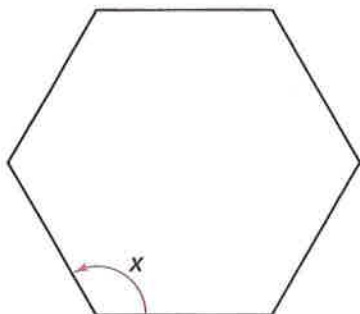




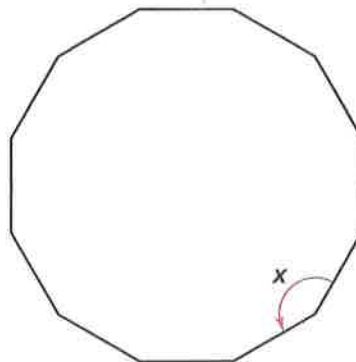
Applications

1. Without measuring, find the measure of the angle labeled x in each regular polygon.

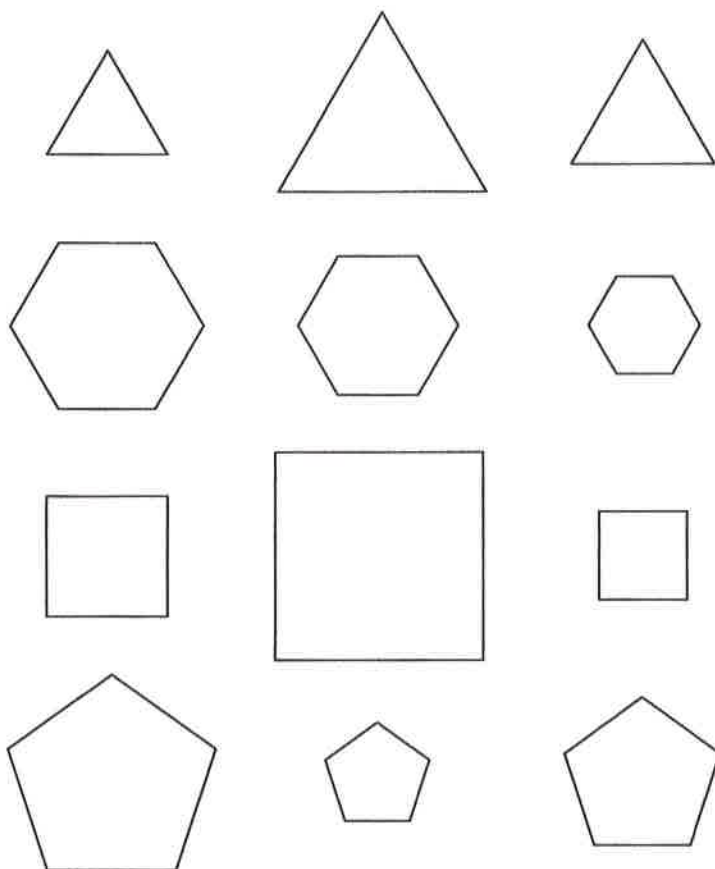
a.



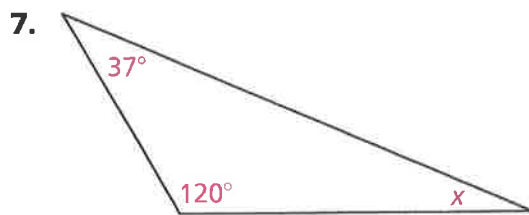
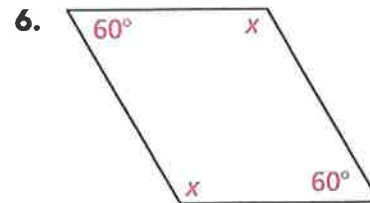
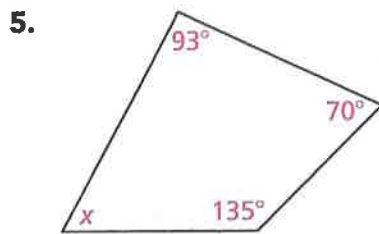
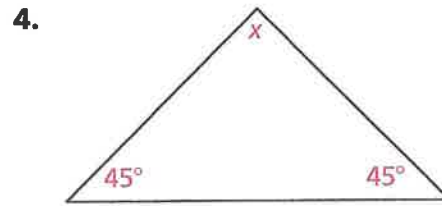
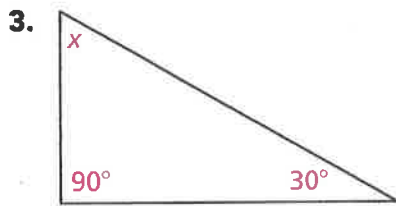
b.



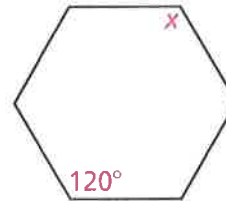
2. Below are sets of regular polygons of different sizes. Does the length of a side of a regular polygon affect the sum of the interior angle measures? Explain.



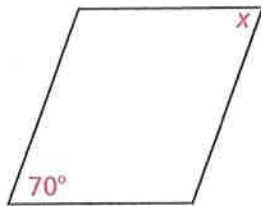
For Exercises 3–10, find the measure of each angle labeled x .



8. This figure is a regular hexagon.



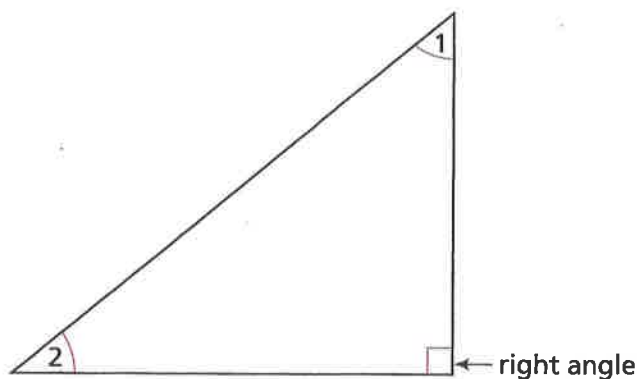
9. This figure is a parallelogram.



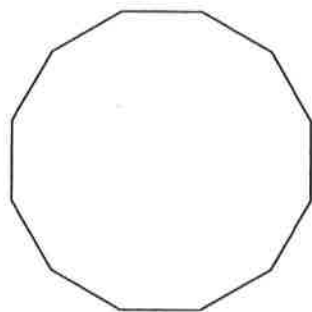
10. This figure is a trapezoid.



11. A right triangle has one right angle and two acute angles. Without measuring the angles, what is the sum of the measures of the two acute angles? Explain your reasoning.



12. The figure below is a regular dodecagon. It has 12 sides.



- What is the sum of the measures of the angles of this polygon?
 - What is the measure of each angle?
 - Can copies of this polygon be used to tile a flat surface? Explain.
13. **Multiple Choice** Which of the following combinations will tile a flat surface?
- regular heptagons and equilateral triangles
 - squares and regular octagons
 - regular pentagons and regular hexagons
 - regular hexagons and squares

14. Suppose in-line skaters make one complete lap around a park shaped like the quadrilateral below.



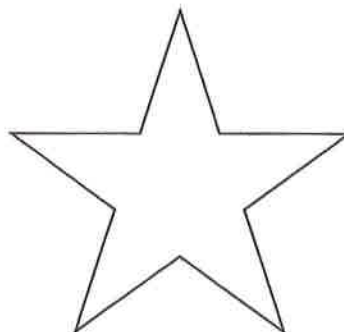
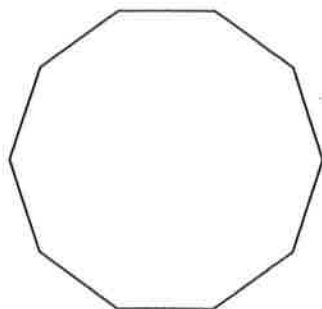
What is the sum of the angles through which they turn?

15. Suppose the skaters complete one lap around a park that has the shape of a regular pentagon.
- What is the sum of the angles through which they turn?
 - How many degrees will the skaters turn if they go once around a regular hexagon? A regular octagon? A regular polygon with n sides? Explain.

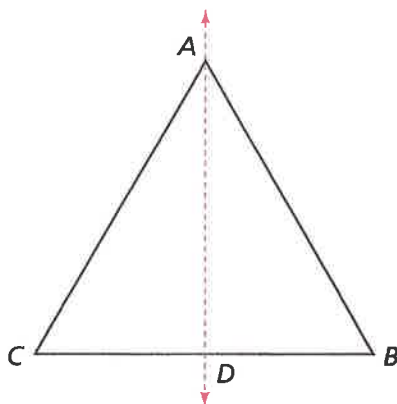


Connections

16. The regular decagon and star below are ten-sided polygons.

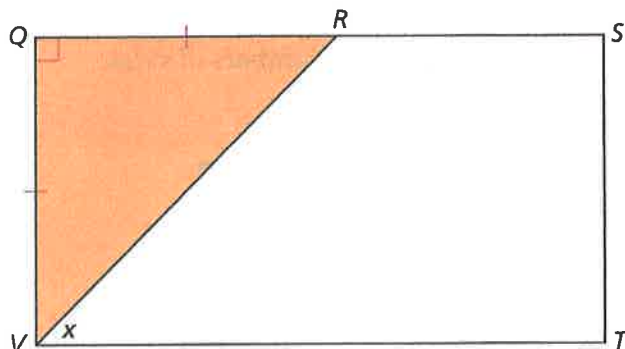


- Measure the angles inside the star to find the angle sum of the star.
 - Calculate the interior angle sum for a regular decagon and compare it to your measured sum for the star.
 - Use a strategy like that of Casey's to split the star into triangles. That is, draw lines from the center of rotation to each vertex of the star. Use that diagram to calculate the sum of angles for the star.
 - Explain why your result in part (c) does or does not match the measurements in part (a).
17. The diagram shows a line of symmetry for an equilateral triangle.



Examine the two smaller triangles that are formed using a part of the symmetry line. What do you know about the angles and the line segments of triangles ABD and ACD ? Give reasons to support your answers.

18. **Multiple Choice** Figure $QSTV$ is a rectangle. The lengths QR and QV are equal. What is the measure of angle x ?



- F. 20° G. 45° H. 90° J. 120°
19. Choose a non-rectangular parallelogram from the Shapes Set or draw one of your own. Using copies of your parallelogram, can you make a tiling pattern? Sketch a picture to help explain what you found.
20. Choose a scalene triangle (all three sides of different lengths) from your Shapes Set or draw one of your own. Using copies of your scalene triangle, can you make a tiling pattern? Sketch a picture to help explain what you found.
21. A class was asked what convinced them that the sum of exterior angles in any polygon is 360° . Here are three different points of view.

"We were convinced when we drew a bunch of different figures and used my angle ruler to measure the exterior angles. They all came out close to 360° ."

"We were convinced when we thought about walking around the figure and realized that we made one complete turn or 360° ."

"We used the results about sums of interior angles and the fact that the measure of each interior angle plus its adjacent exterior angle is 180° to deduce the formula using algebra."

What are the pros and cons of each argument?



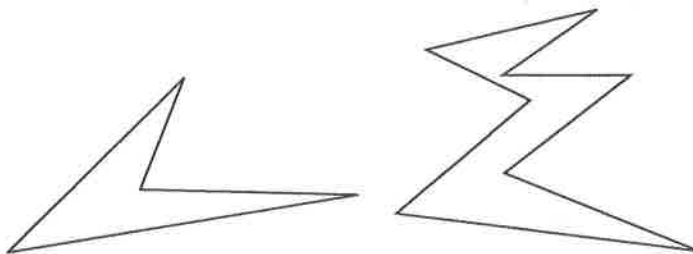
Extensions

22. The table begun here shows a pattern for calculating the measures of interior angles in regular polygons with even numbers of sides.

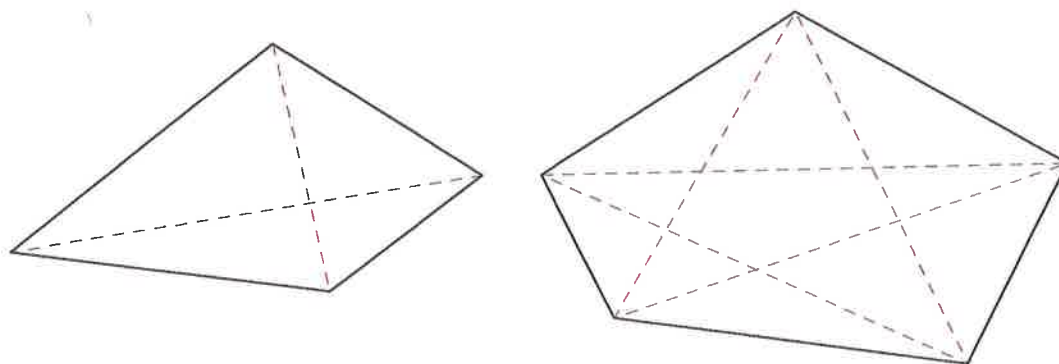
Regular Polygons

Number of Sides	Measure of Interior Angle
4	$\frac{1}{2}$ of 180°
6	$\frac{2}{3}$ of 180°
8	$\frac{3}{4}$ of 180°
10	■
12	■

- a. What entry would give the angle measures for decagons and dodecagons? Are those entries correct? How do you know?
- b. Is there a similar pattern for regular polygons with odd numbers of sides? If so, what is the pattern?
23. Kele claims that the angle sum of a polygon he has drawn is 1660° . Can he be correct? Explain.
24. Look at the polygons below. Does Trevor's method of finding the angle sum (Problem 2.2) still work? Does Casey's method still work? Can you still find the angle sum of the interior angles without measuring? Explain.



25. Below are a quadrilateral and a pentagon with the diagonals drawn from all of the vertices.



- a. How many diagonals does the quadrilateral have? How many diagonals does the pentagon have?
- b. Find the total number of diagonals for a hexagon and for a heptagon.
- c. Copy the table below and record your results from parts (a) and (b).

Number of Sides	4	5	6	7	8	9	10	11	12
Number of Diagonals	■	■	■	■	■	■	■	■	■

Look for a pattern relating the number of sides and the number of diagonals. Complete the table.

- d. Write a rule for finding the number of diagonals for a polygon with n sides.