10–1

NAME ______________________________ DATE __________ PERIOD ______

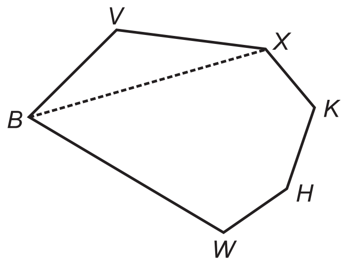
Study Guide

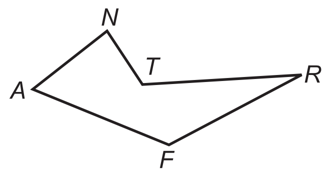
Naming Polygons

A **polygon** is a plane figure formed by a finite number of segments. In a **convex polygon**, all of the diagonals lie in the interior. A **regular polygon** is a convex polygon that is both equilateral and equiangular. In a **concave polygon**, any point of a diagonal lies in the exterior.

Example: Match each term with the appropriate letter from the box below. Some letters may be used more than once.

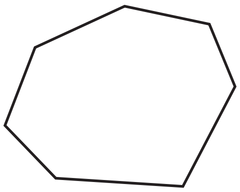
1. concave polygon	c	**a.**	*BVXKHW*
2. convex polygon	a	**b.**	*AFNTR*
3. diagonal	e	**c.**	*RFANT*
4. hexagon	a	**d.**	$\overline{TR}$
5. pentagon	c	**e.**	$\overline{BX}$
6. side	d	**f.**	*R*





Classify each polygon (a) by the number of sides, (b) as* regular *or* not regular*, and (c) as* convex *or* concave*.

1.



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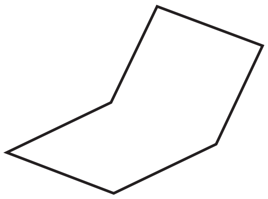

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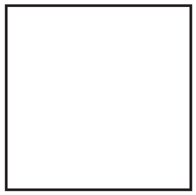

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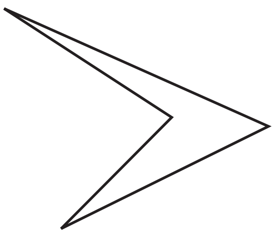

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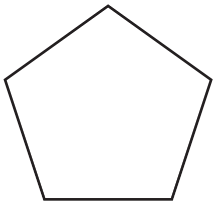

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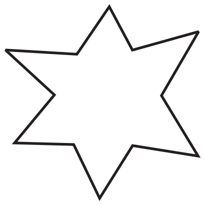

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Study Guide

Diagonals and Angle Measure

A **polygon** is a plane figure formed by a finite number of segments such that (1) sides that have a common endpoint are noncollinear and (2) each side intersects exactly two other sides, but only at their endpoints. A **convex polygon** is a polygon such that no line containing a side of the polygon contains a point in the interior of the polygon.

The following two theorems involve the interior and exterior angles of a convex polygon.

Interior Angle Sum Theorem	If a convex polygon has n sides, then the sum of the measures of its interior angles is $(n - 2)180$.
Exterior Angle Sum Theorem	In any convex polygon, the sum of the measures of the exterior angles, one at each vertex, is 360.

Example: Find the sum of the measures of the interior angles of a convex polygon with 13 sides.

$S = (n - 2)180$ *Interior Angle Sum Theorem*
$S = (13 - 2)180$
$S = (11)180$
$S = 1980$

Find the sum of the measures of the interior angles of each convex polygon.

1. 10-gon **2.** 16-gon **3.** 30-gon

The measure of an exterior angle of a regular polygon is given. Find the number of sides of the polygon.

4. 30 **5.** 20 **6.** 5

The number of sides of a regular polygon is given. Find the measures of an interior angle and an exterior angle for each polygon.

7. 18 **8.** 36 **9.** 25

10. The measure of the interior angle of a regular polygon is 157.5. Find the number of sides of the polygon.

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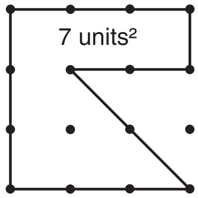
Study Guide

Areas of Polygons

The following theorems involve the areas of polygons.

- For any polygon, there is a unique area.
- Congruent polygons have equal areas.
- The area of a given polygon equals the sum of the areas of the nonoverlapping polygons that form the given polygon.

Example: Find the area of the polygon in square units.



Since the area of each four-dot unit represents 1 square unit, the area of each three-dot unit represents 0.5 square unit.

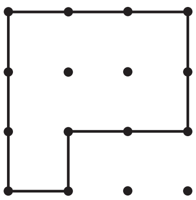
$A = 6(1) + 2(0.5)$ *There are 6 four-dot units and 2 three-dot units.*

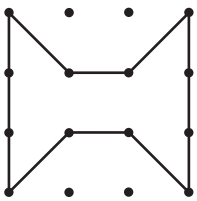
$A = 6 + 1$

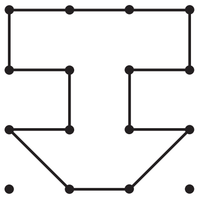
$A = 7$

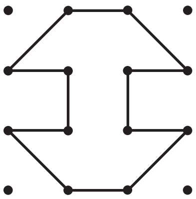
The area of the region is 7 square units, or 7 units^2.

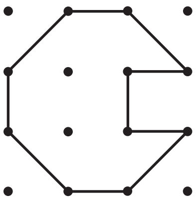
Find the area of each polygon in square units.

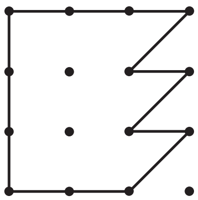
1. 

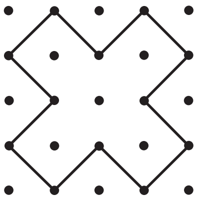
2. 

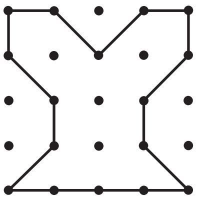
3. 

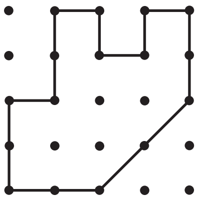
4. 

5. 

6. 

7. 

8. 

9. 

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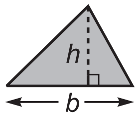
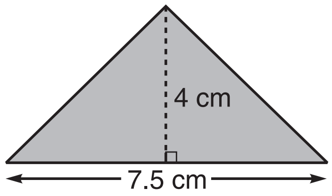
Study Guide

Areas of Triangles and Trapezoids

The area of a triangle is equal to one-half its base times its altitude.
$A = \frac{1}{2}bh$



Example 1: Find the area of the triangle.

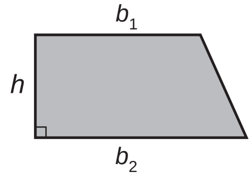


$A = \frac{1}{2}bh$

$A = \frac{1}{2}(7.5)(4) \quad b = 7.5,\ h = 4$

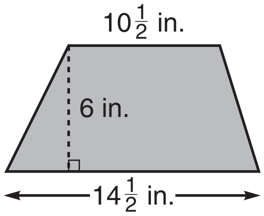
$A = 2(7.5)$

$A = 15$ The area is 15 square centimeters.



The area of a trapezoid is equal to one-half its altitude times the sum of its bases: $A = \frac{1}{2}h(b_1 + b_2)$.

Example 2: Find the area of the trapezoid.



$A = \frac{1}{2}h(b_1 + b_2)$

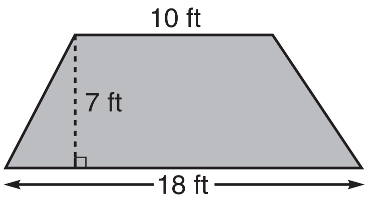
$A = \frac{1}{2}(6)\left(10\frac{1}{2} + 14\frac{1}{2}\right) \quad h = 6,\ b_1 = 10\frac{1}{2},\ b_2 = 14\frac{1}{2}$

$A = 3(25)$

$A = 75$ The area is 75 square inches.

Find the area of each triangle or trapezoid.

1.



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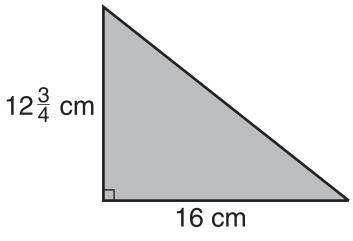

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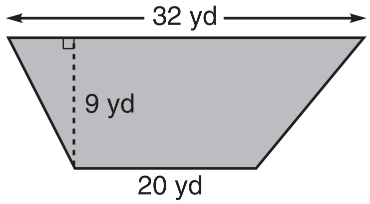

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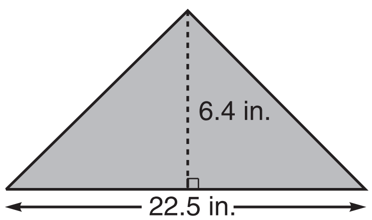

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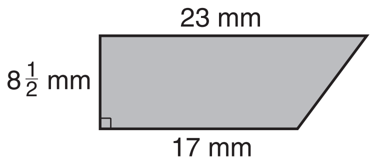

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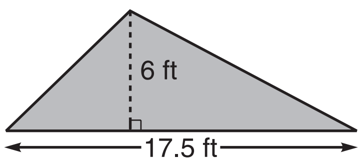

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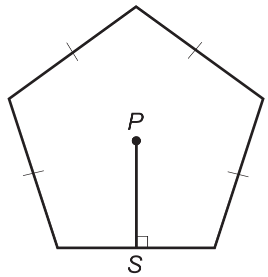
Study Guide

Areas of Regular Polygons

In a regular polygon, a segment drawn from the center of the polygon perpendicular to a side of the polygon is called an **apothem**. In the figure at the right, $\overline{PS}$ is an apothem.



Area of a Regular Polygon	If a regular polygon has an area of A square units, a perimeter of P units, and an apothem of a units, then $A = \frac{1}{2}Pa$.

Example: Find the area of a regular pentagon with an apothem of 2.8 cm and a perimeter of 20.34 cm.

$A = \frac{1}{2}Pa$ *Area of a regular polygon*

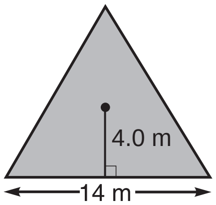
$A = \frac{1}{2}(20.34)(2.8)$

$A = 28.476$

The area is 28.476 square centimeters.

Find the area of each regular polygon. Round your answers to the nearest tenth.

1.



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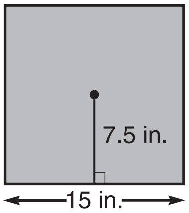

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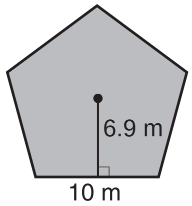


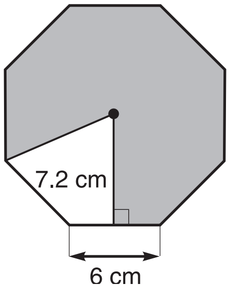
Find the area of each regular polygon described. Round your answers to the nearest tenth.

4. a hexagon with an apothem of 8.7 cm and sides that are each 10 cm long

5. a pentagon with a perimeter of 54.49 m and an apothem of 7.5 m

Find the area of each shaded region.

6.



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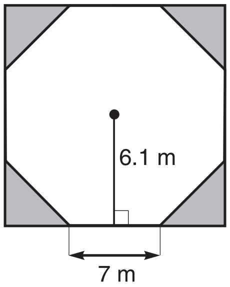

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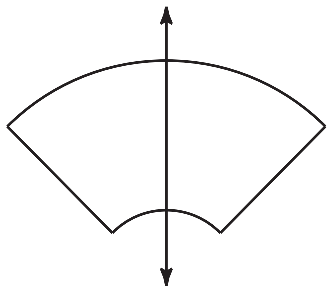
Study Guide

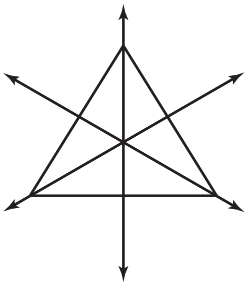
Symmetry

If you can fold a figure along a line so that the two parts reflect each other, the figure has a line of symmetry.

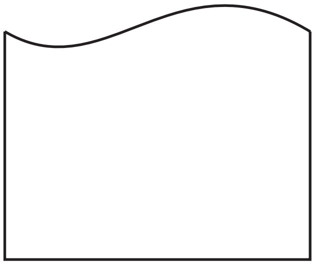
Examples one line symmetry



three lines of symmetry

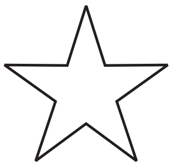


no lines of symmetry

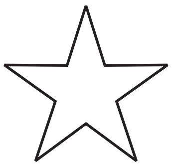


A figure has rotational symmetry if it can be turned less than 360° about its center and it looks like the original figure.

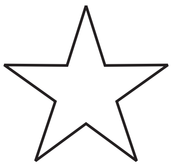
Example Original



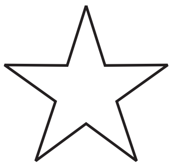
72° turn



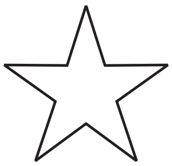
144° turn



216° turn

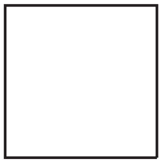


288° turn



Draw the line(s) of symmetry for each figure.

1.



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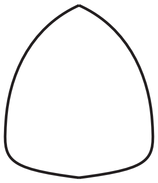

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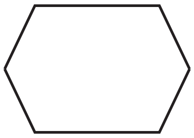

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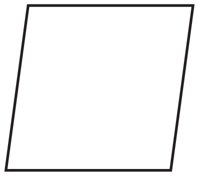
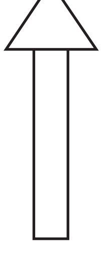


Determine whether each figure has rotational symmetry.

5.



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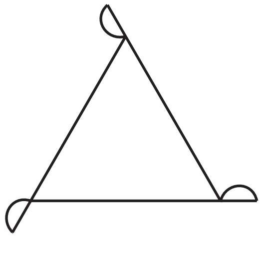

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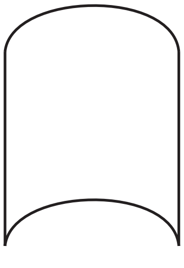

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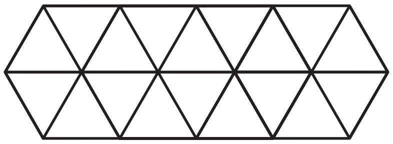
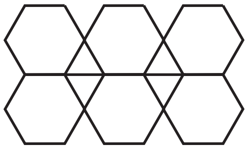
10–7 Study Guide

Tessellations

Tessellations are patterns that cover a plane with repeating polygons so that there are no overlapping or empty spaces. A **regular tessellation** uses only one type of regular polygon. **Semi-regular tessellations** are uniform tessellations that contain two or more regular polygons.



regular

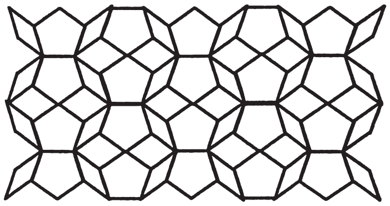


semi-regular

In a tessellation, the sum of the measures of the angles of the polygons surrounding a point (at a vertex) is 360. If a regular polygon has an interior angle with a measure that is a factor of 360, then the polygon will tessellate.

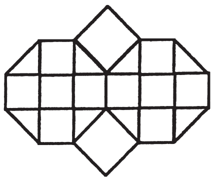
Example: Identify the figures used to create the tessellation below. Then identify the tessellation as *regular*, *semi-regular*, or *neither*.

Regular pentagons and two different types of parallelograms are used. Since the parallelograms are not regular, this tessellation is neither regular nor semi-regular.



***Identify the figures used to create each tessellation. Then identify the tessellation as* regular, semi-regular, *or* neither.**

1.



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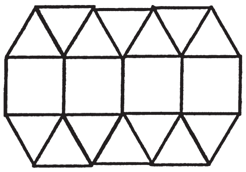

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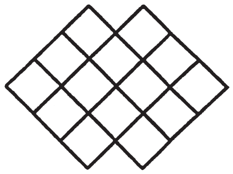

Use isometric or rectangular dot paper to create a tessellation using the given polygons.

4. scalene right triangles

5. squares and isosceles trapezoids

6. parallelograms, rectangles, and hexagons