CHAPTER 10

Geometry



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10.3

Polygons, Perimeters, and Tessellations

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Objectives

- 1. Name certain polygons according to the number of sides.
- 2. Recognize the characteristics of certain quadrilaterals.
- 3. Solve problems involving a polygon's perimeter.
- 4. Find the sum of the measures of a polygon's angles.
- 5. Understand tessellations and their angle requirements.

Polygons and Perimeter

Polygon: Any closed shape in the plane formed by three or more line segments that intersect only at their endpoints.

Regular Polygon: Has sides which are all the same length and angles of all the same measure.

Perimeter of a Polygon: The sum of the lengths of its sides.

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Regular Polygons

Name	Picture	Name	Picture
Triangle	\wedge	Hexagon	
3 sides	\square	6 sides	
Quadrilateral 4 sides		Heptagon 7 sides	\bigcirc
Pentagon 5 sides	\bigcirc	Octagon 8 sides	

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Types of Quadrilaterals

Name	Characteristics	Representation
Parallelogram	Quadrilateral in which both pairs of opposite sides are parallel and have the same measure. Opposite angles have the same measure	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Rhombus	Parallelogram with all sides having equal lengths.	£, 7
Rectangle	Parallelogram with four right angles. Because a rectangle is a parallelogram, opposite sides are parallel and have the same measure.	
Square	A rectangle with all sides having equal length. Each angle measures 90°, and the square is a regular quadrilateral.	
Trapezoid	A quadrilateral with exactly one pair of parallel sides.	

Example: An Application of Perimeter

Fencing costs \$5.25 per foot. Find the cost to enclose the field with fencing.



Solution:

a. Find the perimeter of the rectangle in yards.

$$P = 2l + 2w$$
$$P = 2 \cdot 42 \text{ yd} + 2 \cdot 28 \text{ yd} = 140 \text{ yd}$$

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Example continued

Fencing costs \$5.25 per foot.Find the cost to enclose the field with fencing.Solution:

- b. Convert to feet. $140 \text{ yd} = \frac{140 \text{ yd}}{1} \cdot \frac{3\text{ft}}{1\text{ yd}} = 140 \cdot 3\text{ft} = 420\text{ft}$
- c. Multiply by the cost per foot.

$$\text{Cost} = \frac{420 \text{ feet}}{1} \cdot \frac{\$5.25}{\text{foot}} = 420(\$5.25) = \$2205$$

42 vd

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Example: The Sum of the Measures of a Polygon's Angles

The sum of the measures of the angles of a polygon with n sides is $(n - 2)180^{\circ}$.

Find the sum of the measures of the angles of an octagon.

Solution:

Using the formula $(n - 2)180^{\circ}$ with n = 8, the sum of the measures of an octagon's angles is: $(8 - 2)180^{\circ} = 6 \cdot 180^{\circ} = 1080^{\circ}$

Tessellations (Tiling)

A pattern consisting of the repeated use of the same geometric figures to completely cover a plane, leaving no gaps and no overlaps.

The sum of the measures of the angles that come together at each vertex is always 360°.

Most restrictive condition in creating tessellations is that just one type of regular polygon may be used.

Examples of Tessellations



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Example: Angle Requirements of Tessellations

Explain why a tessellation cannot be created using only regular pentagons.



Solution: Apply $(n - 2)180^{\circ}$ to find the measure of each angle of a regular pentagon.

Each angle measures

$$\frac{(5-2)180^{\circ}}{5} = \frac{3(180^{\circ})}{5} = 108^{\circ}.$$

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