

Midpoint Formula:

Suppose you have a line segment with endpoints:

$(-1, 3)$ & $(4, -3)$.

The MIDPOINT of that segment is the point halfway between the endpoints.

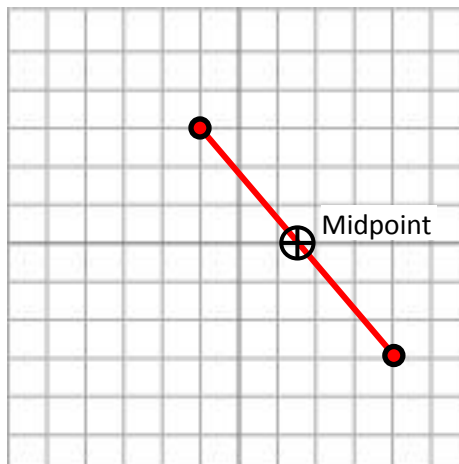
You calculate the coordinates of the midpoint using:

The Midpoint Formula →

$$\text{midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

where (x_1, y_1) is one of the points and (x_2, y_2) is the other.

So the midpoint of this line segment is: $\left(\frac{-1+4}{2}, \frac{3+(-3)}{2} \right) = \left(\frac{3}{2}, \frac{0}{2} \right) = \left(\frac{3}{2}, 0 \right)$



You can find the length of the segment using:

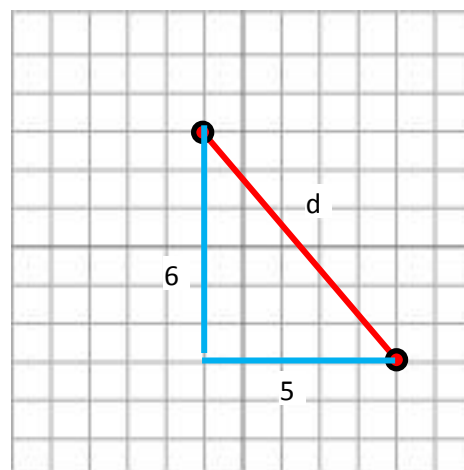
The Distance Formula →

$$\text{distance} = d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

So the distance between the endpoints (or the segment's length) is:

Type equation here.

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(4 - (-1))^2 + (-3 - 3)^2} \\ &= \sqrt{(5)^2 + (-6)^2} = \sqrt{25 + 36} = \sqrt{61} \end{aligned}$$



OR $5^2 + 6^2 = (\sqrt{61})^2$

$$D = \sqrt{61}$$

NOTE: It's ok to leave your answer as a radical, since this is an EXACT answer versus an approximation.

Ex 2: Find the midpoint and length of the segment with endpoints $(1, 1)$ and $(5, 9)$.

$$\text{midpoint} = \left(\frac{1 + 5}{2}, \frac{1 + 9}{2} \right) = \left(\frac{6}{2}, \frac{10}{2} \right) = (3, 5)$$

$$\text{distance} = \sqrt{(5 - 1)^2 + (9 - 1)^2} = \sqrt{(4)^2 + (8)^2} = \sqrt{16 + 64} = \sqrt{80} = 4\sqrt{5}$$