Finding Distances in the Coordinate Plane

Let's find distances in the coordinate plane.

13.1 Closest Distance

1. Order the following pairs of coordinates from closest to farthest apart. Be prepared to explain your reasoning.
   a. $(2, 4)$ and $(2, 10)$

   b. $(-3, 6)$ and $(5, 6)$

   c. $(-12, -12)$ and $(-12, -1)$

   d. $(7, 0)$ and $(7, -9)$

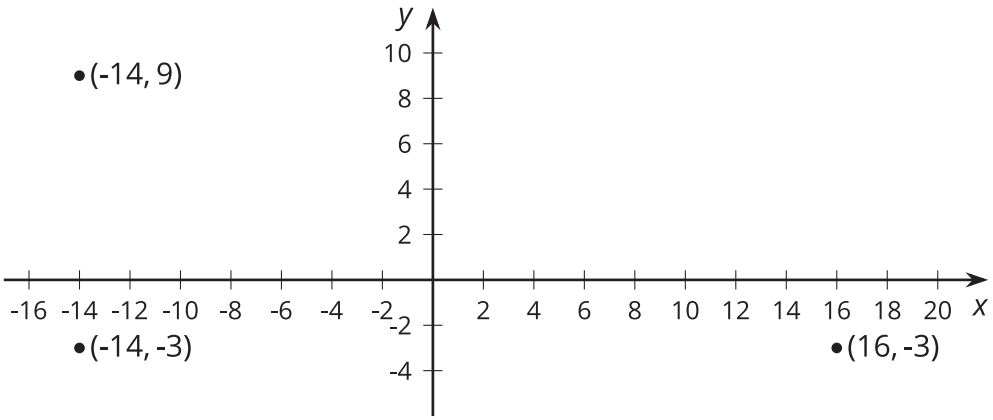
   e. $(1, -10)$ and $(-4, -10)$

2. Name another pair of coordinates that would be closer together than the first pair on your list.

3. Name another pair of coordinates that would be farther apart than the last pair on your list.

13.2 How Far Apart?

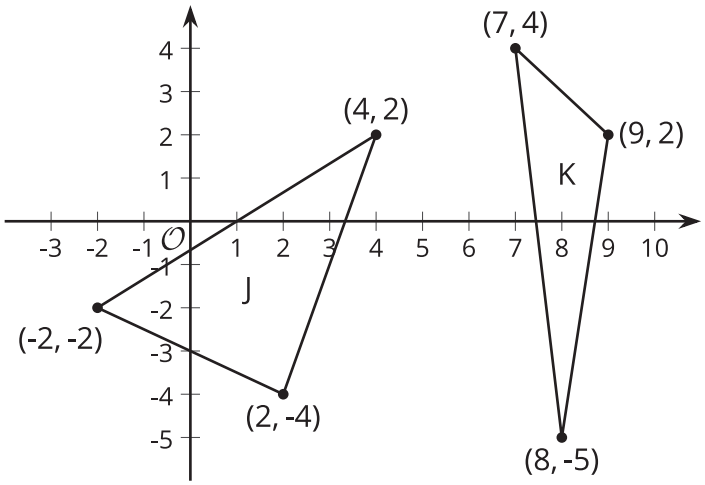
Find the distances between the three points shown.



13.3 Perimeters with Pythagoras

1. Which triangle do you think has the longer perimeter? Be prepared to explain your reasoning.

2. Select one triangle and calculate its perimeter. Your partner will calculate the perimeter of the other. Were you correct about which figure had the longer perimeter?



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Are you ready for more?

Quadrilateral $ABCD$ has vertices at $A = (-5, 1)$, $B = (-4, 4)$, $C = (2, 2)$, and $D = (1, -1)$.

1. Use the Pythagorean Theorem to find the lengths of sides AB, BC, CD, and AD.

2. Use the Pythagorean Theorem to find the lengths of the two diagonals, AC and BD.

3. Explain why quadrilateral $ABCD$ is a rectangle.

13.4 Finding the Right Distance

Have each person in your group select one of the sets of coordinate pairs shown. Then calculate the distance between those two coordinates. Once the distances are calculated, have each person in the group briefly share how they did their calculations.

- $(-2, 1)$ and $(6, -5)$
- $(-1, -6)$ and $(5, 2)$
- $(-1, 2)$ and $(5, -6)$
- $(-2, -5)$ and $(6, 1)$

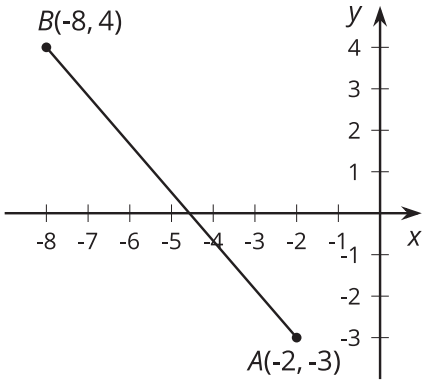
1. How does the distance between your coordinate pairs compare to the distances for the rest of your group?

2. In your own words, write an explanation to another student of how to find the distance between any two coordinate pairs.

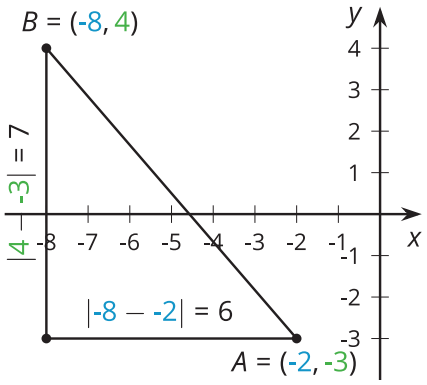
Lesson 13 Summary

We can use the Pythagorean Theorem to find the distance between any two points in the coordinate plane.

For example, if the coordinates of point A are $(-2, -3)$, and the coordinates of point B are $(-8, 4)$, the distance between them is also the length of line segment AB. It is a good idea to plot the points first.



Think of the segment AB as the hypotenuse of a right triangle. The legs can be drawn in as horizontal and vertical line segments.



The length of the horizontal leg is 6, which can be seen in the diagram. This is also the distance between the x-coordinates of A and B ($|-8 - -2| = 6$).

The length of the vertical leg is 7, which can be seen in the diagram. This is also the distance between the y-coordinates of A and B ($|4 - -3| = 7$).

Once the lengths of the legs are known, we use the Pythagorean Theorem to find the length of the hypotenuse, AB, which we can represent with c:

$$\begin{aligned} 6^2 + 7^2 &= c^2 \\ 36 + 49 &= c^2 \\ 85 &= c^2 \\ \sqrt{85} &= c \end{aligned}$$

This length is a little longer than 9, since 85 is a little longer than 81. Using a calculator gives a more precise answer, $\sqrt{85} \approx 9.22$.

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