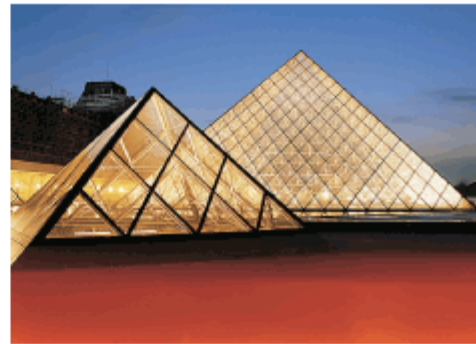


*If you don't live it, it won't
 come out of your horn.*

CHARLIE PARKER

Special Quadrilaterals

If you attach two congruent triangles, you create many different quadrilaterals that have special properties. For example, the quadrilaterals in the photo at right can be formed by reflecting an isosceles triangle across its base, resulting in a quadrilateral with four equal sides. In this lesson you will define different types of special quadrilaterals based on relationships of their sides and angles.



How many shapes make up the overall triangular shapes of these pyramids at the Louvre in Paris?

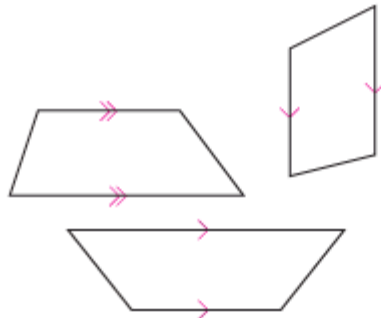


Investigation

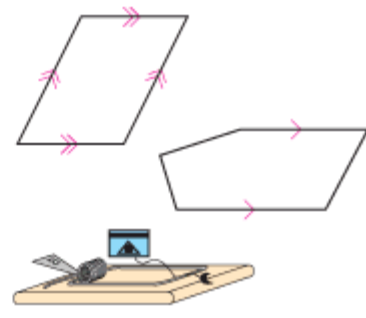
Special Quadrilaterals

Write a good definition of each boldfaced term. Discuss your definitions with others in your group. Agree on a common set of definitions for your class and add them to your definitions list. In your notebook, draw and label a figure to illustrate each definition.

Trapezoid

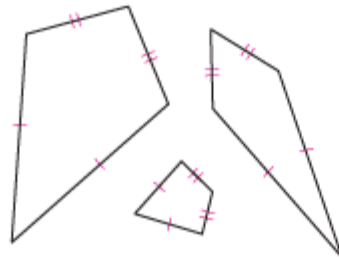


Trapezoids

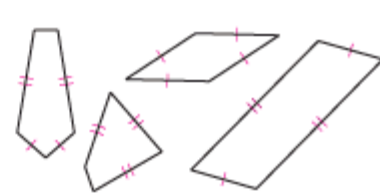


Not trapezoids

Kite



Kites



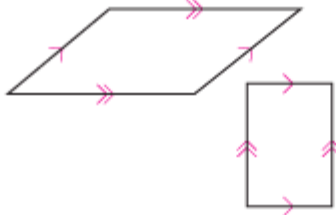
Not kites



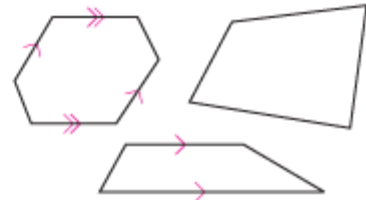
Recreation CONNECTION

Today's kite designers use lightweight synthetic fabrics and complex shapes to sustain kites in the air longer than earlier kites made of wood and cloth that had the basic "kite" shape. Many countries hold annual kite festivals.

Parallelogram

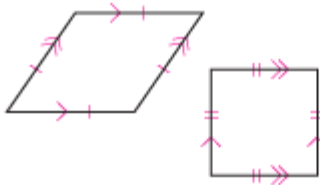


Parallelograms

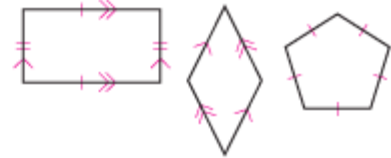


Not parallelograms

Rhombus

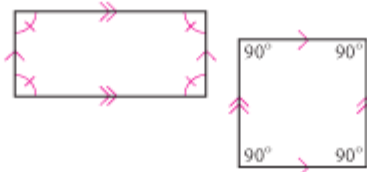


Rhombuses

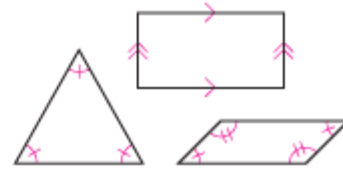


Not rhombuses

Rectangle

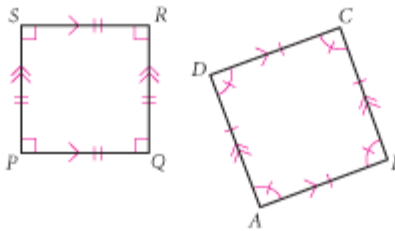


Rectangles

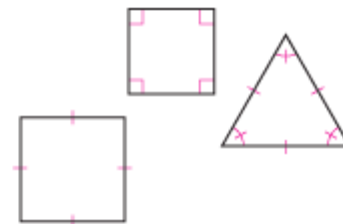


Not rectangles

Square



Squares



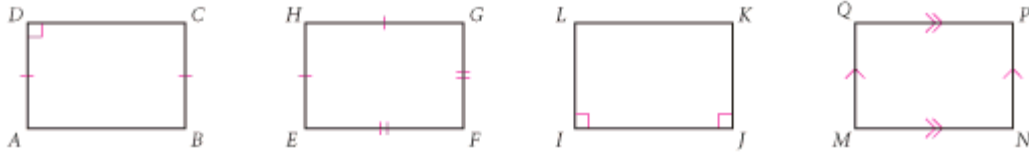
Not squares

As you learned in the investigation, a figure that looks like a square is not a square unless it has the proper markings. Keep this in mind as you work on the exercises.



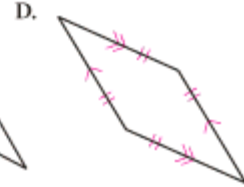
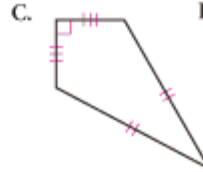
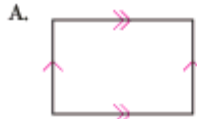
EXERCISES

1. Based on the marks, what can you assume to be true in each figure?



For Exercises 2–6, match the term on the left with its figure on the right.

2. Trapezoid

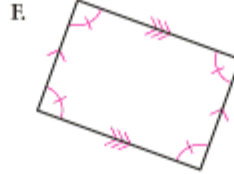


3. Rhombus

4. Rectangle

5. Kite

6. Parallelogram



For Exercises 7–10, sketch and label the figure. Mark the figures.

7. Trapezoid $ZOID$ with $\overline{ZO} \parallel \overline{ID}$

8. Kite $BENF$ with $BE = EN$

9. Rhombus $EQUL$ with diagonals \overline{EU} and \overline{QL} intersecting at A

10. Rectangle $RGHT$ with diagonals \overline{RH} and \overline{GT} intersecting at I

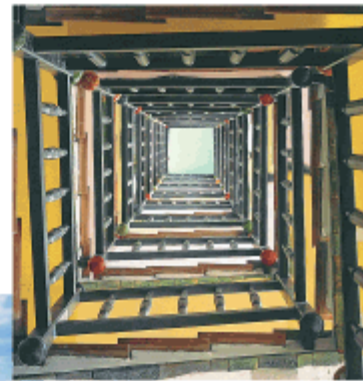
11. Draw a hexagon with exactly two outside diagonals.


12. Draw a regular quadrilateral. What is another name for this shape?

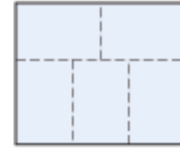
13. Find the other two vertices of a square with one vertex $(0, 0)$ and another vertex $(4, 2)$. Can you find another answer?

Architecture CONNECTION

Quadrilaterals are used in the architecture of many cultures for both practical purposes and aesthetic appeal. The Acoma Pueblo Dwellings in New Mexico, the Chichén Itzá pyramid in Mexico, and the spiral staircase in an apartment house designed by Austrian architect and artist Friedensreich Hundertwasser (1928–2000) all use quadrilateral-based designs for constructing climbing structures and enhancing overall attractiveness.

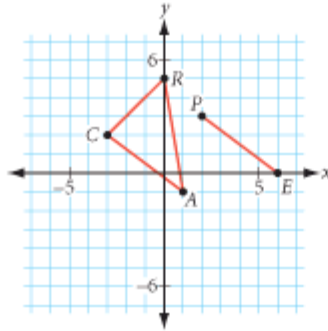


14. A rectangle with perimeter 198 cm is divided into five congruent rectangles, as shown in the diagram at right. What is the perimeter of one of the five congruent rectangles? 

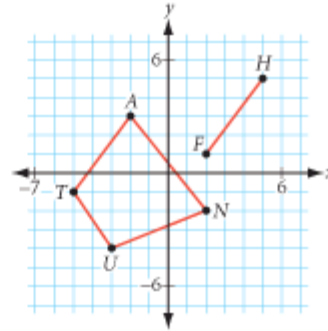


For Exercises 15–18, copy the given polygon and segment onto graph paper. Give the coordinates of the missing points.

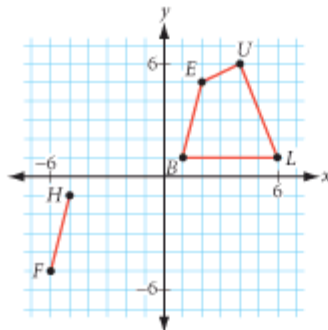
15. $\triangle CAR \cong \triangle PET$



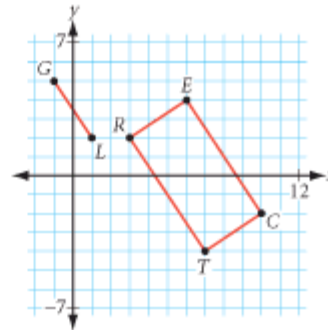
16. $TUNA \cong FISH$



17. $BLUE \cong FISH$



18. $RECT \cong ANGL$




19. Draw and cut out two congruent acute scalene triangles.
- Arrange them into a kite. Sketch the result and mark all congruent sides.
 - Arrange them into a parallelogram. Sketch the result and mark all congruent sides.
20. Draw and cut out two congruent obtuse isosceles triangles. Which special quadrilaterals can you create with these two congruent triangles? Explain.
21. Imagine using two congruent triangles to create a special quadrilateral, as you did in the last two exercises.
- What type of triangles do you need to form a rectangle? Explain.
 - What type of triangles do you need to form a square? Explain.

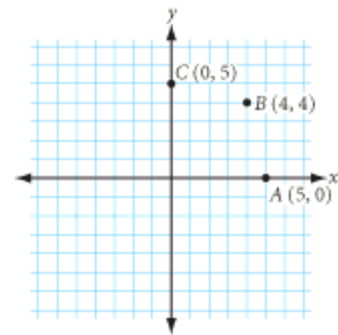


The repeating pattern of squares and triangles creates a geometric tree in this quilt design by Diane Venters. What other polygons can you find in this quilt?

Review

For Exercises 22–24, sketch and carefully label the figure. Mark the congruent parts.

22. A hexagon with exactly one line of reflectional symmetry 
23. Two different equilateral pentagons with perimeter 25 cm
24. Use your compass, protractor, and straightedge to draw a regular pentagon.
25. Draw an equilateral octagon $ABCDEFGH$ with $A(5, 0)$, $B(4, 4)$, and $C(0, 5)$ as three of its vertices. Is it regular?



project

DRAWING THE IMPOSSIBLE

Some optical illusions are tricks—they at first appear to be drawings of real objects, but actually they are impossible to make, except on paper.

For instance, see the photograph and drawings shown here, and the two pieces by M. C. Escher on p. 421 and p. 477. Try drawing some impossible objects. First, copy these two impossible objects by drawing them on full sheets of paper. Then create one of your own, either in a drawing or photograph.

Your project should include

- ▶ The two impossible drawings below.
- ▶ Your own impossible drawing or photograph.



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To see more examples or to further explore optical illusions, visit www.keymath.com/DG.