Name _____ Date_____

Distance on the Coordinate Plane

Determine whether each given pair of endpoints lies on the same horizontal or vertical line. If so, find the length of the line segment that joins the pair of points. If not, explain how you know the points are not on the same horizontal or vertical line.

a. $(0, -2)$ and $(0, 9)$

b. $(11, 4)$ and $(2, 11)$

c. $(3, -8)$ and $(3, -1)$

d. $(-4, -4)$ and $(5, -4)$

1. Find the length of the line segment with endpoints $(7, 2)$ and $(-4, 2)$, and explain how you arrived at your solution.

2. Sarah and Jamal were learning partners in math class and were working independently. They each started at the point $(-2, 5)$ and moved 3 units vertically in the plane. Each student arrived at a different endpoint. How is this possible? Explain and list the two different endpoints.

3. The length of a line segment is 13 units. One endpoint of the line segment is $(-3, 7)$. Find four points that could be the other endpoints of the line segment.

Determine whether each given pair of endpoints lies on the same horizontal or vertical line. If so, find the length of the line segment that joins the pair of points. If not, explain how you know the points are not on the same horizontal or vertical line.

a. $(0, -2)$ and $(0, 9)$

The endpoints both have x-coordinates of 0, so they both lie on the y-axis, which is a vertical line. They lie on opposite sides of zero, so their absolute values have to be combined to get the total distance. $|-2| = 2$ and $|9| = 9$, so by addition, $2 + 9 = 11$. The length of the line segment with endpoints $(0, -2)$ and $(0, 9)$ is 11 units.

b. $(11, 4)$ and $(2, 11)$

The points do not lie on the same horizontal or vertical line because they do not share a common x- or y-coordinate.

c. $(3, -8)$ and $(3, -1)$

The endpoints both have x-coordinates of 3, so the points lie on a vertical line that passes through 3 on the x-axis. The y-coordinates lie on the same side of zero. The distance between the points is determined by subtracting their absolute values, $|-8| = 8$ and $|-1| = 1$. So, by subtraction, $8 - 1 = 7$. The length of the line segment with endpoints $(3, -8)$ and $(3, -1)$ is 7 units.

d. $(-4, -4)$ and $(5, -4)$

The endpoints have the same y-coordinate of -4, so they lie on a horizontal line that passes through -4 on the y-axis. The numbers lie on opposite sides of zero on the number line, so their absolute values must be added to obtain the total distance, $|-4| = 4$ and $|5| = 5$. So, by addition, $4 + 5 = 9$. The length of the line segment with endpoints $(-4, -4)$ and $(5, -4)$ is 9 units.

1. Find the length of the line segment with endpoints $(7, 2)$ and $(-4, 2)$, and explain how you arrived at your solution.

   11 units. Both points have the same y-coordinate, so I knew they were on the same horizontal line. I found the distance between the x-coordinates by counting the number of units on a horizontal number line from -4 to zero, and then from zero to 7, and $4 + 7 = 11$.

   or

   I found the distance between the x-coordinates by finding the absolute value of each coordinate. $|7| = 7$ and $|-4| = 4$. The coordinates lie on opposite sides of zero, so we find the length by adding the absolute values together. Therefore, the length of a line segment with endpoints $(7, 2)$ and $(-4, 2)$ is 11 units.

2. Sarah and Jamal were learning partners in math class and were working independently. They each started at the point $(-2, 5)$ and moved 3 units vertically in the plane. Each student arrived at a different endpoint. How is this possible? Explain and list the two different endpoints.

   It is possible because Sarah could have counted up and Jamal could have counted down or vice-versa. Moving 3 units in either direction vertically would generate the following possible endpoints: $(-2, 8)$ or $(-2, 2)$.

3. The length of a line segment is 13 units. One endpoint of the line segment is $(-3, 7)$. Find four points that could be the other endpoints of the line segment.

   $(-3, 20)$, $(-3, -6)$, $(-16, 7)$ *or* $(10, 7)$