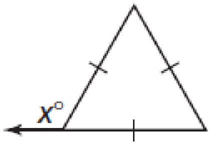
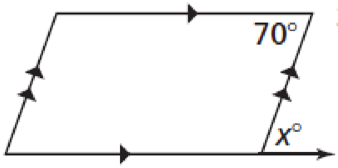
Find the value of *x* in the diagram.

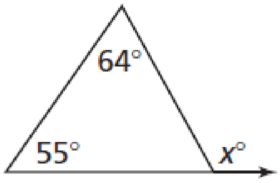
1.



2.



3.



Write an equation of the perpendicular bisector of the segment with endpoints *P* and *Q*.

1. $P(-3, -2)$, $Q(5, -2)$

2. $P(5, 0)$, $Q(5, -2)$

3. $P(7, -4)$, $Q(3, 2)$

4. $P(-8, 8)$, $Q(6, 3)$

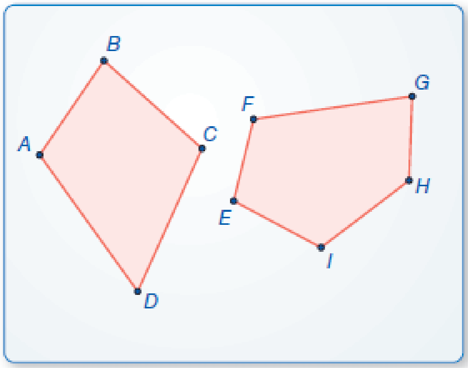
Essential Question

What is the sum of the measures of the interior angles of a polygon?

Work with a partner. Use dynamic geometry software.

a. Draw a quadrilateral and a pentagon. Find the sum of the measures of the interior angles of each polygon.

Sample



b. Draw other polygons and find the sums of the measures of their interior angles. Record your results in the table below.

Number of sides, *n*	3	4	5	6	7	8	9
Sum of angle measures, *S*							

c. Plot the data from your table in a coordinate plane.

d. Write a function that fits the data. Explain what the function represents.

Work with a partner.

a. Use the function you found in Exploration 1 to write a new function that gives the measure of one interior angle in a regular polygon with *n* sides.

b. Use the function in part (a) to find the measure of one interior angle of a regular pentagon. Use dynamic geometry software to check your result by constructing a regular pentagon and finding the measure of one of its interior angles.

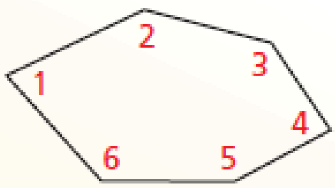
c. Copy your table from Exploration 1 and add a row for the measure of one interior angle in a regular polygon with *n* sides. Complete the table. Use dynamic geometry software to check your results.

Theorem

Theorem 7.1 Polygon Interior Angles Theorem

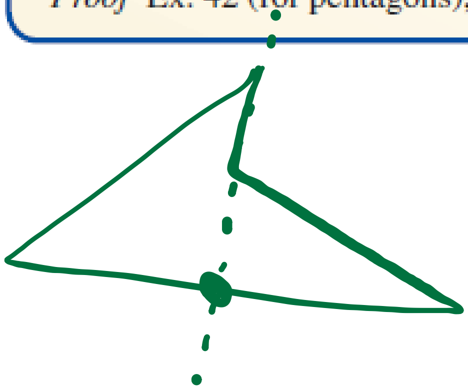
The sum of the measures of the interior angles of a convex n-gon is $(n-2) \cdot 180°$.

$$m\angle 1 + m\angle 2 + \cdots + m\angle n = (n-2) \cdot 180°$$



$n = 6$

Proof Ex. 42 (for pentagons), p. 365



Find the sum of the measures of the interior angles of the figure.

$(8-2)\cdot 180$

$6\cdot 180$

1080°

1. The coin shown is in the shape of an 11-gon. Find the sum of the measures of the interior angles.

$(11-2)\cdot 180$

$9 \cdot 180$

1620°

$\frac{1620^\circ}{11}$

147.27°

The sum of the measures of the interior angles of a convex polygon is 900°. Classify the polygon by the number of sides.

$$\frac{(n-2)180}{180} = \frac{900}{180}$$

$$n-2 = 5$$
$$+2 \quad +2$$
$$\boxed{n=7}$$

Corollary

Corollary 7.1 Corollary to the Polygon Interior Angles Theorem

The sum of the measures of the interior angles of a quadrilateral is 360°.

Proof Ex. 43, p. 366

Quad = 360°

Find the value of *x* in the diagram.

$108 + 121 + 59 + x = 360$

$x + 288 = 360$

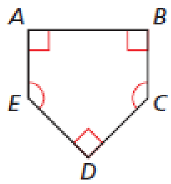
$-288 \quad -288$

$\boxed{x = 72}$

2. The sum of the measures of the interior angles of a convex polygon is 1440°. Classify the polygon by the number of sides.

3. The measures of the interior angles of a quadrilateral are $x°$, $3x°$, $5x°$, and $7x°$. Find the measures of all the interior angles.

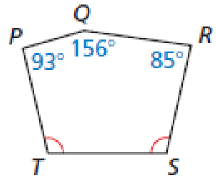
A home plate for a baseball field is shown.



a. Is the polygon regular? Explain your reasoning.

b. Find the measures of $\angle C$ and $\angle E$.

4. Find $m\angle S$ and $m\angle T$ in the diagram.



5. Sketch a pentagon that is equilateral but not equiangular.

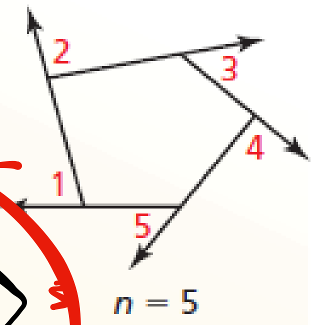
Theorem

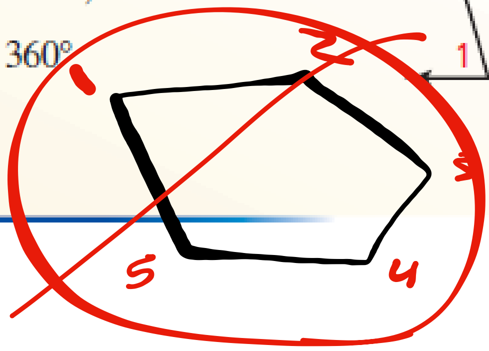
Theorem 7.2 Polygon Exterior Angles Theorem

The sum of the measures of the exterior angles of a convex polygon, one angle at each vertex, is 360°.

$$m\angle 1 + m\angle 2 + \cdots + m\angle n = 360°$$

Proof Ex. 51, p. 366





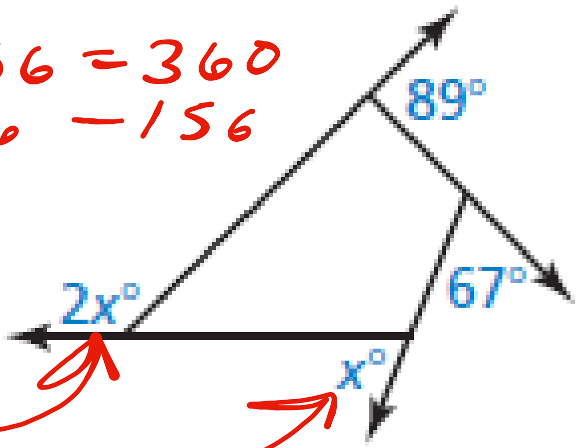
Find the value of *x* in the diagram.

$$2x + 89 + 67 + x = 360^\circ$$

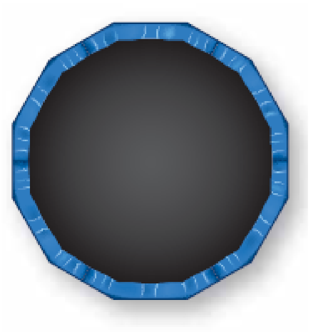
$$3x + 156 = 360$$
$$-156 \quad -156$$

$$\frac{3x}{3} = \frac{204}{3}$$

$$x = 68$$



The trampoline shown is shaped like a regular dodecagon.



a. Find the measure of each interior angle.

b. Find the measure of each exterior angle.

6. A convex hexagon has exterior angles with measures 34°, 49°, 58°, 67°, and 75°. What is the measure of an exterior angle at the sixth vertex?

7. An interior angle and an adjacent exterior angle of a polygon form a linear pair. How can you use this fact as another method to find the measure of each exterior angle in Example 6?

• **Writing Prompt:** To find the sum of the measures of the interior angles of an *n*-gon …