1-3 Distance and Midpoints

Objective(s): • Find the distance between
two points

• Find the midpoint between
two points

* The distance between two points is
the length of the segment with those
points as its endpoints.

* We will use the distance formula
to find the distance between two points.

$$d_{(x,y)} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

(x_1, y_1) and $(x_2, y_2) \Leftarrow$ ordered pairs

Ex) Find the distance between $E(-5, 6)$
and $F(8, -4)$.

x_1 y_1 (under E(-5,6))

x_2 y_2 (under F(8,-4))

Solution: $d_{EF} = \sqrt{(8-(-5))^2 + (-4-6)^2}$

The distance
between E
and F.

$= \sqrt{(8+5)^2 + (-4-6)^2}$

$= \sqrt{(13)^2 + (-10)^2}$ -10^2 vs $(-10)^2$

$= \sqrt{169 + 100}$

$= \sqrt{269} \approx 16.40$ units

approximate

Ex) Find the distance between $J(4, 3)$ and
$K(-3, -7)$

x_1 y_1 (under J(4,3))

x_2 y_2 (under K(-3,-7))

$d_{JK} = \sqrt{(-3-4)^2 + (-7-3)^2}$ OR

$d_{JK} = \sqrt{(4-(-3))^2 + (3-(-7))^2}$

You could also use

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

Ex) Find the distance between
E(-5, 6) and F(8, -4)
x_1 y_1 x_2 y_2

Solution: $d_{EF} = \sqrt{(8+5)^2 + (-4-6)^2}$

the distance
between E and F

$$= \sqrt{(13)^2 + (-10)^2}$$

$$= \sqrt{169 + 100}$$
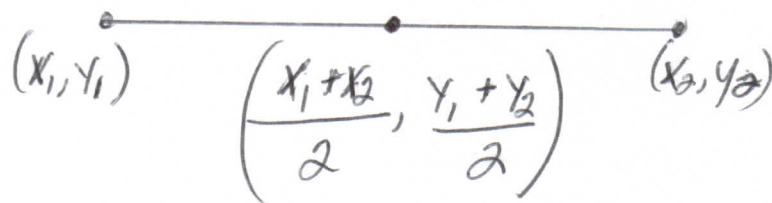
$$= \sqrt{269} \approx 16.40 \text{ units}$$

approximate

Midpoint of a Segment

- The midpoint of a segment is the point halfway between the endpoints of the segment.

(x_1, y_1) ——— $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$ (x_2, y_2)

- We will use the midpoint formula to find the midpoint of a segment.
- The midpoint can also be referred to as the segment bisector.

$$M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$$

Note: This will _always_ be an ordered pair.

Ex) Find the midpoint between

$$E(-8, 6) \text{ and } F(-5, 10)$$

$x_1 \; y_1 \qquad\qquad x_2 \; y_2$

Solution: $M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$

$$M = \left(\dfrac{-8 + (-5)}{2}, \dfrac{6 + 10}{2} \right)$$

$$M = \left(\dfrac{-13}{2}, \dfrac{16}{2} \right)$$

$$M = \left(\dfrac{-13}{2}, 8 \right)$$

Ex) Find the midpoint between

$$P(-1, 3) \text{ and } G(5, 6)$$

Ex) Find the midpoint between

E$(-8, 6)$ and F$(-5, 10)$
    x_1 y_1 x_2 y_2

$$M = \left(\frac{-8 + (-5)}{2}, \frac{6 + 10}{2} \right)$$

$$= \left(\frac{-13}{2}, \frac{16}{2} \right)$$
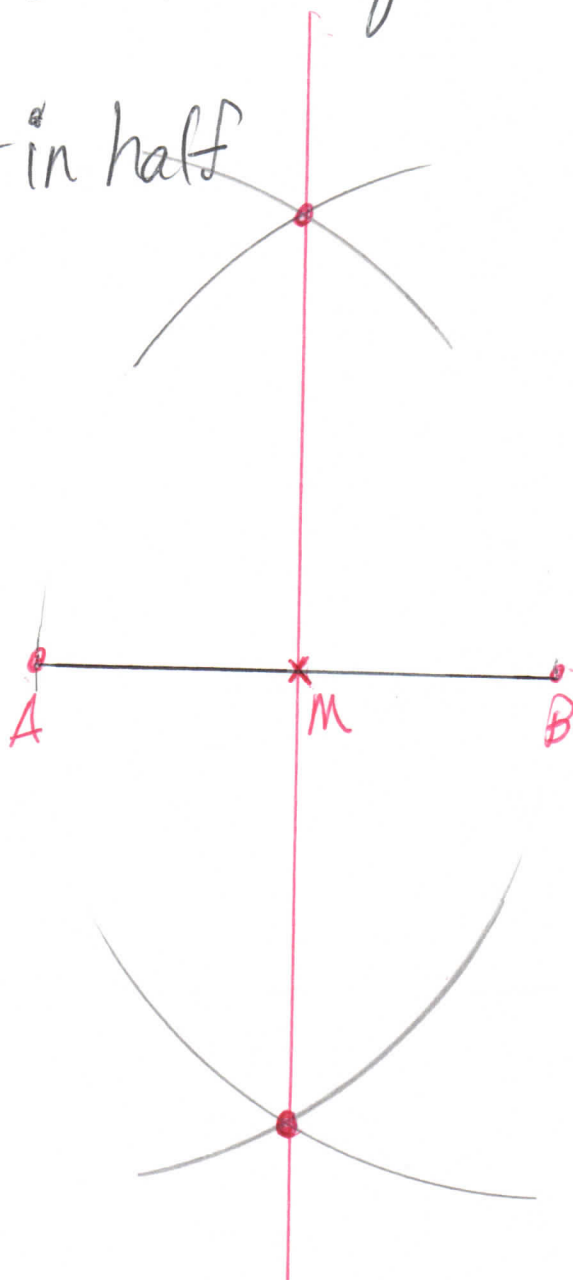
$$\boxed{M = \left(-\frac{13}{2}, 8 \right)}$$

Ex) Find the ~~distance~~ midpoint between P$(-1, 3)$ and G$(5, 6)$

$$M = \left(2, \frac{9}{2} \right)$$

Construction of the segment bisector

bisect = cut in half

① Begin with segment AB.

② Draw arcs above and below the line from point A, the length of AB.

③ Draw arcs above and below the line from point B, the length of AB.

④ Make points where the arcs intersect.

5) Draw a line through the two new points (points of intersection).