

## Analytic Geometry

1) Distance formula:

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

The distance formula calculates the length of a line segment. Distance is always **positive** or **zero**.

Key words: length, distance, how far...

### Examples

Find the distance between:

1) A(<sup>x<sub>1</sub></sup>1, <sup>y<sub>1</sub></sup>5) and B(<sup>x<sub>2</sub></sup>4, <sup>y<sub>2</sub></sup>10)

$$\begin{aligned}d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(4 - 1)^2 + (10 - 5)^2} \\&= \sqrt{(3)^2 + (5)^2} \\&= \sqrt{34} \\&= 5.83 \text{ u}\end{aligned}$$

2) Midpoint of a Line Segment:  $M(x_m, y_m)$ 

$$x_m = \frac{x_1 + x_2}{2} \quad y_m = \frac{y_1 + y_2}{2}$$

Solution:  $M(x_m, y_m)$ 

The midpoint gives you the **exact middle** of a line segment.

Keywords: midpoint, middle, center, halfway

Example:

1) Find the midpoint of  $A(-1, 4)$  and  $B(5, -2)$ .

$$\begin{aligned} x_m &= \frac{-1 + 5}{2} & y_m &= \frac{4 + (-2)}{2} \\ &= \frac{4}{2} & &= \frac{2}{2} \\ &= 2 & &= 1 \\ & & & M(2, 1) \end{aligned}$$

2) Given  $M(4, 6)$ ,  $A(3, 7)$  and  $B(x_2, y_2)$ , find B.

$$\begin{aligned} x_m &= \frac{x_1 + x_2}{2} & y_m &= \frac{y_1 + y_2}{2} \\ 4 &= \frac{3 + x_2}{2} & 6 &= \frac{7 + y_2}{2} \\ 8 &= 3 + x_2 & 12 &= 7 + y_2 \\ x_2 &= 5 & y_2 &= 5 \\ & & & B(5, 5) \end{aligned}$$