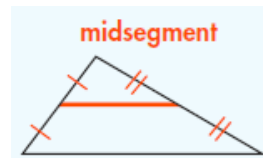


# Polygons and Quadrilaterals Unit

# 5-1 Midsegments in Triangles

## Vocabulary

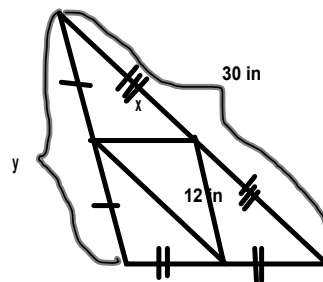
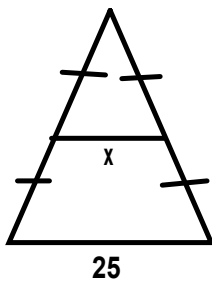
**Definition:** A midsegment of a triangle is a segment connecting the midpoints of two sides of the triangle.



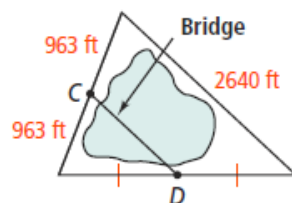
## Midsegment Theorem

-If there is a midsegment, then it is parallel to base and midsegment is equal to  $\frac{1}{2}$  of the base measurement!

$$\text{midsegment} = \frac{1}{2}(\text{base})$$



**Got It?**  $\overline{CD}$  is a bridge being built over a lake, as shown in the figure at the right. What is the length of the bridge?



# 6-1 Polygon Angle Sum Theorem

## Vocabulary

- Polygon - a closed figure made of line segments that do not cross
- Equilateral - a figure with all SIDES that are congruent
- Equiangular - a figure with all ANGLES that are congruent
- Regular Polygon - a polygon that is both equilateral and equiangular

## Polygon Angle Sum Theorem

**Theorem 6-1** The sum of the measures of the interior angles of an  $n$ -gon is  $(n - 2)180$ .

**Corollary** The measure of each interior angle of a regular  $n$ -gon is  $\frac{(n - 2)180}{n}$ .

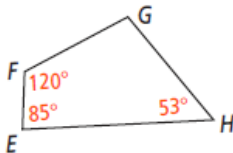
What is the sum of the interior angles of a pentagon?

What is the measure of EACH interior angle of a regular pentagon?

What is the sum of the interior angles of a nonagon?

What is the measure of EACH interior angle of a regular nonagon?

**Got It?** What is  $m\angle G$  in quadrilateral  $EFGH$ ?



## Polygon Exterior Angle Theorem

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

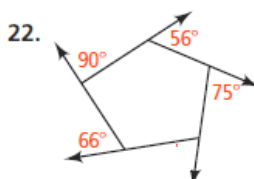
What is the sum of the exterior angles of a 27-gon?

How many sides does a regular polygon have if each exterior angle measures  $36^\circ$ ?

What is the sum of the exterior angles of a nonagon?

How many sides does a regular polygon have if each exterior angle measures  $60^\circ$ ?

Find the missing angle measurement.



# 6-2 Properties of Parallelograms

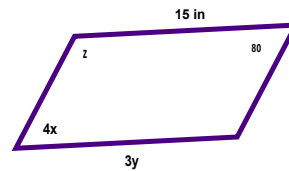
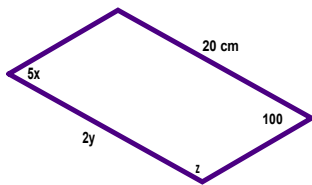
## Vocabulary

- Quadrilateral - a polygon with 4 sides
- Parallelogram - a polygon with two sets of parallel sides. Symbol =  $\square$

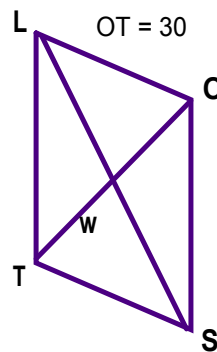
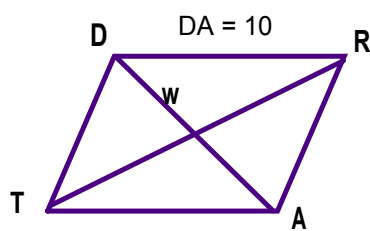
Other characteristics:

- opposite sides are congruent
- opposite angles are congruent
- consecutive angles are supplementary  
(Note: Consecutive angles are ones that occur one right after the other are on the same line segment.)
- diagonals bisect each other

The figures below are parallelograms. Find  $x$ ,  $y$ ,  $z$ .

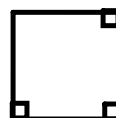
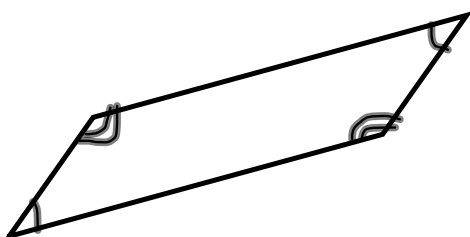


The figure below is a parallelogram. Find  $w$ .

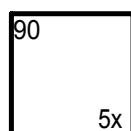
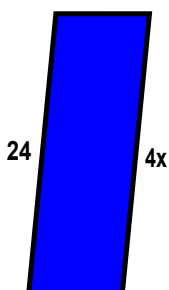


## 6-3 Proving Quadrilaterals are Parallelograms

Is the figure below a parallelogram. Explain.



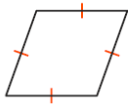
For which value of  $x$  is the figure below a parallelogram?



# 6-4 Properties of Rhombuses, Rectangles, and Squares

## Special Parallelograms

A *rhombus* is a parallelogram with four congruent sides.



Other Characteristics

- ALL parallelogram characteristics
- diagonals are perpendicular
- diagonals bisect opposite angles

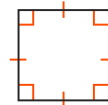
A *rectangle* is a parallelogram with four right angles.



Other Characteristics

- ALL parallelogram characteristics
- diagonals are congruent

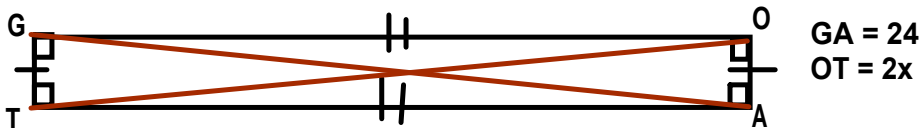
A *square* is a parallelogram with four congruent sides and four right angles.



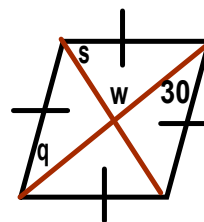
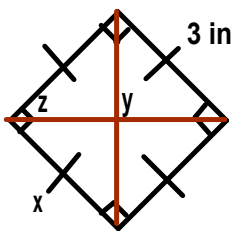
Other Characteristics

- ALL parallelogram characteristics
- diagonals are perpendicular
- diagonals bisect opposite angles
- diagonals are congruent

For each figure below, classify it as specifically as you can. Then, solve for the missing variables.

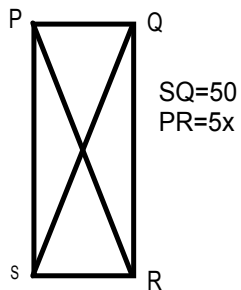


Try these on your own.

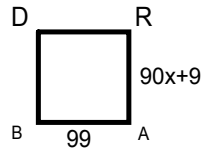


## 6-5 Conditions for Rhombuses, Rectangles, and Squares

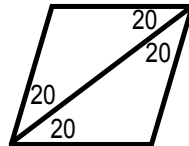
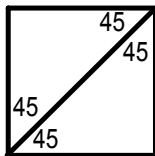
For what value of  $x$  is the figure below a rectangle?



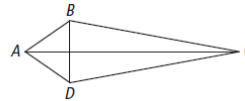
For what value of  $x$  is the figure below a rhombus?



Classify the figures below as specifically as you can.



## 6-6 Trapezoids and Kites

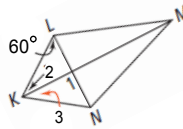
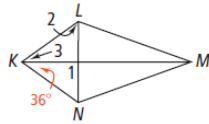


### Kites

A *kite* is a quadrilateral with two pairs of consecutive sides congruent and no opposite sides congruent.

**Theorem 6-22** If a quadrilateral is a kite, then its diagonals are perpendicular.

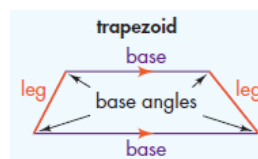
**Got It?** Quadrilateral  $KLMN$  is a kite. What are  $m\angle 1$ ,  $m\angle 2$ , and  $m\angle 3$ ?



### Trapezoids

**Related Words:** base, leg

**Definition:** A trapezoid is a quadrilateral with exactly one pair of parallel sides.

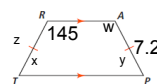
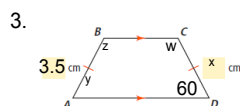
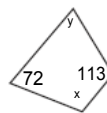
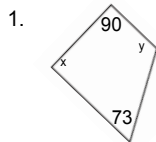


**Main Idea:** The parallel sides of a trapezoid are called *bases*. The nonparallel sides are called *legs*. The two angles that share a base of a trapezoid are called *base angles*.

**Theorem 6-19** If a quadrilateral is an isosceles trapezoid, then each pair of base angles is congruent.

**Theorem 6-20** If a quadrilateral is an isosceles trapezoid, then its diagonals are congruent.

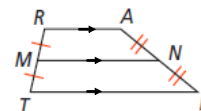
Find the value of the missing variable(s) in the trapezoids below.



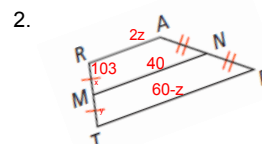
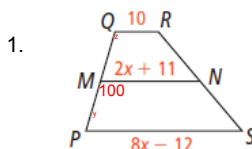
### Trapezoid Midsegment Theorem

**Theorem 6-21 Trapezoid Midsegment Theorem** If a quadrilateral is a trapezoid, then

- (1) the midsegment is parallel to the bases, and
- (2) the length of the midsegment is half the sum of the lengths of the bases.



Segment  $MN$  is a midsegment in the trapezoids below. Find the value of the variables.





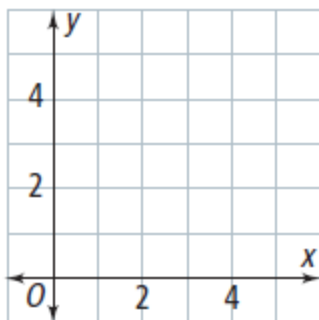
## 6-7 Polygons in the Coordinate Plane

In this lesson, you will be using ALGEBRA to prove if figures are special triangles or quadrilaterals based on their characteristics.

### Reminders:

	Distance Formula	Midpoint Formula	Slope Formula
Formula	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$	$m = \frac{y_2 - y_1}{x_2 - x_1}$
When to Use It	To determine whether <ul style="list-style-type: none"> <li>• sides are congruent</li> <li>• diagonals are congruent</li> </ul>	To determine <ul style="list-style-type: none"> <li>• the coordinates of the midpoint of a side</li> <li>• whether diagonals bisect each other</li> </ul>	To determine whether <ul style="list-style-type: none"> <li>• opposite sides are parallel</li> <li>• diagonals are perpendicular</li> <li>• sides are perpendicular</li> </ul>

**Got It?**  $\triangle DEF$  has vertices  $D(0, 0)$ ,  $E(1, 4)$ , and  $F(5, 2)$ . Is  $\triangle DEF$  scalene, isosceles, or equilateral?



**Got It?** An isosceles trapezoid has vertices  $A(0, 0)$ ,  $B(2, 4)$ ,  $C(6, 4)$ , and  $D(8, 0)$ . What special quadrilateral is formed by connecting the midpoints of the sides of  $ABCD$ ?

