LESSON MAKER PRO

Coordinate Proof Lab

Use slopes, midpoints, and distance to test geometric claims.

HIGH SCHOOL · HSG-GPE.B.4

CCSS.Math.Content.HSG-GPE.B.4 "Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1…"

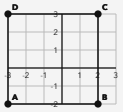
NAME _____ DATE _____

PROVE IT WITH COORDINATES

Use slopes to show that sides are parallel or perpendicular. Use matching midpoints to show that diagonals bisect each other, and compare squared distances when testing whether a point lies on a circle.

WORKED EXAMPLE

Use the graph to prove that quadrilateral ABCD is a rectangle.



1. mAB = 0 and mBC is undefined, so AB is perpendicular to BC.
2. mCD = 0 and mDA is undefined, so CD is perpendicular to DA.
3. AB and CD are parallel. BC and DA are parallel.
4. The quadrilateral has parallel opposite sides and right angles.

Answer: ABCD is a rectangle.

PRACTICE 4 problems

1 Determine whether A(-6, 7), B(-6, 9), C(8, 9), and D(8, 7) form a rectangle. Use slopes.

ANSWER _____

2 Circle C has center (0, 0) and passes through (0, 8). Does P(6, 8) lie on circle C? Show a distance comparison.

ANSWER _____

3 Prove that triangle ABC with A(0, 6), B(0, 9), and C(7, 6) is a right triangle. Name the right angle.

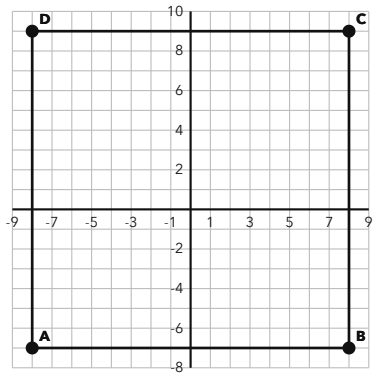
ANSWER _____

4 Use diagonal midpoints to determine whether A(-8, -6), B(6, -6), C(8, 8), and D(-6, 8) form a parallelogram.

ANSWER _____

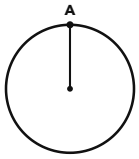
APPLY IT Show your work

1 A school club makes the LED frame shown. Use slopes of its sides to decide whether the frame is a rectangle.



ANSWER _____

2 A music app shows the circular listening zone. Its center is O(0, 0), and A(0, 10) is on the boundary. Does listener B(-6, 8) lie on the boundary?



ANSWER _____

CHALLENGE One step up

For nonzero values of r and s, quadrilateral A(p, q), B(p + r, q), C(p + r, q + s), and D(p, q + s) is defined. Prove that ABCD is a rectangle using slopes.

WORK SPACE AND ANSWER

Coordinate Proof Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Determine whether A(-6, 7), B(-6, 9), C(8, 9), and D(8, 7) form a rectangle. Use slopes.	**Yes. AB and CD are vertical, while BC and DA are horizontal, so adjacent sides are perpendicular and opposite sides are parallel.**
2	Circle C has center (0, 0) and passes through (0, 8). Does P(6, 8) lie on circle C? Show a distance comparison.	**No. The radius squared is $8^2 = 64$, but $OP^2 = 6^2 + 8^2 = 100$.**
3	Prove that triangle ABC with A(0, 6), B(0, 9), and C(7, 6) is a right triangle. Name the right angle.	**AB is vertical and AC is horizontal, so AB is perpendicular to AC. The right angle is angle A.**
4	Use diagonal midpoints to determine whether A(-8, -6), B(6, -6), C(8, 8), and D(-6, 8) form a parallelogram.	**Yes. The midpoint of AC is (0, 1), and the midpoint of BD is (0, 1), so the diagonals bisect each other.**

PART 2 · APPLY IT

1. **Yes. AB and CD have slope 0, and BC and DA are vertical, so adjacent sides are perpendicular and opposite sides are parallel.** Read the four vertices from the grid. Compare the horizontal and vertical slopes of opposite and adjacent sides.
2. **Yes. The radius is 10, and $OB^2 = (-6)^2 + 8^2 = 100 = 10^2$.** Use OA as the radius. Compare OB^2 with OA^2.

CHALLENGE

AB and CD are horizontal, so both have slope 0. BC and DA are vertical, so their slopes are undefined. Thus opposite sides are parallel and adjacent sides are perpendicular, so ABCD is a rectangle.

Accept "undefined slope" or "vertical line" for vertical sides. For circle tests, accept any correct comparison of squared distances rather than evaluating square roots.