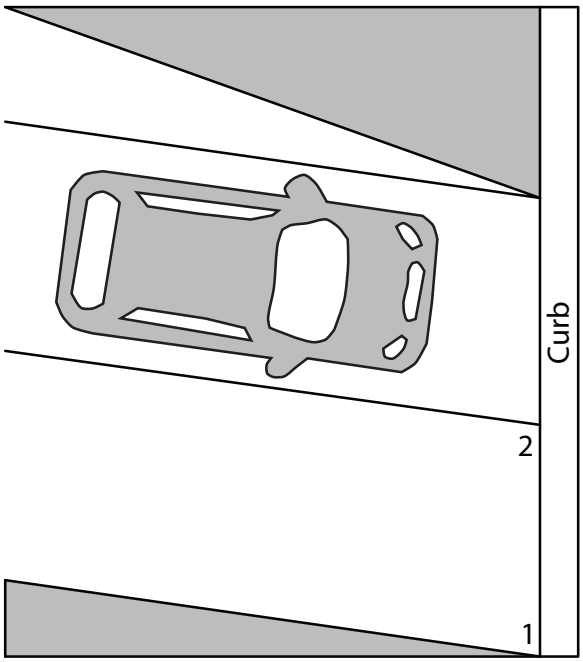
Lesson 1.10.1: Proving Properties of Parallelograms

Warm-Up 1.10.1

Parking lots have standard measures for the width of each space, the backout distance required, and the angle measure. There are several acceptable angles for parking spaces. The desired angle is marked as $\angle 1$ in the illustration below.



1. Find the measure of $\angle 2$ given the desired angle. Assume that the width of the parking spaces is constant, meaning the lines of the spaces are parallel.

$m\angle 1$	$m\angle 2$
45°	
60°	
75°	
90°	

2. Explain how you determined your angle measures.

Example 1

Quadrilateral *ABCD* has the following vertices: *A* (–4, 4), *B* (2, 8), *C* (3, 4), and *D* (–3, 0). Determine whether the quadrilateral is a parallelogram. Verify your answer using slope and distance to prove or disprove that opposite sides are parallel and opposite sides are congruent.

Example 2

Use the parallelogram from Example 1 to verify that the opposite angles in a parallelogram are congruent and consecutive angles are supplementary given that $\overline{AD} \| \overline{BC}$ and $\overline{AB} \| \overline{DC}$.

Example 3

Quadrilateral *ABCD* has vertices *A* (–1, 2), *B* (1, 5), *C* (4, 3), and *D* (2, 0). Using slope, distance, and/or midpoints, classify $\square ABCD$ as a rectangle, rhombus, square, trapezoid, or kite.

Example 4

Use what you know about the diagonals of rectangles, rhombuses, squares, kites, and trapezoids to classify the quadrilateral given the vertices *M* (0, 3), *A* (5, 2), *T* (6, –3), and *H* (–1, –4).

For problems 1–8, use the given coordinates as well as slope, distance, midpoints, and/or diagonals to classify each quadrilateral in as many ways as possible (parallelogram, rectangle, rhombus, square, kite, trapezoid, or isosceles trapezoid). Justify your answers.

1. A (–5, 6), B (3, –3), C (0, –6), D (–9, 3)

2. E (0, 2), F (4, 2), G (4, –2), H (–1, –3)

3. I (–6, 7), J (–3, 4), K (–6, 1), L (–9, 4)

4. M (–3, 8), N (2, 5), O (–1, 0), P (–6, 3)

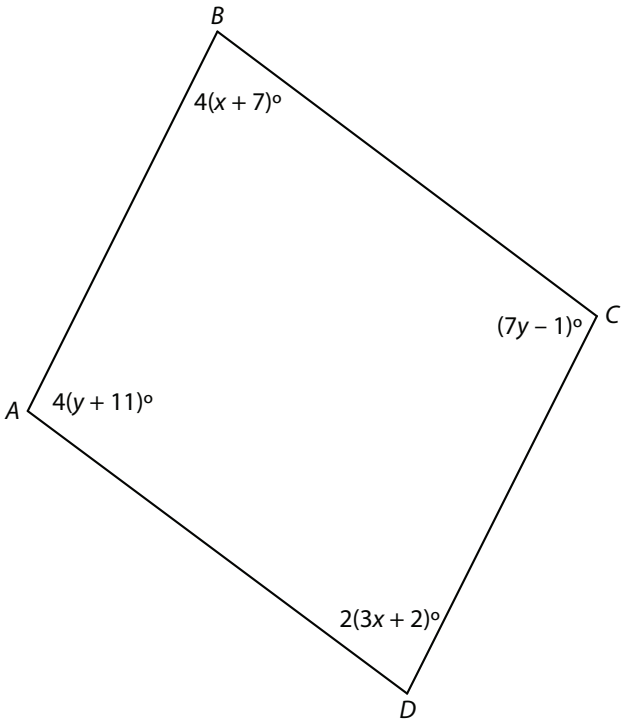
5. P (1, 5), Q (5, 2), R (3, –1), S (–1, 2)

6. T (–6, –4), U (6, –4) V (3, –8), W (–3, –8)

7. W (3, 3), X (8, 1), Y (4, –9), Z (–1, –7)

8. A (2, –2), B (9, –2), C (9, –9), D (2, –9)

9. Determine the unknown angle measures and the values of x and y that make quadrilateral $ABCD$ a parallelogram.



Problem-Based Task 1.10.2: Where Are the Catchers?

Aric, Carl, Bree, and Daisy play Little League baseball. At catching practice, the coach positions each player according to his or her skill level. The four players' positions form a rhombus. Aric, Bree, and Carl can be represented on a coordinate plane by points A (0, 0), B (–5, 0), and C (–1, 3). Find Daisy's location, point D.

Elian and Faith are the best catchers on the team, so the coach has them practice separately. The coach places Elian in a spot represented by point E (7, –6) on a coordinate plane. The coach places Faith so that she's as far away from Elian as Bree is from Daisy. If Bree, Daisy, Elian, and Faith's positions form a rectangle, find point F, Faith's position. Graph the positions of all the players.