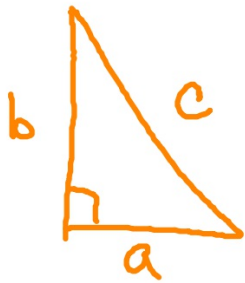


## 2.1 The distance and midpoint formulas

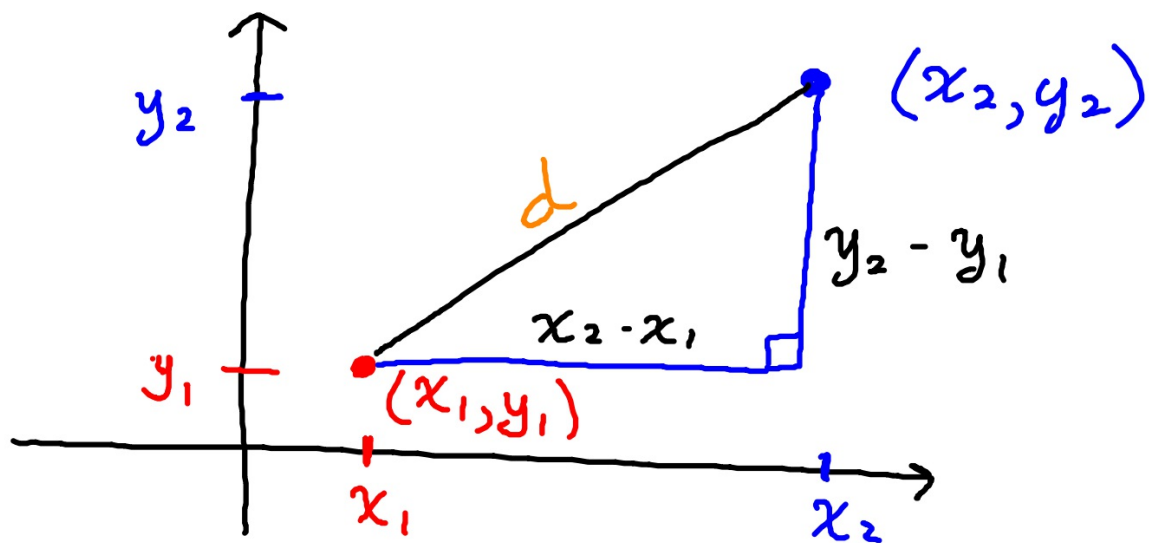
### ① Distance formula

Pythagorean theorem



$$c^2 = a^2 + b^2$$

$$a^2 + b^2 = c^2$$

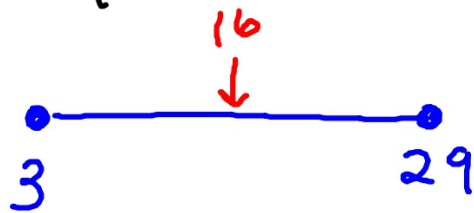


$$\sqrt{d^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

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

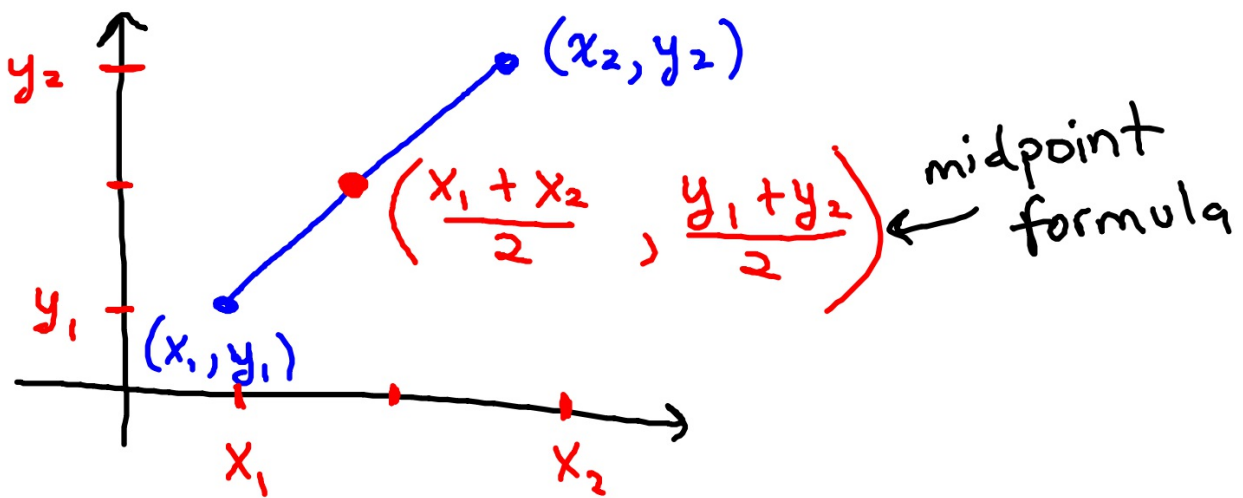
Distance formula

## ② midpoint Formula.



Average

$$\frac{29+3}{2} = \frac{32}{2} = 16$$



Ex. Find the distance and midpoint  
given:

$$P_1(-5, -3) \text{ and } P_2(-1, 2)$$

Distance:

$$d = \sqrt{(-1 + 5)^2 + (2 + 3)^2}$$

$$d = \sqrt{4^2 + 5^2}$$

$$= \sqrt{41}$$

midpoint:

$$\left( \frac{-5 + (-1)}{2}, \frac{-3 + 2}{2} \right)$$

$$\left( \frac{-6}{2}, \frac{-1}{2} \right)$$

$$\boxed{\left( -3, -\frac{1}{2} \right)}$$

Q2	Q1
(-, +)	(+, +)
Q3 (-, -)	(+, -)
	Q4

Ex: Find all points having an x-coordinate of 4 and whose distance from the point  $(-4, 2)$  is 10.

$$P_1 (\overset{x_1}{-4}, \overset{y_1}{2})$$

$$P_2 (\overset{x_2}{4}, \overset{y_2}{y})$$

$$d = 10$$

$$10 = \sqrt{(4 - (-4))^2 + (y - 2)^2}$$

$$10 = \sqrt{(4 + 4)^2 + (y - 2)^2}$$

$$10 = \sqrt{8^2 + (y - 2)^2}$$

$$10 = \sqrt{64 + (y - 2)^2}$$

$$10 = \sqrt{64 + y^2 - 4y + 4}$$

$$(y-2)^2 \text{ FOIL} \\ \rightarrow y^2 - 4y + 4$$

$$(10)^2 = (\sqrt{y^2 - 4y + 68})^2$$

$$\begin{array}{r} 100 = y^2 - 4y + 68 \\ -100 \quad \quad \quad -100 \end{array}$$

$$0 = y^2 - 4y - 32$$

$$0 = (y - 8)(y + 4)$$

$$\begin{array}{l} \rightarrow y - 8 = 0 \text{ or } y + 4 = 0 \\ y = 8 \text{ or } y = -4 \end{array}$$

$$\begin{array}{l} (4, 8) \\ (4, -4) \end{array}$$

