NAME:______________________________

1. Give an example from real life when finding the midpoint of a segment might be useful.

2. Prove that the midpoint of $\overline{AB}$, where $A=(x_1,\ y_1)$ and $B=(x_2,\ y_2)$, is $C\left(\frac{x_1+x_2}{2},\ \frac{y_1+y_2}{2}\right)$.

3. Explain why you can use the coordinates of either point as $(x_2,\ y_2)$ when finding the distance between two points.

4. Use the distance formula to show why the distance between two points on a number line is $|a-b|$, where a and b are the x-coordinates of the points.

[1] Answers may vary. Sample: You may need to cut a metal pipe into two equal pieces.

$$AC = \sqrt{\left(x_1 - \frac{x_1 + x_2}{2}\right)^2 + \left(y_1 - \frac{y_1 + y_2}{2}\right)^2}$$
$$= \sqrt{\left(\frac{x_1 - x_2}{2}\right)^2 + \left(\frac{y_1 - y_2}{2}\right)^2}$$
$$BC = \sqrt{\left(x_2 - \frac{x_1 + x_2}{2}\right)^2 + \left(y_2 - \frac{y_1 + y_2}{2}\right)^2}$$
$$= \sqrt{\left(\frac{x_2 - x_1}{2}\right)^2 + \left(\frac{y_2 - y_1}{2}\right)^2}$$

[2] Since $\left(\frac{x_2 - x_1}{2}\right)^2 = \left(\frac{x_1 - x_2}{2}\right)^2$ and $\left(\frac{y_2 - y_1}{2}\right)^2 = \left(\frac{y_1 - y_2}{2}\right)^2$, $AC = BC$ and C is the midpoint.

[3] In the distance formula, you square the differences, and $(a-b)^2 = (b-a)^2$.

Using the points (a, 0) and (b, 0),

$$d = \sqrt{(a-b)^2 + (0-0)^2}$$
$$= \sqrt{(a-b)^2}$$

[4] $= |a-b|$