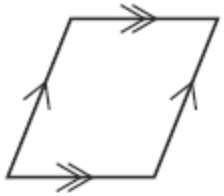
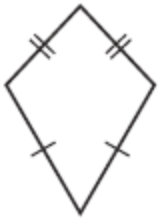
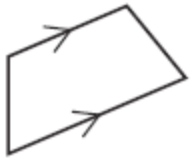
Lesson 19

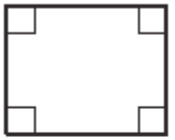
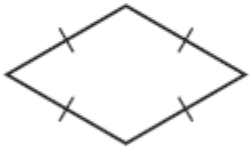
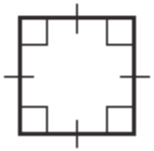
Introduction to Quadrilaterals

Quadrilateral – A polygon with four sides.

Quadrilaterals are classified according to the number of congruent and parallel sides they have.

Quadrilateral	Properties	Example
Parallelogram	Both pairs of opposite sides are parallel.	
Kite	Exactly two pairs of consecutive sides are congruent.	
Trapezoid	Exactly one pair of opposite sides are parallel.	
Trapezium	No sides are parallel.	

In addition to the quadrilaterals listed, there are three types of parallelograms. Parallelograms are classified based on whether or not their sides are congruent and whether or not they have right angles.

Parallelogram	Properties	Example
Rectangle	A parallelogram with four right angles	
Rhombus	A parallelogram with four congruent sides	
Square	A parallelogram with four right angles and four congruent sides	

Some quadrilaterals can be named in several ways. For example, a square is also a rectangle, a rhombus, and a parallelogram; a kite is also a trapezium.

Though parallelograms can often be given several names, always try to find the **most specific name**. For example, a quadrilateral with four right angles could be called a parallelogram, but it is more specific to call it a rectangle.

Example 1 Classifying Quadrilaterals

Classify each quadrilateral. Give multiple names if possible.

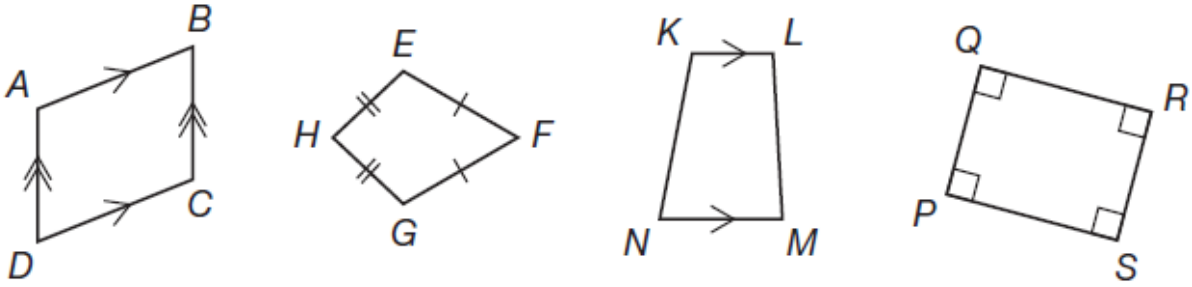
SOLUTION

$\overline{AB} \parallel \overline{DC}$ *and* $\overline{AD} \parallel \overline{BC}$. Therefore, *ABCD* is a parallelogram.

In quadrilateral *EFGH*, $\overline{EH} \cong \overline{GH}$ *and* $\overline{EF} \cong \overline{GF}$. Since both of these pairs of sides are consecutive, *EFGH* is a kite. Since no sides are parallel, *EFGH* is also a trapezium.

In quadrilateral *KLMN*, $\overline{KL} \parallel \overline{MN}$. *KLMN* is a trapezoid.

Quadrilateral *PQRS* has four right angles, so it is a rectangle.



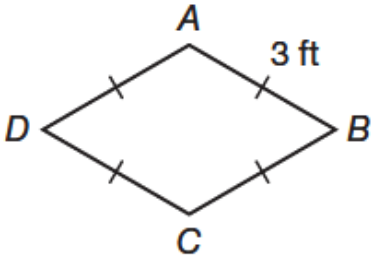
Example 2 Sketching Quadrilaterals

Sketch each quadrilateral based on its description.

a. In quadrilateral *ABCD*, each side measures 3 feet.

SOLUTION

1. Draw four sides of equal length. (The sides need not be perpendicular.)
2. Label the vertices *A*, *B*, *C*, and *D* in order.
3. Mark one side "3 ft".
4. Use tick marks on all four sides to show that they are congruent.



Example 2 Sketching Quadrilaterals

Sketch each quadrilateral based on its description.

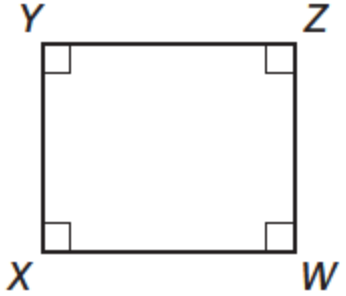
b. In quadrilateral *WXYZ*, each angle measures 90°.

SOLUTION

1. All four angles are right angles. Draw a rectangle.

2. Label the vertices *W*, *X*, *Y*, and *Z* in order.

3. Mark each angle with the symbol for a right angle.



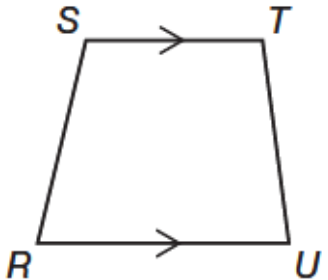
Example 2 Sketching Quadrilaterals

Sketch each quadrilateral based on its description.

c. In quadrilateral *RSTU*, $\overline{ST} \parallel \overline{RU}$.

SOLUTION

1. Draw one pair of parallel sides.
2. Mark these two sides with arrows to show they are parallel.
3. Draw the other two sides connecting the first two sides.
4. Label the vertices so that the parallel sides are $\overline{ST}$ *and* $\overline{RU}$.



$$Area\ of\ a\ Rectangle = b \cdot h$$

$$Area\ of\ a\ Square = s^2$$

Example 3 Finding Perimeters and Areas of Rectangles and Squares

a. Determine the perimeter and area of this rectangle.

SOLUTION

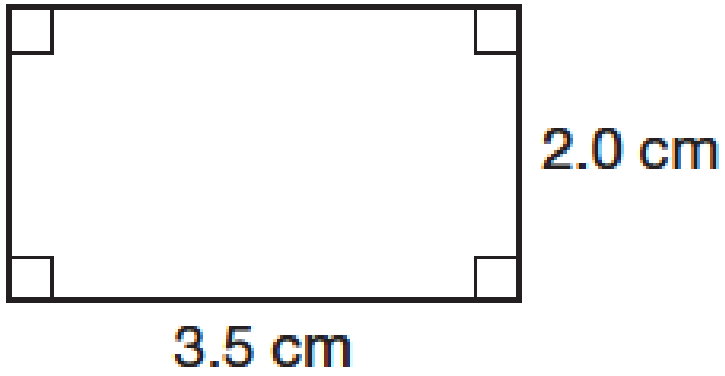
The length of the rectangle is 3.5 centimeters and its width is 2.0 centimeters.

The perimeter is the sum of the side lengths:

$P = 3.5 + 2.0 + 3.5 + 2.0$

$P = 2(3.5) + 2(2.0)$

$P = 11.0$



The area is:

$A = bh$

$A = (3.5)\ (2.0)$

$A = 7.0$

The rectangle's perimeter is 11.0 cm and its area equals $7.0\ cm^2$.

Example 3 Finding Perimeters and Areas of Rectangles and Squares

b. Determine the perimeter and area of this square.

SOLUTION

The square has side lengths of $5\frac{1}{2}$ inches.

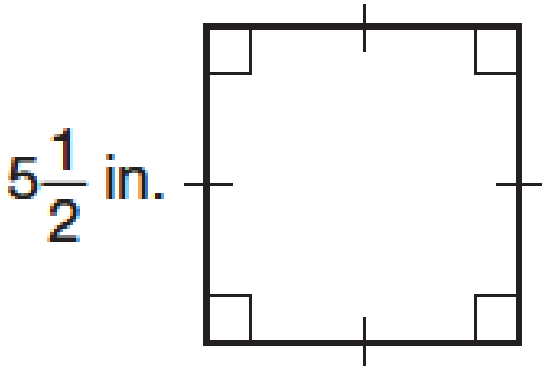
$P = 5\frac{1}{2} + 5\frac{1}{2} + 5\frac{1}{2} + 5\frac{1}{2}$

$P = 4(5.5) = 22$

$A = s^2$

$A = 5.5^2$

$A = 30.25$



The perimeter of the square is 22 inches and its area equals $30.25in^2$.

Example 4 Sports

Each side of a baseball diamond measures 30 yards. Each of its corners is a right angle.

a. What kind of quadrilateral is a baseball diamond? Give as many different names for it as possible.

SOLUTION

Since the sides are congruent, each measuring 30 yards, and each corner forms a right angle, the most specific name for the diamond is a square. So, it follows that it can also be called a rhombus, rectangle, and parallelogram.

Example 4 Sports

Each side of a baseball diamond measures 30 yards. Each of its corners is a right angle.

b. What distance must a batter run for a homerun?

SOLUTION

The distance is the perimeter of the diamond:

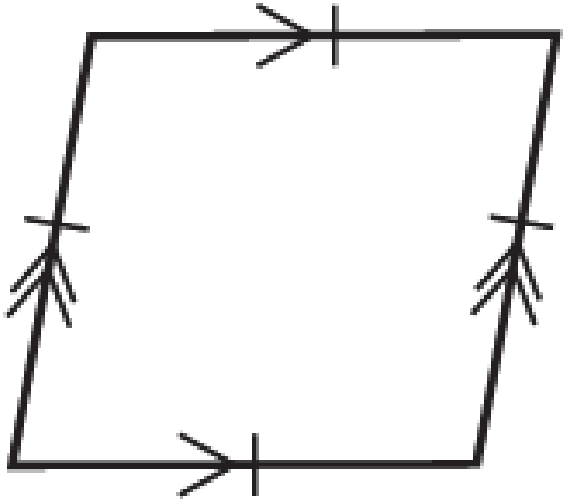
$P = 30 + 30 + 30 + 30$

$P = 120$

The batter must run 120 yards.

You Try!!!!

Classify this quadrilateral. Give multiple names if possible.



In quadrilateral *PQRS*, $\overline{PQ} \parallel \overline{RS}$ and $\overline{PS} \parallel \overline{QR}$. Also, $\overline{PQ}$ is approximately twice as long as, $\overline{QR}$. Sketch *PQRS*.

Assignment

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Lesson Practice (Ask Mr. Heintz)

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Practice 1-30 (Do the starred ones first)