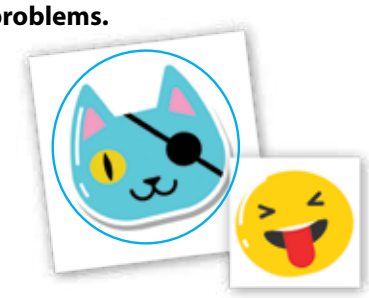
8 **B** (No);
C (Yes);
E (Yes);
G (Yes)

Error Alert **If** students chose **A**, **then** remind them that comparing lengths is the same as finding their difference. Adding the lengths together represents combining them.

APPLY IT

Use what you just learned to solve these problems.

Use these stickers for problems 6 and 7.

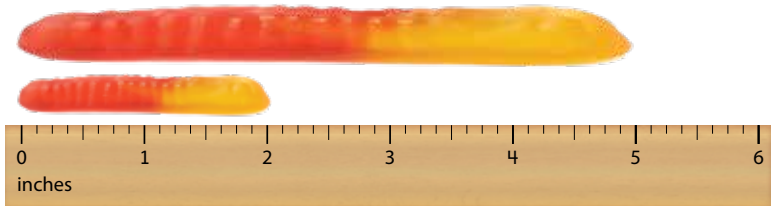


6 Circle the sticker that is longer.

7 Measure and write the length of each sticker in centimeters. How much longer is the long sticker than the short sticker?

The blue sticker is 5 centimeters long, and the yellow sticker is 3 centimeters long. So the blue sticker is 2 centimeters longer.

8 Choose *Yes* or *No* to tell if you can use the equations to compare the lengths of the worms.



	Yes	No
$? = 5 + 2$	Ⓐ	Ⓑ
$5 = 2 + ?$	Ⓒ	Ⓓ
$? = 5 - 2$	Ⓔ	Ⓕ
$2 = 5 - ?$	Ⓖ	Ⓗ

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Solutions

1. 2 centimeters; 6 centimeters
Basic

2. $6 - 2 = ?$
Medium

3. 4 centimeters
Medium

Name: _____ LESSON 24 SESSION 2

Practice Finding Differences Between Lengths

Study the Example showing how to find the difference between two lengths. Then solve problems 1–8.

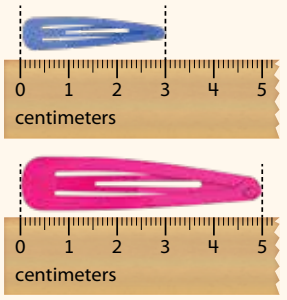
EXAMPLE

How much longer is the pink hair clip than the blue hair clip?

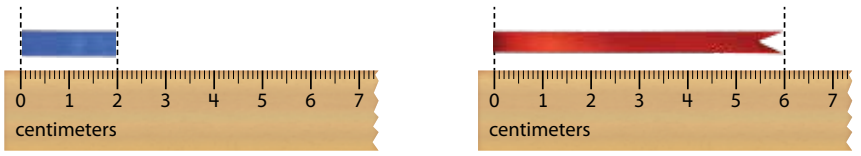
Write an equation.

$3 + ? = 5$ or $5 - 3 = ?$

So, the pink hair clip is 2 centimeters longer.



1. Write the length of each ribbon.



2 centimeters 6 centimeters

2. Complete the equation to compare the lengths.

6 − 2 = ?

3. How much longer is the red ribbon than the blue one?

4 centimeters

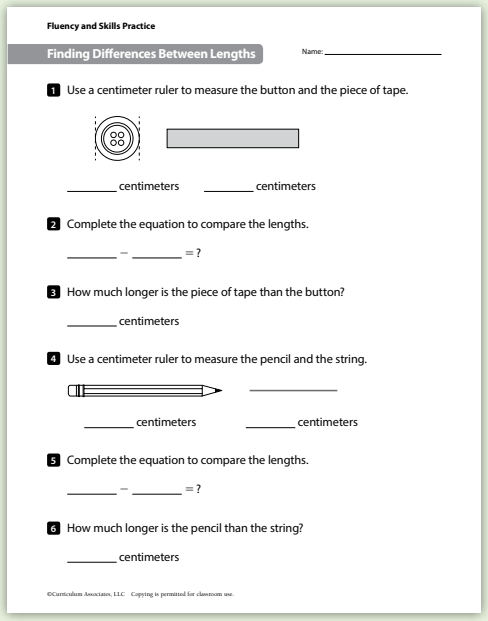
577

Fluency & Skills Practice

Teacher Toolbox

Assign *Finding Differences Between Lengths*

Students will need a centimeter ruler to complete this activity. In this activity students practice measuring lengths in centimeters. They also practice using subtraction to find the difference between two lengths. This activity gives students practical experience in comparing lengths quantitatively.



Fluency and Skills Practice

Finding Differences Between Lengths

Name: _____

1 Use a centimeter ruler to measure the button and the piece of tape.

_____ centimeters _____ centimeters

2 Complete the equation to compare the lengths.

_____ − _____ = ?

3 How much longer is the piece of tape than the button?

_____ centimeters

4 Use a centimeter ruler to measure the pencil and the string.

_____ centimeters _____ centimeters

5 Complete the equation to compare the lengths.

_____ − _____ = ?

6 How much longer is the pencil than the string?

_____ centimeters

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4 3 centimeters; Possible work: 5 − 2 = ?
Medium

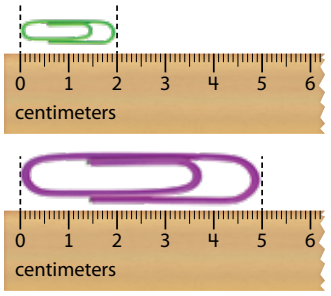
5 9 centimeters
Medium

6 5 centimeters
Medium

7 5 + ? = 9, ? + 5 = 9, 9 − ? = 5, or 9 − 5 = ?
Medium

8 4 centimeters
Medium

4 How much longer is the purple paper clip than the green paper clip? Show your work.

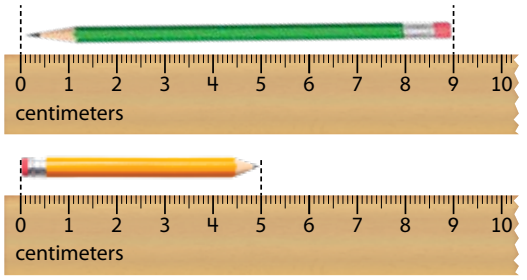


Possible work: 5 − 2 = ?

3 centimeters

Use these pencils for problems 5–8.

Aruna measures a green pencil and an orange pencil using a centimeter ruler.



5 What is the length of the green pencil?

9 centimeters

6 What is the length of the orange pencil?

5 centimeters

7 Write an equation you can use to find the difference in lengths.

5 + ? = 9 or 9 − 5 = ?

8 How much longer is the green pencil than the orange pencil? 4 centimeters

ELL English Language Learners: Differentiated Instruction

Prepare for Session 3
Use with *Try It*.

Levels 1–3

Reading/Writing Have students chorally read the ***Try It*** problem. Restate the question as: *Which object is shorter? How much shorter is it?*

Have students work with a partner to write the steps for solving the problem. Provide the following sentence frames:

First, we measure the length of the _____.

Next, we measure the length of the _____.

Then we compare _____ and _____ to find out how much shorter the _____ is than the _____.

When finished, encourage students to write and complete the following sentence frames:

The eraser is shorter.

The eraser is 3 *inches shorter than the crayon.*

Levels 2–4

Reading/Writing Have students read the ***Try It*** problem with partners.

Have students work in pairs. Ask partners to write the steps for solving the problem using the sequence words *first, next*, and *then*. When finished, encourage students to write and complete the following sentence frames:

The eraser is shorter.

The eraser is 3 *inches shorter than the crayon.*

Levels 3–5

Writing/Reading Have students read the ***Try It*** problem with a partner. Instruct them to use the sequence terms *first*, *next,* and *then* to write about the strategy they used to find the difference between the lengths of the objects.

When finished, ask Partner A to read his or her sentences aloud while Partner B attempts to solve the problem based on what he or she hears. Then have Partner B show his or her work. If Partner B's work looks different, then encourage Partner A to revise his or her sentences so that the information is clear.

Students reverse roles and repeat.

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LESSON 24

SESSION 3 Develop

Purpose In this session, students solve a problem that requires them to find how many inches shorter one object is than another object. They measure the lengths of the objects or the length of the difference between their lengths. The purpose of this problem is to help students develop strategies for comparing lengths.

Start

Connect to Prior Knowledge

Materials For each student: inch ruler, Activity Sheet *Shell Measurements*

Why Support students' knowledge of measuring length in inches, foreshadowing comparing the lengths of two objects in inches.

How Have students measure the length of three objects in inches.

Use an inch ruler. Measure each shell in inches.

Shell A is _____ inches long.

Shell B is _____ inches long.

Shell C is _____ inches long.

Solutions

3; 2; 4

Develop Language

Why Clarify the meaning of the comparative term *shorter* and provide practice using the term in context.

How Explain that the word *short* means *having a small distance from one point to another point.* Then explain that *shorter* is the comparative form of *short,* and that it is used to compare the length of two objects. Provide students with practice using the term by showing two similar objects of different lengths such as the used pencils of two different students. Have students compare the lengths of the two pencils, using the word *shorter*. For example: *John's pencil is shorter than Ella's pencil.*

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that the eraser and the crayon have different lengths and that the eraser is shorter than the crayon.

Develop Ways to Compare Lengths

Read and try to solve the problem below.

How much shorter in inches is the eraser than the crayon?

TRY IT

Possible student work:

Sample A

crayon	eraser
5 inches	2 inches

2 is 3 less than 5, so the eraser is 3 inches shorter than the crayon.

Sample B

Length of crayon 5 inches	
Length of eraser 2 inches	Difference of lengths 3 inches

The eraser is 3 inches shorter than the crayon.

DISCUSS IT

Ask your partner: Do you agree with me? Why or why not?

Tell your partner: I agree with you about . . . because . . .

579

DISCUSS IT

Support Partner Discussion

Encourage students to use the *Discuss It* questions and sentence starters on the Student Worktext page as part of their discussion.

Support as needed with questions such as:

- *How did you start?*
- *What did you notice about your partner's strategy that is different from yours?*

Common Misconception Look for students who line up an inch ruler below the crayon and eraser but read the longest length, 5 inches, instead of finding the difference between 5 inches and 2 inches.

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Select and Sequence Student Solutions

One possible order for whole class discussion:

- measuring the eraser and crayon individually and finding the difference
- measuring the difference in length between the eraser and the crayon
- using a bar model to find the difference using an addition fact
- using a bar model to find the difference using an equation

Support Whole Class Discussion

Compare and connect the lengths of the objects and how the difference was found between their lengths.

Ask *How was the difference between the lengths found?*

Listen for I found the difference by first measuring and then subtracting; I found the difference by measuring the length from the right side of the eraser to the right side of the crayon.

MEASURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the length of the crayon
- the length of the eraser
- the difference between the lengths

Ask *How could you use the rulers to find the difference between the lengths of the crayon and the eraser?*

Listen for I can use the rulers to measure the length of the crayon and the eraser and then subtract; I also can use the ruler to measure the pat of the crayon that does not have the eraser lined up under it.

For measuring each object and finding the difference, prompt students to describe how they used the rulers.

- *How can you use the ruler to find the length of the crayon? To find the length of the eraser?*

For measuring the difference, prompt students to describe how they used the ruler.

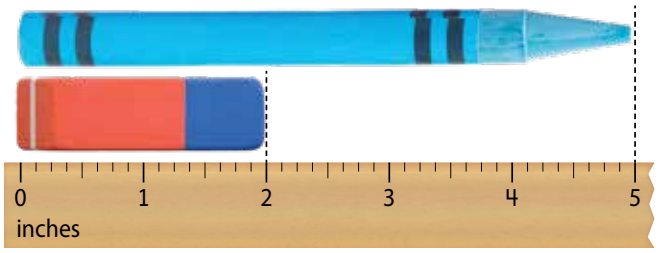
- *What part of the ruler shows the difference in the lengths?*

Explore different ways to understand comparing lengths.

How much shorter in inches is the eraser than the crayon?

MEASURE IT

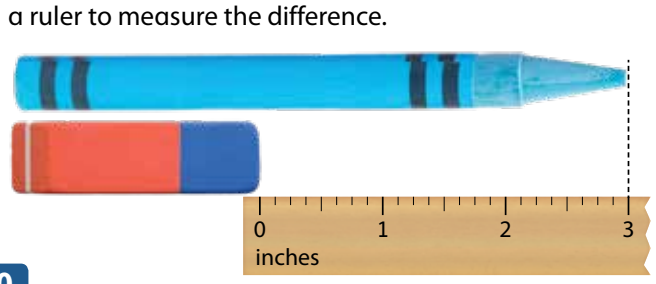
You can measure each object and find the difference.



MODEL IT

You can measure the difference.

Line up one end of the eraser and the crayon. Then use a ruler to measure the difference.



Deepen Understanding

Measuring the Difference

SMP 6 Attend to precision.

When discussing measuring the difference of the lengths of the crayon and the eraser, prompt students to consider how the ruler is used to directly measure the difference.

Ask *What part of the crayon shows the difference between the lengths? Why is the 0 mark of the ruler lined up under the right end of the eraser? How is the ruler used to measure the difference in the lengths?*

Listen for The part of the crayon without the eraser under it shows the difference. The right end of the eraser is above the 0 mark because that is where the difference between the objects begins.

Ask *Could you use an inch ruler in the same way to find out how many inches longer one object is than another object?*

Listen for Finding how much longer one object is than another is the same as finding how much shorter the other object is than the first object. Both differences represent the same length.

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CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page, students will use the problem from the previous page to learn how to find the difference between two lengths.

Monitor and Confirm

1 – 2 Check for understanding that:

- the length of the eraser can be subtracted from the length of the crayon to find how much shorter the eraser is
- the eraser is 3 inches shorter than the crayon

Support Whole Class Discussion

3 Be sure students understand that the problem is asking them to identify that the difference between the length of the crayon and the length of the eraser is being measured.

Ask *What part of the crayon is being measured? Why?*

Listen for The part of the crayon that is being measured is the part of the crayon that does not have the eraser lined up under it. This part is being measured because it shows the difference in the lengths of the two objects.

4 REFLECT Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand different ways to compare lengths.

1 Look at **Measure It**. Explain how to find how much shorter the eraser is than the crayon.

Possible answer: Subtract the length of the eraser from the length of the crayon.

2 How much shorter is the eraser than the crayon?

The eraser is 3 inches shorter than the crayon.

3 What is measured in **Model It**?

the difference between the length of the crayon and the length of the eraser

4 REFLECT

Look back at your **Try It**, strategies by classmates, and **Measure It** and **Model It**. Which models or strategies do you like best for comparing lengths? Explain.

Possible answer: I like to line up the objects and then measure the difference in their lengths with a ruler. I like this because I only have to measure once.

Hands-On Activity

Use inch tiles to measure the difference between lengths.

If . . . *students are unsure about comparing lengths in inches,*

Then . . . *use this activity to have them concretely measure the difference between two lengths using inch tiles.*

Materials For each student: inch tiles cut from Activity Sheet *1-Inch Grid Paper*

- Ask students to find two books that are different lengths.
- Have them compare the books by aligning them on the left side, one book above the other.
- Ask: *What length would tell you the difference between the lengths of your books?* [the length from the right edge of the shorter book to the right edge of the longer book]
- Instruct students to lay their tiles one next to another to extend from the shorter book to the longer book. Have them tell the difference between the books in inches by counting the tiles.
- Have students measure the difference with their rulers to see that the difference in the lengths of the books is the same as the number of inch tiles.

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APPLY IT

For all problems, encourage students to explain how they found the difference between the lengths of the two objects.

5 Students should circle the shorter paper clip and respond that it is 1 inch shorter.

6 6 centimeters; Possible work: The length of the longer ribbon is 15 centimeters. The length of the shorter ribbon is 9 centimeters. $15 - 9 = 6$, so the difference is 6 centimeters.

Close: Exit Ticket

7 Possible answer for first way: I would measure the lengths of the carrot and the string bean using an inch ruler and then subtract the lesser number from the greater number. The carrot is 6 inches long, and the string bean is 4 inches long; $6 - 4 = 2$.

Possible answer for second way: I would line up the objects at their left sides. Then I would measure the difference between their right sides. The difference between their right sides is 2 inches.

Students' solutions should indicate understanding of:

- using an inch ruler to measure the length of each object
- writing an equation or making a bar model to find the difference between the two lengths
- using an inch ruler to measure the difference between the lengths of the objects

Error Alert **If** students are only able to describe finding the difference between the lengths by measuring each of the objects and subtracting, **then** review the process of lining up the objects and measuring the difference.

APPLY IT

Use what you just learned to solve these problems.

5 Henry has two paper clips.

Circle the paper clip that is shorter. How many inches shorter is it?

It is 1 inch shorter.

6 Sharon has two pieces of ribbon. What is the difference in the lengths of the pieces of ribbon, in centimeters? Show your work.

6 centimeters. Possible work: The longer ribbon is 15 centimeters long. The shorter piece is 9 centimeters long. $15 - 9 = 6$, so the difference is 6 centimeters.

7 Explain how you could find the difference between the length of the bean and the length of the carrot in two different ways.

First way: **Possible answer: I would measure the lengths of the carrot and the bean using an inch ruler and then subtract the lesser number from the greater number. The carrot is 6 inches long, and the bean is 4 inches long; $6 - 4 = 2$.**

Second way: **Possible answer: I would line up the objects at their left sides. Then I would measure the difference between their right sides. The difference in their right sides is 2 inches.**

582

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Solutions

1 The hair clip is 2 inches shorter than the marker.
Medium

Name: _____ LESSON 24 SESSION 3

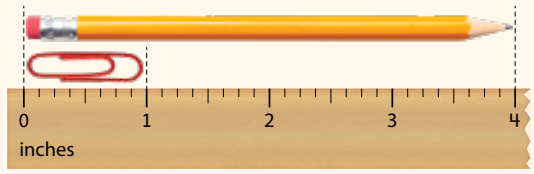
Practice Ways to Compare Lengths

Study the Example showing two ways to find the difference between lengths. Then solve problems 1–4.

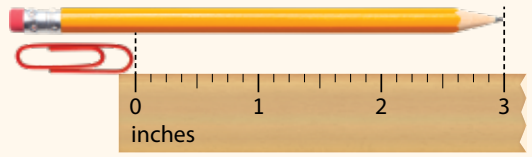
EXAMPLE

How much shorter is the paper clip than the pencil?

- Measure each object.
  Pencil: 4 inches
  Paper clip: 1 inch
  $4 - 1 = ?$ or $1 + ? = 4$

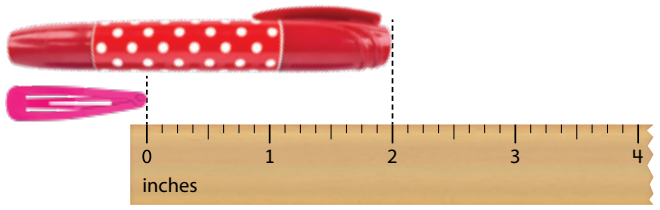


- Or measure the difference.
  Line up the two objects.
  Measure the difference.



So, the paper clip is 3 inches shorter than the pencil.

1 How many inches shorter is the hair clip than the marker?



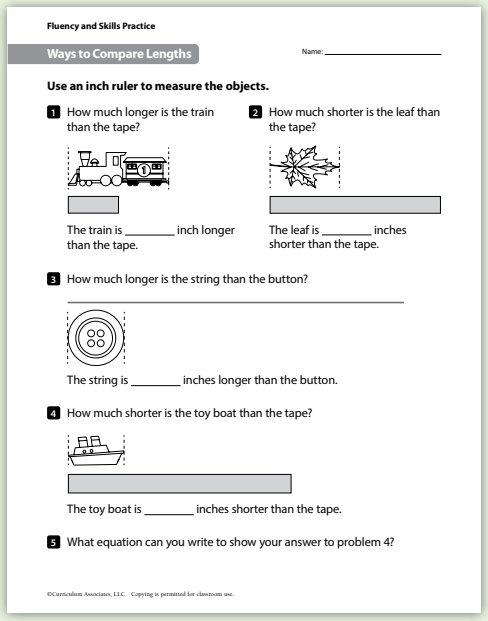
The hair clip is 2 inches shorter than the marker.

583

Fluency & Skills Practice Teacher Toolbox

Assign *Ways to Compare Lengths*

Students will need an inch ruler to complete this activity. In this activity students practice measuring lengths in inches and finding the difference between two lengths. The problems give students experience in measuring and comparing lengths. The last problem has students write an equation to represent a comparison.



Fluency and Skills Practice

Ways to Compare Lengths

Name: _____

Use an inch ruler to measure the objects.

1 How much longer is the train than the tape?

The train is _____ inch longer than the tape.

2 How much shorter is the leaf than the tape?

The leaf is _____ inches shorter than the tape.

3 How much longer is the string than the button?

The string is _____ inches longer than the button.

4 How much shorter is the toy boat than the tape?

The toy boat is _____ inches shorter than the tape.

5 What equation can you write to show your answer to problem 4?

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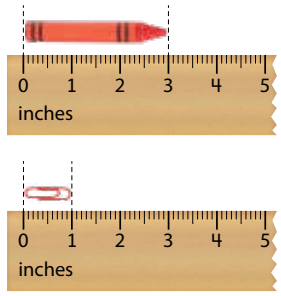
2 The crayon is 2 inches longer than the paper clip.
Medium

3 The eraser is 4 inches shorter than the pen.
Medium

4 Answers will vary: Possible answer: I like the method shown in problem 3 better because you only have to measure once.
Challenge

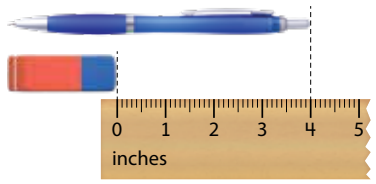
2 How much longer is the crayon than the paper clip?



The rulers on this page are not life-sized.

The crayon is 2 inches longer than the paper clip.

3 How much shorter is the eraser than the pen?



The eraser is 4 inches shorter than the pen.

4 Do you like the method shown in problem 2 or in problem 3 better? Explain why.

Answers will vary. Possible answer: I like the method shown in problem 3 better because you only have to measure once.

ELL English Language Learners: Differentiated Instruction

Prepare for Session 4
Use with *Apply It*.

Levels 1–3

Speaking/Listening Read ***Apply It*** problem 1 and have students follow along silently. Have students point to the paper strips. Ask: *What do you need to find?*

Pair students and ask them to decide on a strategy they could use and an equation they could write in order to solve the problem.

When finished, encourage students to share their strategies, equations, and answers. Ask: *Which strip is longer?* Allow students to point or answer with single words or phrases.

Levels 2–4

Listening/Speaking Have students chorally read ***Apply It*** problem 1. Instruct students to work with partners to discuss a strategy for solving the problem.

Ask: *What do you need to find? Which strategy will you use?*

When finished, have students talk about their answers. Provide these sentence frames:

The green strip is _____ centimeters long, and the red strip is _____ centimeters long.

The difference in the _____ is _____ centimeters.

Levels 3–5

Listening/Speaking Have students chorally read ***Apply It*** problem 1. Instruct students to work with partners and discuss a strategy for solving the problem.

Have students solve the problem individually. When finished, have partners share their strategies and answers with other students. Encourage them to use the words *length, lengths,* and *long*.

Provide these sentence frames:

The _____ of the green strip is _____.

The length of the red strip is _____.

The difference in their lengths is _____.

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LESSON 24

SESSION 4 Refine

Purpose In this session, students use different strategies to compare the lengths of two objects.

Start

Connect to Prior Knowledge

Materials For each student: Activity Sheet *Shell Measurements*

Why Support students' knowledge of measuring and comparing length in inches.

How Have students compare measurements made in inches.

Use the lengths of the shells you measured. Is Shell A longer or shorter than Shell B? What is the difference in their lengths? Is Shell B longer or shorter than Shell C? What is the difference in their lengths?

Solutions
longer; 1 inch
shorter; 2 inches

EXAMPLE

Jonah is 9 inches taller than Sophia. Using a bar model and an equation is shown as one way to solve the problem. Students also could solve the problem using the equation $43 + ? = 52$.

Look for Asking *How much taller* means the difference between the heights must be found.

APPLY IT

1 6 centimeters; Possible work: $9 - 3 = 6$; Students also could solve the problem by counting the number of inch marks from 3 to 9 on the ruler.
DOK 2

Look for The difference is shown as the part of the longer paper strip that does not have the shorter paper strip below it.

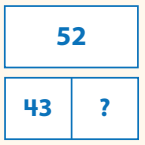
Refine Comparing Lengths

Complete the Example below. Then solve problems 1–3.

EXAMPLE

Jonah is 52 inches tall. His sister Sophia is 43 inches tall. How much taller is Jonah than Sophia?

You can use a bar model and equation.

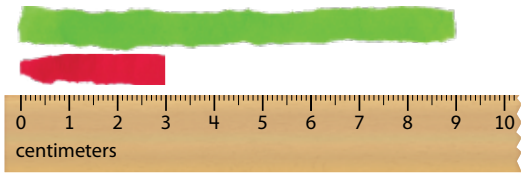


$52 - 43 = 9$

Solution Jonah is 9 inches taller than Sophia.

APPLY IT

1 Anna measures the paper strips below in centimeters. What is the difference in the lengths of the paper strips? Show your work.



The difference in the lengths of the paper strips is how much longer or shorter one is than the other.

Possible work: $9 - 3 = 6$

Solution 6 centimeters

2 The shorter nail should be circled; 4 centimeters; Possible work: $7 - 3 = 4$
Students also could solve the problem using the equation $3 + ? = 7$.
DOK 2

Look for The difference of the lengths of the nails equals the length from the right end of the short nail to the right end of the long nail.

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3 **D**; Students could solve this problem by finding $3 - 1 = 2$ and then measuring the lengths of the pieces of yarn in the answer choices to find that the piece of yarn in choice **D** is 2 inches long.

Explain why the other two answer choices are not correct:

B is not correct because 1 inch is the difference, not the length of the yarn.

C is not correct because 3 inches is the length of Tim's yarn.

DOK 3

Close: Exit Ticket

Check for Understanding

Materials For each student: two strips of paper (one 12 centimeters long and one 7 centimeters long), a centimeter ruler

For remediation: an unused pencil, an unused crayon, centimeter tiles cut from Activity Sheet *1-Centimeter Grid Paper* or centimeter cubes

Ask students to solve the following problem:

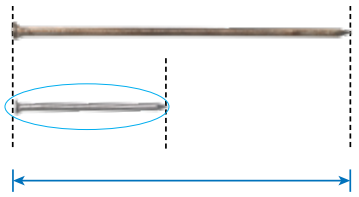
Measure the two strips of paper. How much longer is one strip of paper than the other strip? [5 centimeters]

For students who are still struggling, use the table below to guide remediation.

After providing remediation, check students' understanding using the following problem:

Measure the length of the crayon and the pencil. What is the difference between their lengths? [Answers will vary.]

2 Circle the nail that is shorter. Then tell how much shorter it is. Use a ruler. Measure using centimeters. Show your work.



Possible work: 7 − 3 = 4

What equation can you write to help you find the answer?

Solution **4 centimeters**

3 Tim has a piece of yarn that is 3 inches long. Which piece of yarn is 1 inch shorter than Tim's yarn?

Ⓐ

Ⓑ

Ⓒ

Ⓓ

Will the length of the correct piece of yarn be more or less than 3 inches?

Ben chose Ⓐ as the answer. How did Ben get his answer?

Possible answer: He found the piece of yarn that is 1 inch longer instead of shorter.

586

Error Alert

If the error is . . .	*Students may . . .*	*To support understanding . . .*
19 cm	have added the lengths rather than subtracted.	Provide students with centimeter tiles cut from Activity Sheet *1-Centimeter Grid Paper* or centimeter cubes. Ask them to identify where the difference between the paper strips is shown. Have them place the tiles or cubes along the side of the longer strip to find the difference.
4 cm	have measured or subtracted incorrectly.	Have students measure the paper strips again to ensure they measured accurately. If they used subtraction previously to find the difference, have them use addition this time. If they used addition previously, have them use subtraction this time.

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Solutions

1 5 centimeters; Possible work: $9 - 4 = 5$
Medium

2 **A**; The eraser is 2 inches long and the paper clip is 1 inch long; $2 - 1 = 1$.

Explain why the other two answer choices are not correct:

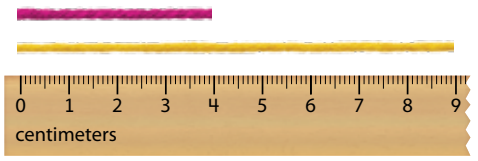
B is not correct because 2 inches is the length of the eraser, not the difference in the lengths.

D is not correct because 4 inches is greater than the lengths of the eraser and the paper clip combined.
Medium

Name: _____ **LESSON 24 SESSION 4**

Practice Comparing Lengths

1 What is the difference in the lengths of the two pieces of yarn? The ruler shows centimeters. Show your work.

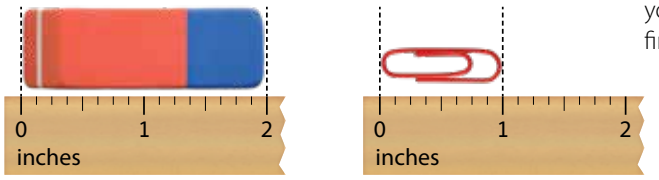


Possible work: 9 − 4 = 5

Remember: finding the difference in length means you tell how much longer or shorter one piece of yarn is than the other.

Solution 5 centimeters

2 How much longer is the eraser than the paper clip?



What equation can you write to help you find the answer?

Ⓐ 1 inch
Ⓑ 2 inches
Ⓒ 3 inches
Ⓓ 4 inches

Jane chose Ⓒ. How did Jane get her answer?

Possible answer: She added the two lengths. She should have subtracted 1 from 2 instead.

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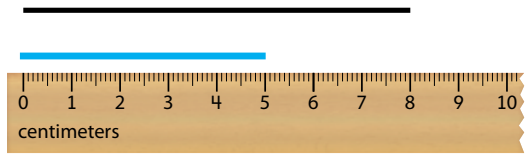
3 Students should draw a line that is 5 centimeters long.
Medium

4 **B, C, D**
Challenge

5 Possible explanation: Sadie did not line up the objects correctly before measuring the difference.
Medium

3 Frank drew the line below. Draw a line below it that is 3 centimeters shorter.



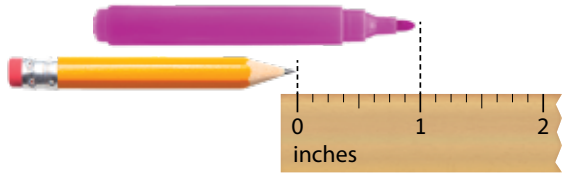
How many centimeters long should your line be?

4 Keith's tower is 37 centimeters tall. Ruby's tower is 45 centimeters tall. Which equations could you use to find out how much taller Ruby's tower is than Keith's tower?

Ⓐ $45 + 37 = ?$
Ⓑ $45 - ? = 37$
Ⓒ $37 + ? = 45$
Ⓓ $45 - 37 = ?$
Ⓔ $37 - 45 = ?$

Can you use a bar model to help you decide which equations you could use?

5 Sadie says the marker is 1 inch longer than the pencil. What did Sadie do wrong?



What do you need to do first when you measure the difference?

Possible answer: She didn't line up the objects correctly before measuring the difference.

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LESSON 24

SESSION 5 Refine

Purpose In this session, students gain fluency with comparing the lengths of objects.

Start

Develop Fluency

Materials For each student: centimeter ruler

Why Support students' facility with finding the difference of lengths in centimeters.

How Have students measure and compare two different length sides of a sheet of paper, in centimeters.

Use a centimeter ruler.

Find the difference between the lengths of the longer side and the shorter side of a sheet of paper to the nearest centimeter.

Solution

Possible answer: about 6 centimeters

APPLY IT

1 **A**; $4 - 2 = 2$; 2 inches
DOK 2

2 **B**; $7 - 3 = 4$; 4 centimeters
DOK 2

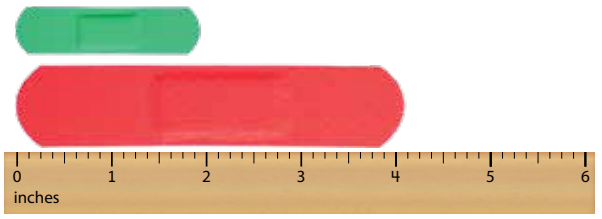
3 **B** (False);
C (True);
E (True);
H (False)
DOK 2

Refine Comparing Lengths

APPLY IT

Solve the problems.

1 How much longer in inches is the bottom bandage than the top bandage?



Ⓐ 2 inches
Ⓑ 3 inches
Ⓒ 4 inches
Ⓓ 5 inches

2 What is the difference in the lengths of the two straws? Measure using centimeters.

Ⓐ 3 centimeters
Ⓑ 4 centimeters
Ⓒ 7 centimeters
Ⓓ 10 centimeters

Differentiated Instruction

RETEACH

Hands-On Activity

Compare foot length and hand length.

Students struggling with measuring and comparing the lengths of objects in inches

Will benefit from additional practice by measuring and comparing the lengths of their hands and feet.

Materials For each student: inch ruler

- Tell students that they will each measure the length of their own foot and hand in inches. Then they will find the difference between those lengths.
- Have students first measure their foot. For measuring their hand, have them place a hand flat on a desk and measure from the middle of their wrist to the tip of their longest finger. Ask students to record their findings in a chart.
- When the chart is completed, ask students to compare the difference they found with that of other students. They should observe a consistent difference.

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4 Students should draw a line that is 11 centimeters long. Possible explanation: I measured to find that the line already on the page is 5 centimeters. Since $5 + 6 = 11$, I knew my line should be 11 centimeters long. ***DOK 3***

Close: Exit Ticket

5 MATH JOURNAL

Student responses should indicate understanding that the difference will always be the same, regardless of which method they use, because the length of the part of the longer object that extends beyond the shorter object is equal to subtracting the shorter length from the longer one.

Error Alert **If** students are unclear in their explanations of why either strategy gives the same difference, **then** show them two objects of different lengths aligned above a ruler and model how each method will find that the difference is the same.

SELF CHECK Have students consider whether they feel they are ready to check off any new skills on the Unit 4 Opener.

3 A table is 10 feet long. A desk is 3 feet long. Choose *True* or *False* for each statement.

	True	False
The table is 7 feet shorter than the desk.	Ⓐ	Ⓑ
The table is 7 feet longer than the desk.	Ⓒ	Ⓓ
The desk is 7 feet shorter than the table.	Ⓔ	Ⓕ
The desk is 7 feet longer than the table.	Ⓖ	Ⓗ

4 Draw a line that is 6 centimeters longer than the line below.

How long is your line in centimeters? How did you know the length your line should be?

My line is 11 centimeters. I measured to find that the line already on the page is 5 centimeters. Since $5 + 6 = 11$, I knew my line should be 11 centimeters.

5 MATH JOURNAL

When you find the difference in length of two objects, why do you get the same answer whether you measure each object and find the difference or you just measure the difference?

Possible answer: The answer is the same because both ways tell you how much longer one object is than the other.

SELF CHECK Go back to the Unit 4 Opener and see what you can check off.

EXTEND

Challenge Activity

Compare units of measure.

Students who have achieved proficiency with measuring and comparing the lengths of objects

Will benefit from comparing measurements in inches and centimeters.

Materials For each student: inch/centimeter ruler; or yardstick and meter stick

- Have students measure at least 10 different classroom objects in both inches and centimeters. Have them record their measurements in a table.
- Instruct students to compare the measurements in inches and centimeters for each object in order to find a pattern for estimating a centimeter length, given an inch length. (The number of centimeters is just less than 3 times the number of inches.)
- Have students test their pattern and share it with peers.

PERSONALIZE

i-Ready

Provide students with opportunities to work on their personalized instruction path with *i-Ready* Online Instruction to:

- fill prerequisite gaps
- build up grade-level skills

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