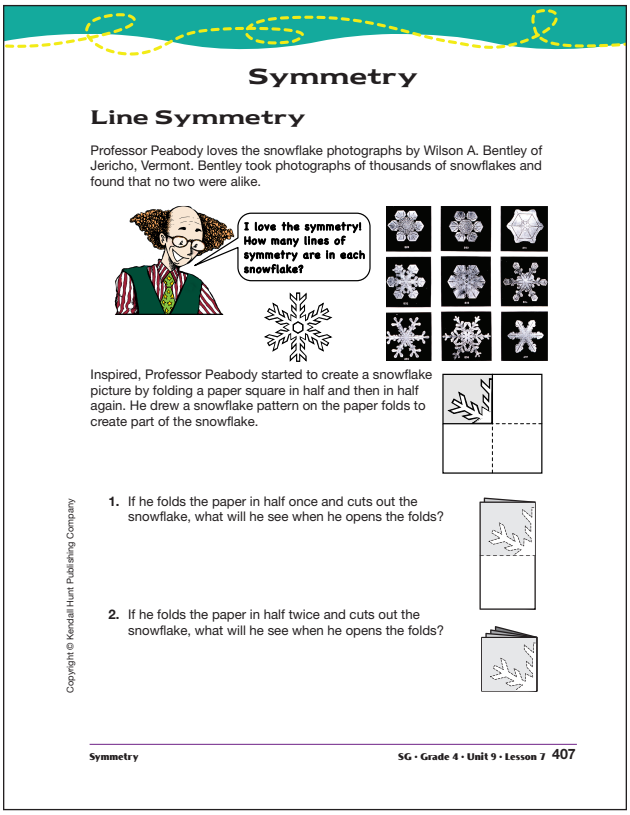

Symmetry

Line Symmetry

Professor Peabody loves the snowflake photographs by Wilson A. Bentley of Jericho, Vermont. Bentley took photographs of thousands of snowflakes and found that no two were alike.

Inspired, Professor Peabody started to create a snowflake picture by folding a paper square in half and then in half again. He drew a snowflake pattern on the paper folds to create part of the snowflake.

1. If he folds the paper in half once and cuts out the snowflake, what will he see when he opens the folds?

2. If he folds the paper in half twice and cuts out the snowflake, what will he see when he opens the folds?

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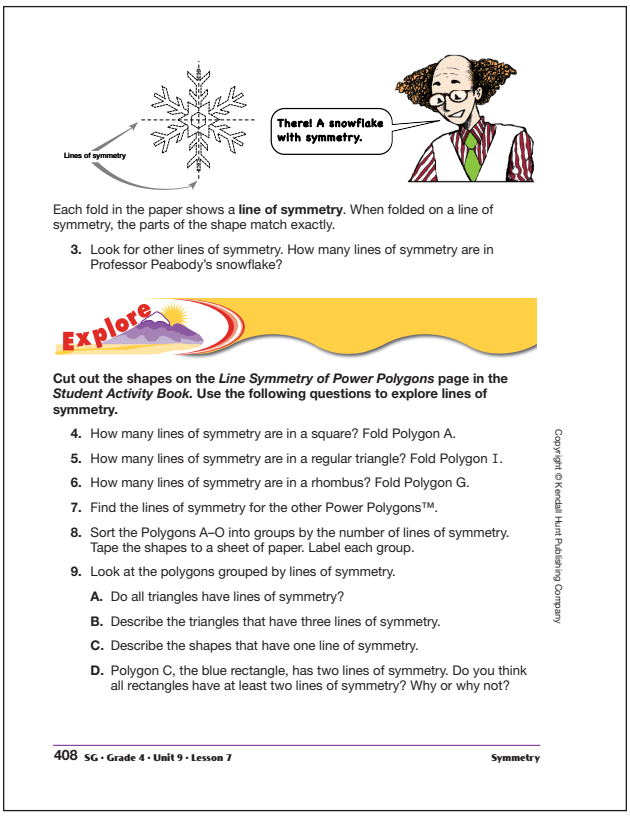

Each fold in the paper shows a **line of symmetry**. When folded on a line of symmetry, the parts of the shape match exactly.

3. Look for other lines of symmetry. How many lines of symmetry are in Professor Peabody's snowflake?

Explore

Cut out the shapes on the *Line Symmetry of Power Polygons* page in the *Student Activity Book*. Use the following questions to explore lines of symmetry.

4. How many lines of symmetry are in a square? Fold Polygon A.
5. How many lines of symmetry are in a regular triangle? Fold Polygon I.
6. How many lines of symmetry are in a rhombus? Fold Polygon G.
7. Find the lines of symmetry for the other Power Polygons™.
8. Sort the Polygons A–O into groups by the number of lines of symmetry. Tape the shapes to a sheet of paper. Label each group.
9. Look at the polygons grouped by lines of symmetry.
   - **A.** Do all triangles have lines of symmetry?
   - **B.** Describe the triangles that have three lines of symmetry.
   - **C.** Describe the shapes that have one line of symmetry.
   - **D.** Polygon C, the blue rectangle, has two lines of symmetry. Do you think all rectangles have at least two lines of symmetry? Why or why not?

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Questions 1–18 (SG pp. 407–411)

1. There will be half a snowflake cut out of the top half of the paper. The half snowflake will be symmetrical on each side of the vertical fold.
2. A whole snowflake that is symmetrical on the vertical fold and the horizontal fold. Symmetrical means both sides meet up exactly when folded.
3. There are six lines of symmetry.
4.* Four lines of symmetry. See Figure 2 in the lesson.
5.* Three lines of symmetry. See Figure 2.
6.* Two lines of symmetry. See Figure 2.
7.* See Figure 2.
8.* See Figure 2.
9. **A.** No, The orange triangle (L) does not have any lines of symmetry.
   B. The triangles that have three lines of symmetry have three equal sides.
   C. The shapes that have one line of symmetry all have two sides that are the same length.
   D. Yes, I think all rectangles have at least two lines of symmetry. Squares are also rectangles and they have four lines of symmetry. I drew a few other rectangles and they all had two lines of symmetry.

***Answers and/or discussion are included in the lesson.**

10. I do not agree with Jerome. GF and EH are not lines of symmetry. The triangles do not line up exactly with each other when I fold the rectangle.

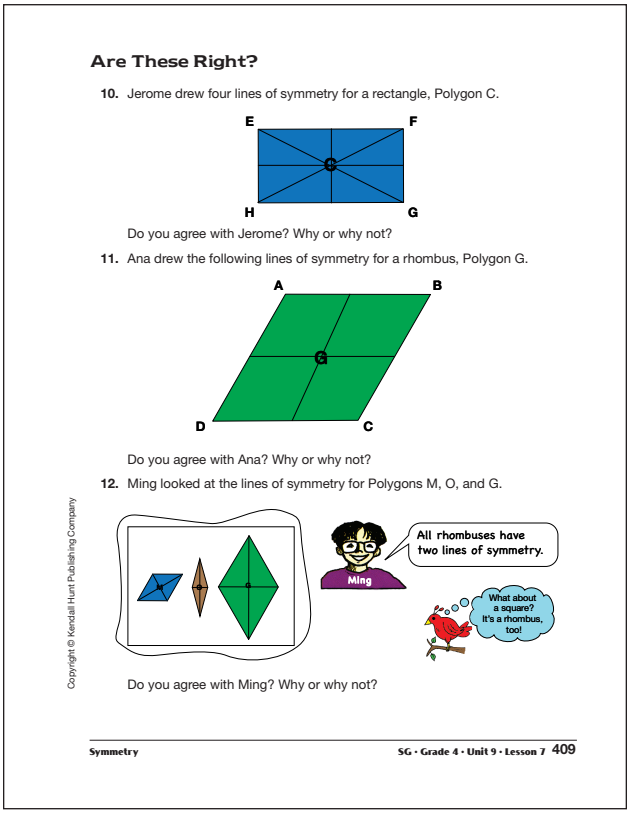
11. I do not agree with Ana. The green rhombus does not fold onto itself on the lines she drew.

12. Yes. I drew a few other rhombuses and they each had two lines of symmetry. But a square is also a rhombus and it has four lines of symmetry. So Ming is sort of right. All rhombuses have two or more lines of symmetry.

13. I agree with Linda. I tried to draw a line of symmetry on a parallelogram that was not a rhombus. The shapes did not match exactly.

14. I agree with Nicholas. The trapezoids that do not have two sides that are the same length will not have line symmetry. I would improve what Nicholas said by saying opposite sides that are not parallel must be the same length for the trapezoid to have line symmetry.

15. Professor Peabody can turn the snowflake 6 different ways.



Are These Right?

10. Jerome drew four lines of symmetry for a rectangle, Polygon C.

E F C H G

Do you agree with Jerome? Why or why not?

11. Ana drew the following lines of symmetry for a rhombus, Polygon G.

A B G D C

Do you agree with Ana? Why or why not?

12. Ming looked at the lines of symmetry for Polygons M, O, and G.

Ming: All rhombuses have two lines of symmetry.

What about a square? It's a rhombus, too!

Do you agree with Ming? Why or why not?

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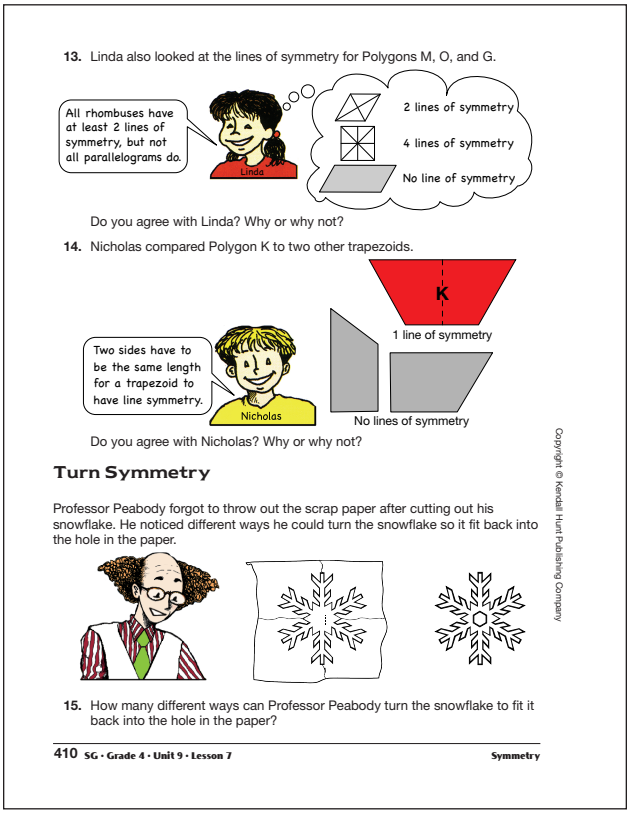

13. Linda also looked at the lines of symmetry for Polygons M, O, and G.

Linda: All rhombuses have at least 2 lines of symmetry, but not all parallelograms do.

2 lines of symmetry

4 lines of symmetry

No line of symmetry

Do you agree with Linda? Why or why not?

14. Nicholas compared Polygon K to two other trapezoids.

K

1 line of symmetry

Nicholas: Two sides have to be the same length for a trapezoid to have line symmetry.

No lines of symmetry

Do you agree with Nicholas? Why or why not?

Turn Symmetry

Professor Peabody forgot to throw out the scrap paper after cutting out his snowflake. He noticed different ways he could turn the snowflake so it fit back into the hole in the paper.

15. How many different ways can Professor Peabody turn the snowflake to fit it back into the hole in the paper?

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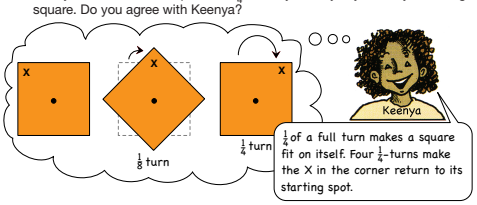
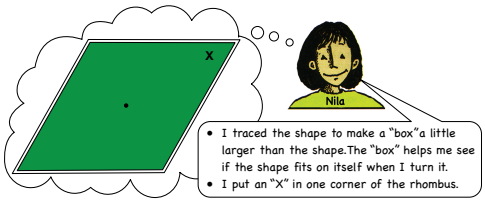
A shape has **turn symmetry** if it can be turned less than a full turn of 360° and fit on itself exactly.

16. Keenya decided that a square has $\frac{1}{4}$-turn symmetry. Try it with your orange square. Do you agree with Keenya?



Nila wanted to see if a rhombus had turn symmetry.



17. A. Use Nila's strategy to find out if a rhombus has turn symmetry.

B. What part of a full turn makes a rhombus fit on itself exactly?

18. Use Nila's strategy to find another Power Polygon™ with each characteristic.

A. Has turn symmetry

B. Has half-turn symmetry

C. Does not have turn symmetry

For more opportunities to find line and turn symmetry in shapes, complete the *Finding Symmetry* pages in your *Student Activity Book.*

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16. Yes, I agree with Keenya. The square turns a $\frac{1}{4}$ turn and ends up back on itself.

17 A. Yes, a rhombus has turn symmetry.

B. Half turn or 180° turn.

18. Answers will vary. Possible answer given.

A. The rhombuses, rectangle, regular triangles, squares, and hexagon have turn symmetry. (Polygons A, B, C, G, H, I, M, N, O)

B. The rhombuses and non-square rectangle have half-turn symmetry. (Polygons C, G, M, O)

C. Triangles D, J, E, F, and L and Trapezoid K do not have rotational symmetry.