Midpoint Shape Check

Use diagonal midpoints to sort coordinate quadrilaterals.

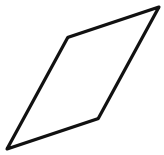
MA.912.GR.3.2 "Given a mathematical context, use coordinate geometry to classify or justify definitions, properties and theorems involving circles, triangles or quadrilaterals."

NAME _____ DATE _____

PARALLELOGRAM

A quadrilateral is a parallelogram if its diagonals have the same midpoint. Find the midpoint of each diagonal and compare the ordered pairs.

Example: The vertices are (8, 15), (26, 21), (38, 43), and (20, 37). Both diagonal midpoints are (23, 29), so this is a parallelogram.



NOT A PARALLELOGRAM

If the two diagonals have different midpoints, the quadrilateral is not a parallelogram. One matching pair of opposite sides is not enough.

Example: The vertices are (12, 12), (36, 12), (42, 29), and (22, 29). The diagonal midpoints differ, so this is not a parallelogram.



1 SORT

8 items

For Part 1, circle VALID or INVALID for each figure; for Part 2, choose two figures and explain your classifications by finding both diagonal midpoints. Each sketch corresponds to the supplied ordered coordinates; use the coordinates, not visual appearance, for exact midpoint evidence.

1.



Figure 1: A(10, 10), B(40, 10), C(55, 30), D(25, 30). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

2.

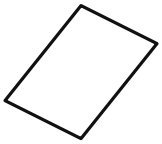


Figure 2: A(15, 20), B(35, 45), C(55, 35), D(35, 10). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

3.



Figure 3: A(8, 8), B(30, 8), C(38, 25), D(14, 25). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

4.



Figure 4: A(20, 15), B(50, 15), C(50, 35), D(20, 35). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

5.

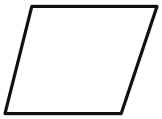


Figure 5: A(12, 18), B(38, 18), C(46, 42), D(18, 42). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

6.

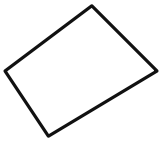


Figure 6: A(10, 40), B(30, 55), C(45, 40), D(20, 25). Vertices are in order; compare midpoints of AC and BD.

VALID INVALID

7.

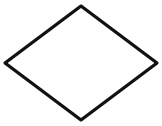


Figure 7: A(30, 10), B(50, 25), C(30, 40), D(10, 25). Vertices are in order; compare midpoints of AC and BD.

VALID **INVALID**

8.

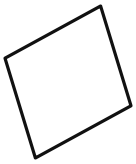


Figure 8: A(60, 20), B(82, 32), C(75, 55), D(53, 43). Vertices are in order; compare midpoints of AC and BD.

VALID **INVALID**

2 PROVE IT

Explain your thinking

Pick two items from Part 1. For each one, tell how you knew where it belonged.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write coordinates for four vertices in order to make one VALID example and one INVALID example. For each, state the two diagonal midpoints.

VALID _____

INVALID _____

CHALLENGE

Create a VALID quadrilateral with no horizontal or vertical sides. List its vertices in order and prove that it is VALID using diagonal midpoints.

ANSWER KEY

Midpoint Shape Check

HIGH SCHOOL · MA.912.GR.3.2

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	Figure 1: A(10, 10), B(40, 10), C(55, 30), D(25, 30). Vertices are in order; compare midpoints of AC and BD. (polygon)	**VALID**	The diagonal midpoints are both (32.5, 20).
2	Figure 2: A(15, 20), B(35, 45), C(55, 35), D(35, 10). Vertices are in order; compare midpoints of AC and BD. (polygon)	**VALID**	The diagonal midpoints are both (35, 27.5).
3	Figure 3: A(8, 8), B(30, 8), C(38, 25), D(14, 25). Vertices are in order; compare midpoints of AC and BD. (polygon)	**INVALID**	The diagonal midpoints are (23, 16.5) and (22, 16.5).
4	Figure 4: A(20, 15), B(50, 15), C(50, 35), D(20, 35). Vertices are in order; compare midpoints of AC and BD. (polygon)	**VALID**	The diagonal midpoints are both (35, 25).
5	Figure 5: A(12, 18), B(38, 18), C(46, 42), D(18, 42). Vertices are in order; compare midpoints of AC and BD. (polygon)	**INVALID**	The diagonal midpoints are (29, 30) and (28, 30).
6	Figure 6: A(10, 40), B(30, 55), C(45, 40), D(20, 25). Vertices are in order; compare midpoints of AC and BD. (polygon)	**INVALID**	The diagonal midpoints are (27.5, 40) and (25, 40).
7	Figure 7: A(30, 10), B(50, 25), C(30, 40), D(10, 25). Vertices are in order; compare midpoints of AC and BD. (polygon)	**VALID**	The diagonal midpoints are both (30, 25).
8	Figure 8: A(60, 20), B(82, 32), C(75, 55), D(53, 43). Vertices are in order; compare midpoints of AC and BD. (polygon)	**VALID**	The diagonal midpoints are both (67.5, 37.5).

PART 2 · PROVE IT

Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **VALID**: (5, 30), (25, 38), (35, 58), and (15, 50). The diagonal midpoints are both (20, 44).
- **INVALID**: (45, 10), (65, 10), (72, 30), and (50, 30). The diagonal midpoints are (58.5, 20) and (57.5, 20).

Challenge: Vertices: (12, 18), (30, 27), (42, 49), and (24, 40). The midpoint of the first diagonal is (27, 33.5), and the midpoint of the second diagonal is (27, 33.5), so the quadrilateral is VALID. None of its sides is horizontal or vertical.

Students may justify VALID figures by showing equal diagonal midpoints or by showing both pairs of opposite sides are parallel. For INVALID figures, different diagonal midpoints are sufficient evidence.