Proving Shapes with Coordinates

Slope for parallel and perpendicular, distance for equal sides, midpoint for the diagonals. Use the checklist, then write your reasons in sentences.

Name _____ Date _____

Words we use

say the math word, then the plain English

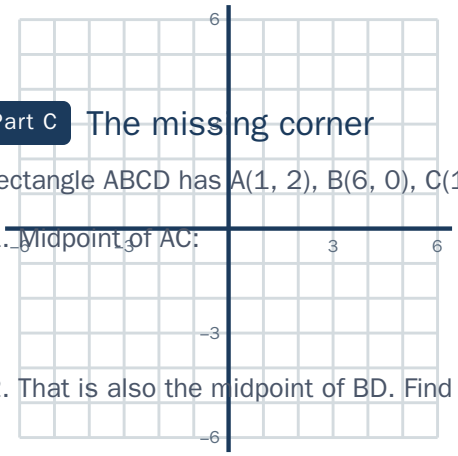
WORD	PLAIN ENGLISH	WHAT YOU DO
Parallelogram	A four-sided shape with both pairs of opposite sides parallel.	Equal slopes, or diagonals with the same midpoint.
Rectangle	A parallelogram with four right angles.	Show one right angle with negative reciprocal slopes.
Rhombus	Four equal sides.	Distance on every side.
Square	Four equal sides and four right angles: a rectangle and a rhombus.	Distance and slope.
Isosceles, right triangle	Two equal sides; one right angle.	Distance; slope.
Diagonal	A segment joining two corners that are not next to each other.	Compare the midpoints of the two diagonals.

Part A Which tool?

TO SHOW	TOOL	WHAT YOU LOOK FOR
two sides are parallel		
two sides are perpendicular		
two sides are equal		
the diagonals bisect each other		

Part B MNPQ

M(3, 0), N(1, 3), P(–2, 1), Q(0, –2). Plot it.



Part C The missing corner

Rectangle ABCD has A(1, 2), B(6, 0), C(10, 10).

1. Midpoint of AC:
2. That is also the midpoint of BD. Find D by the step way.

SIDE	LENGTH	SLOPE
MN		
NP		
PQ		
QM		

1. What shape is MNPQ? Write the evidence in two sentences.
3. Prove angle B is a right angle in one sentence.

Part D Parallelogram?

1. A(0, 0), B(5, 1), C(7, 4), D(2, 3). Find the midpoints of AC and BD. Is ABCD a parallelogram?

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Part E Which triangle?

1. A(0, 0), B(6, 0), C(3, 4). Find the three side lengths. Isosceles, equilateral, or right?

2. Check whether angle C is a right angle with slopes.

Part F Exit ticket

1. Which tool shows perpendicular? Equal sides? Bisecting diagonals?

2. Four sides of root 13 and neighboring slopes –3 over 2 and 2 over 3: what shape, and why?

Answer key

Part A. Slope, equal slopes. Slope, negative reciprocals (multiply to –1). Distance, equal lengths. Midpoint, the same midpoint.

Part B. Every side root 13 ≈ 3.61. Slopes: –3 over 2, 2 over 3, –3 over 2, 2 over 3. A square: four equal sides, and neighboring slopes multiply to –1, so the angles are right angles.

Part C. 1. (5.5, 6). 2. From B, 0.5 left and 6 up, once more: D(5, 12). 3. AB and BC have slopes –2 over 5 and 5 over 2, which multiply to –1, so angle B is a right angle.

Part D. Both midpoints are (3.5, 2): yes, a parallelogram.

Part E. 1. AB = 6, AC = 5, BC = 5: isosceles. 2. Slopes 4 over 3 and –4 over 3 multiply to –16 over 9, not –1: not a right angle.

Part F. 1. Slope; distance; midpoint. 2. A square: four equal sides and a right angle.