Objective To guide the discovery of basic properties of reflections.

Key Concepts and Skills
- Measure length.  
  [Measurement and Reference Frames Goal 1]
- Draw and describe congruent figures.  
  [Geometry Goal 2]
- Explore basic properties of reflections.  
  [Geometry Goal 3]
- Solve problems involving spatial visualization.  
  [Geometry Goal 3]

Key Activities
Students use a transparent mirror to discover basic properties of reflections. They draw reflected images.

Ongoing Assessment: Recognizing Student Achievement
Use Math Masters, page 309.  
[Geometry Goal 3]

Key Vocabulary
line of reflection

Materials
Study Link 10-2  
Math Masters, p. 309  
per partnership: 1 transparent mirror  
  ruler  
  slate

World Tour Option: Visiting a Second Country in Region 4
Student Reference Book, pp. 276, 277, 281, 288–291, 297, and 302–305  
Math Masters, pp. 419–421 (optional)
Students resume the World Tour in Region 4.

Growing Patterns
Math Journal 2, pp. 277A and 277B  
Students complete growing patterns.

Math Boxes 10-3
Math Journal 2, p. 278  
Students practice and maintain skills through Math Box problems.

Study Link 10-3
Math Masters, p. 310  
Students practice and maintain skills through Study Link activities.

Creating Reflections with Pattern Blocks or Centimeter Cubes
Math Masters, pp. 389 and 403  
centimeter cubes or pattern blocks  
  blank paper or centimeter grid paper  
Students create designs with pattern blocks or centimeter cubes and reflect the designs.

Exploring Reflections of 3-Dimensional Figures
Math Masters, p. 447  
centimeter cubes  
Students use centimeter cubes to construct 3-dimensional buildings and their reflections.

5-Minute Math
5-Minute Math™, p. 149  
blank paper  
Students solve problems involving reflections.

Advance Preparation
Getting Started

Mental Math and Reflexes
Dictate large numbers for students to write on their slates.
Suggestions:
- 14,887,320
- 45,318,972
- 89,246,307
- 100,456,892
- 203,541,986
- 160,507,349
- 34,206,408,900
- 7,940,005,030
- 49,802,103,062

For each number, ask questions such as the following:
- Which digit is in the millions place?
- What is the value of the digit $x$?
- How many hundred millions are there?

Math Message
Stand facing a partner. One partner poses. The other partner positions his or her body to be the mirror image of the partner. Then switch roles.

Study Link 10-2 Follow-Up
Have students compare answers and share the preimages and images they created for Problem 7.

1 Teaching the Lesson

Math Message Follow-Up
Have partners show their mirror-image poses to the class. Strike your own pose. Have students show the mirror image. Slowly change your pose and challenge students to mirror your changes.

Tell students that in this lesson they will investigate some of the basic properties of reflections.

Examining Relationships between an Object and Its Reflected Image

Tell partnerships to put the recessed edge of the mirror on the line next to the dog's head. When they look directly through the mirror, they will see the image of the dog's head. (It is best to look through the mirror at eye level.) Ask students to carefully draw the image of the dog's head on the paper where they see it through the mirror and describe, on the back of Math Masters, page 309, how the drawings are alike and how they are different.

When all students have completed the tasks, bring the class together and lead them in the following exploration:

- Point out that the picture of the dog's head to the left of the line of reflection is the preimage. Remind students that pre-means “before,” so they can think of this as the “before image.”
- Ask: How are the two drawings alike? How are they different? Sample answers: The drawings are congruent; they are the same size and shape. They look exactly alike, except that the heads are facing in opposite directions.
Have students mark a point A anywhere on the preimage. Then ask them to look through the mirror, mark the image of point A, and label the image A’ ("A prime"). Write A’ on the board and explain that the little mark by the A is read "prime." The prime mark shows that A and A’ are different, but related, points.

Check that all students have labeled the corresponding points A and A’ on the dogs. The points may be anywhere, but they must be in the same place on the image as on the preimage.

Have students use a ruler to measure the distance from point A to the line of reflection and from point A’ to the line of reflection. Ask: What did you find out about the distances? They are the same.

Have students mark and label several other points (B, C, and so on) on the preimage; use the mirror to mark and label the corresponding points (B’, C’, and so on) on the image; and check with a ruler that corresponding points are the same distance from the line of reflection.

Remind students of the Pocket-Billiards Game. Ask: Where did you place the mirror in order to get the ball in the pocket? Halfway between the ball and the pocket.

Finally, have each student draw a picture on the left side of the reflection line in the bottom half of the page. Then ask partners to exchange papers and draw the image of their partner's picture.

Folding Paper to Observe Reflected Images

(Math Masters, p. 309)

Lead the class through the following procedure:

1. Fold Math Masters, page 309 in half lengthwise along the lines of reflection.
2. Hold the folded sheet up to the light to check if the preimage and image in Problem 1 and the preimage and image in Problem 3 match.

Ask: For each problem, are the preimage and image congruent? yes How do you know? They are the same size and shape.
2 Ongoing Learning & Practice

World Tour Option: Visiting a Second Country in Region 4


Social Studies Link If you have chosen to extend the scope of the World Tour for your class, have small groups visit a second country in Region 4. You may let them choose which countries to visit, or you may assign a country to each group. Remind students to update their Route Log (if they are keeping one) and Route Map and to complete Country Notes for the country they visit.

Growing Patterns

(Math Journal 2, pp. 277A and 277B)

Students complete growing patterns of numbers and shapes. Encourage students to discuss the patterns.

After students complete the journal pages, point out that the numbers in Problem 2 are called rectangular numbers and the numbers in Problem 4 are called pentagonal numbers. The shapes in Problem 1 show the rectangular numbers as arrays of dots. The shapes in Problem 3 are nonregular pentagons.

Math Boxes 10·3

(Math Journal 2, p. 278)

Mixed Practice Math Boxes in this lesson are paired with Math Boxes in Lesson 10·6. The skill in Problem 5 previews Unit 11 content.

Writing/Reasoning Have students write a response to the following: How did you choose the weight for the cat in Problem 5? Sample answer: I eliminated two of the choices. I knew the cat weighed more than 2 pounds of butter, and some of my friends weigh about 50 pounds. That made 10 pounds the best choice.

Study Link 10·3

(Math Masters, p. 310)

Home Connection Students shade grid squares to create images of given preimages. A transparent mirror is not required to do this page.
Differentiation Options

**READINESS**

▶ **Creating Reflections with Pattern Blocks or Centimeter Cubes**  
*(Math Masters, pp. 389 and 403)*

To explore reflections using concrete materials, have students use pattern blocks or centimeter cubes to create preimages for a partner to reflect.

▶ For centimeter cubes, have students fold a sheet of centimeter grid paper in half on a grid line. One partner creates a design on one side of the fold for the other partner to reflect.

▶ To use pattern blocks, have students fold a blank piece of paper in half to create a line of reflection. One student creates a design on one side of the fold for a partner to reflect on the other side of the fold.

On an Exit Slip, have students explain how they made their reflections.

**ENRICHMENT**

▶ **Exploring Reflections of 3-Dimensional Figures**  
*(Math Masters, p. 447)*

To apply students’ understanding of reflections, have partnerships use centimeter cubes to construct a 3-dimensional building, then trade buildings and construct the reflections. Each point in the first building should correspond to a point in the reflected building. Have students draw the original cube building and the reflection of the building on isometric dot paper.

**EXTRA PRACTICE**

▶ **5-Minute Math**

To offer students more experience with reflections, see *5-Minute Math*, page 149.