Chapter 3 – Analytic Geometry
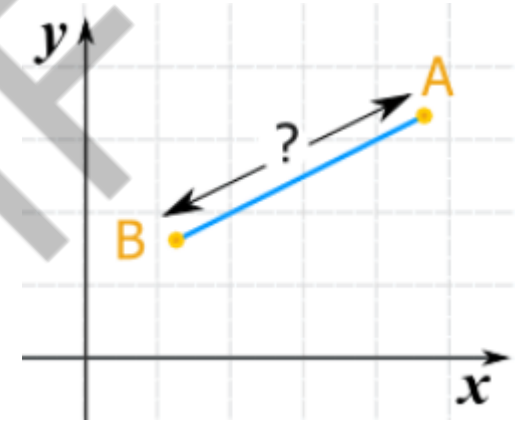
Sub-topics:

→ **Distance**

→ **Midpoint**

→ **Division Point**

Distance between 2 points

The distance or length between 2 points A and B can be found by:

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

The result is a _____.

Note: You can label (x_1, y_1) either A or B.

Examples:

1. **Find the distance between**
   $E(-10, 50)$ **and** $F(-20, -70)$**.**

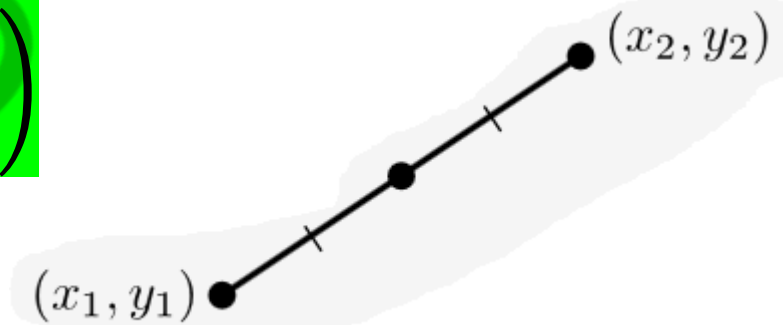**2.** **Find the length between** $M(15, 27)$ **and** $N(-14, 20)$.

3. Find the radius of a circle if the diameter's endpoints are $A(15, 20)$ and $B(20, 40)$.

Midpoint of a segment

To find the coordinates _____ between a segment with endpoints A and B, we use:

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

The result is a _____.

Examples:

1. **Find the midpoint between** $E(-3, 10)$ **and** $F(-6, 20)$**.**

2. **Find the coordinates of the point halfway between** $M(10,20)$ **and** $N(-40,60)$.

3. Find the center of a circle if the diameter's endpoints are $A(-10, 40)$ and $B(-50, -80)$.

(Optional)

Finding an endpoint given midpoint

(Midpoint Backwards)

Example 1: $M(6, 3)$ **is the midpoint of segment** $\overline{AB}$ **with point** $A(2, 0).$ **Find the coordinates of** $B.$

Example 2: Find the endpoint

  A) $M(6,4)$ **and** $A(2,4)$ **B)** $M(6,1)$ **and**

    $T(10,4)$

Convert the fractions to a ratio

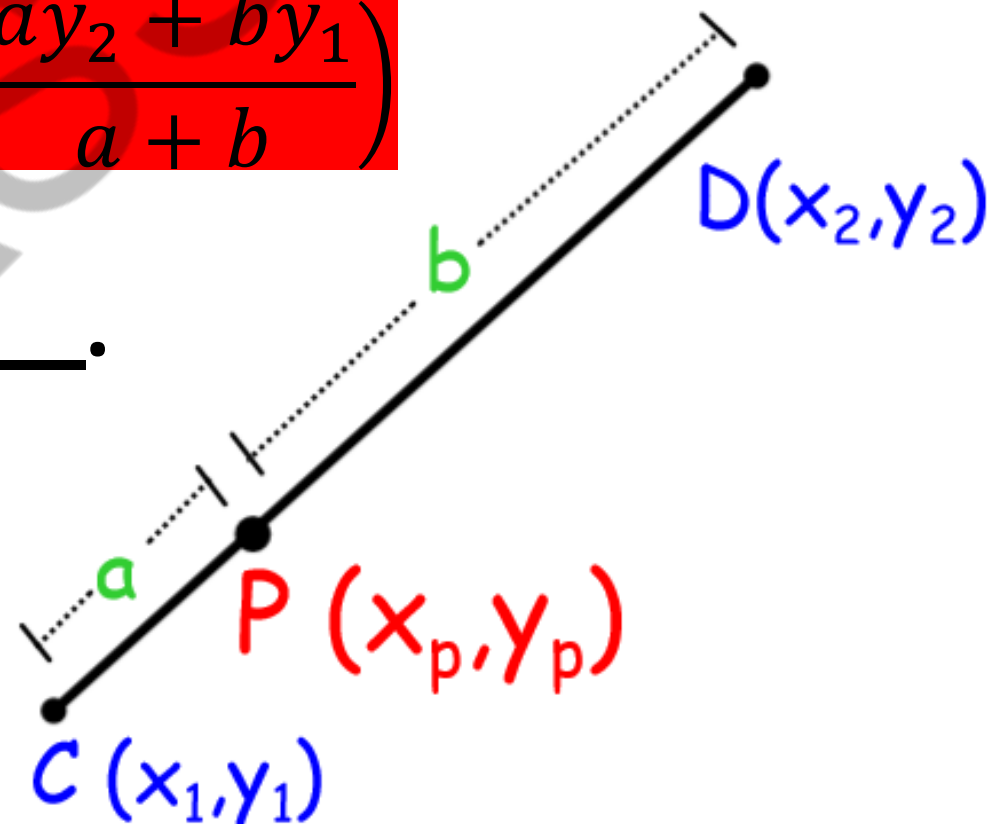|	
$\dfrac{2}{5}$	
$\dfrac{3}{4}$	
$\dfrac{5}{7}$	

Note: A ratio may already be given as $a:b$.

The point of division is the point $P(x_p, y_p)$ that divides a segment with endpoints C and D in a specific ratio $a:b$.

$$P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

The result is a _____.

$D(x_2, y_2)$

b

$P(x_p, y_p)$

a

$C(x_1, y_1)$

Examples:

1) $A(10, -20) \quad B(30, 20)$

$\quad 3:2 \; from \; A$

2) $C(-6, 10)$ $D(-14, 20)$

$\frac{3}{4}$ *from D*