LESSON MAKER PRO

Equal Distance Detective

Use coordinates to test and explain equal distances.

HIGH SCHOOL · MT.CORE.GEOM.ARG.1.a

MT.CORE.GEOM.ARG.1.a "Investigate, conjecture, prove theorems, and communicate the proofs in a variety of ways by: Proving theorems about lines and angles. Theorems include: vertical angles are congruent..."

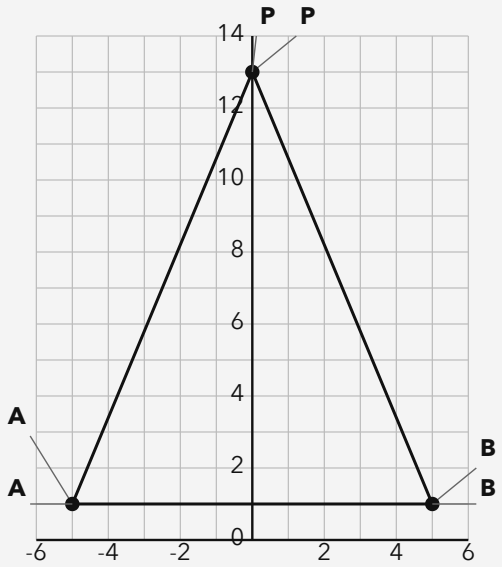
NAME _____ DATE _____

THE BIG IDEA

A point is on the perpendicular bisector of a segment exactly when it is the same distance from both endpoints. On a coordinate grid, you can compare distances using horizontal and vertical changes and the Pythagorean theorem.

WORKED EXAMPLE

Does P lie on the perpendicular bisector of AB? Show how you know.

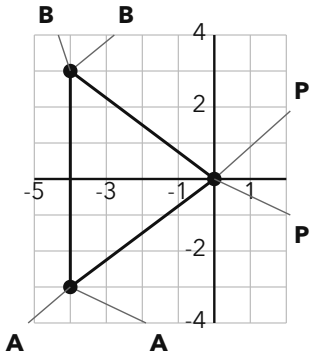


1. From A to P, the horizontal change is 5 and the vertical change is 12.
2. PA = $\sqrt{(5^2 + 12^2)} = 13$.
3. From B to P, the changes are also 5 and 12, so PB = 13.
4. Because PA = PB, P is on the perpendicular bisector of AB.

Answer: Yes. PA = PB = 13 units.

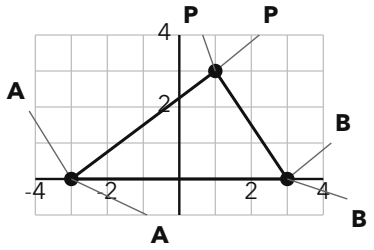
PRACTICE 6 problems

1 Find PA and PB. Does P lie on the perpendicular bisector of AB? Explain briefly.



ANSWER _____

2 Find PA and PB. Does P lie on the perpendicular bisector of AB? Explain briefly.



ANSWER _____

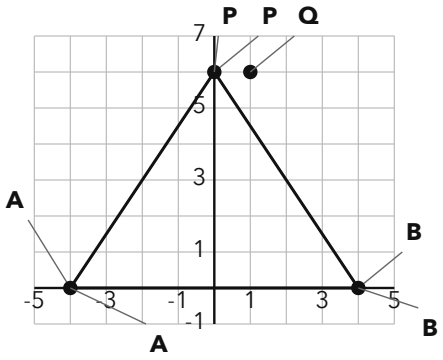
3 A = (-6, 2), B = (2, 2), and P = (x, -1). Find x so P lies on the perpendicular bisector of AB.

ANSWER _____

4 A = (3, -5) and B = (3, 3). Write an equation for the perpendicular bisector of AB.

ANSWER _____

5 Which point, P or Q, lies on the perpendicular bisector of AB? Explain without calculating square roots.



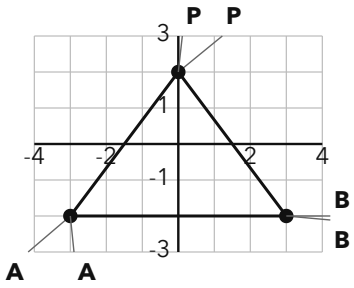
ANSWER _____

6 A = (-2, 1), B = (4, 1), and P = (x, 5). Find x so PA = PB. Then find that common distance.

ANSWER _____

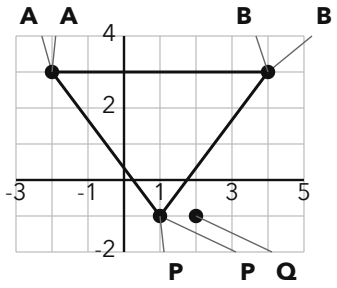
APPLY IT Show your work

1 For an outdoor school event, a charging station must be equally far from booth entrances A and B. The proposed station is P. Each grid unit represents 10 m. Does P meet the goal? How far is it from each entrance?



ANSWER _____

2 A game designer wants a checkpoint equally far from spawn points A and B. Which proposed checkpoint, P or Q, works? How far is it from each spawn point?



ANSWER _____

CHALLENGE One step up

A = (-4, 0), B = (4, 0), and P = (x, 3). Prove that if PA = PB, then x = 0. Use squared distances so you do not need square roots.

WORK SPACE AND ANSWER

ANSWER KEY

Equal Distance Detective

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find PA and PB. Does P lie on the perpendicular bisector of AB? Explain briefly.	**PA = PB = 5 units. Yes, P is equally far from A and B.**
2	Find PA and PB. Does P lie on the perpendicular bisector of AB? Explain briefly.	**PA = 5 units and PB = √13 units. No, the distances are different.**
3	A = (-6, 2), B = (2, 2), and P = (x, -1). Find x so P lies on the perpendicular bisector of AB.	**x = -2**
4	A = (3, -5) and B = (3, 3). Write an equation for the perpendicular bisector of AB.	**y = -1**
5	Which point, P or Q, lies on the perpendicular bisector of AB? Explain without calculating square roots.	**P. It is directly above the midpoint of AB, so it is equally far from A and B.**
6	A = (-2, 1), B = (4, 1), and P = (x, 5). Find x so PA = PB. Then find that common distance.	**x = 1; PA = PB = 5 units.**

PART 2 · APPLY IT

1. **Yes. P is 50 m from each entrance.** The horizontal and vertical changes from either entrance to P are 3 and 4 grid units. Each distance is 5 grid units, or 50 m.
2. **P works. It is 5 grid units from each spawn point.** P is directly below the midpoint of AB. Its horizontal and vertical changes from either endpoint are 3 and 4, giving a distance of 5 grid units.

CHALLENGE

$PA^2 = (x + 4)^2 + 9$ and $PB^2 = (x - 4)^2 + 9$. If PA = PB, then $(x + 4)^2 = (x - 4)^2$. Expanding gives $x^2 + 8x + 16 = x^2 - 8x + 16$, so $16x = 0$ and $x = 0$.

Accept equivalent exact forms for distances. For explanations, students should connect equal distances to the perpendicular bisector, not rely only on how a figure looks.