

# The Distance Formula

The distance formula is used to ...

- find the distance between two points
- find the length of a segment
- find the distance between a point and a line

## The Distance Formula:

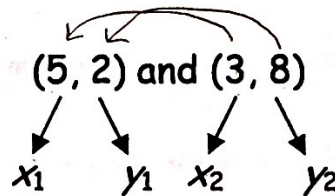
The distance  $d$  between any two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is

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

This is how it's done ...

**EXAMPLE 1:** Find the distance between  $(5, 2)$  and  $(3, 8)$ .

Step 1: Label your points



Step 2: Substitute into formula

$$d = \sqrt{(3 - 5)^2 + (8 - 2)^2}$$

Step 3: Perform correct operations!

$$d = \sqrt{(-2)^2 + (6)^2}$$

$$d = \sqrt{4 + 36} = \sqrt{40} = \sqrt{4} \cdot \sqrt{10}$$

$$d = 2\sqrt{10}$$

# The Midpoint Formula

The midpoint formula is used to ...

- find the midpoint between two points
- find the midpoint of a segment

## The Midpoint Formula:

The midpoint  $M$  of the line segment with endpoints  $A(x_1, y_1)$  and  $B(x_2, y_2)$  is

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

This is how it's done ...

**EXAMPLE 1:** Find the midpoint of the line segment with endpoints  $(14, 3)$  and  $(6, 9)$ .

Step 1: Label your points

$$\begin{array}{cccc} (14, 3) & \text{and} & (6, 9) & \\ \swarrow & & \swarrow & \swarrow \\ x_1 & & y_1 & x_2 & y_2 \end{array}$$

Step 2: Substitute into formula

$$M = \left( \frac{14+6}{2}, \frac{3+9}{2} \right)$$

Step 3: Perform correct operations!


$$M = \left( \frac{20}{2}, \frac{12}{2} \right) = (10, 6)$$

## Circles

A circle is the set of all points  $(x, y)$  that are equidistant from a fixed point called the center.

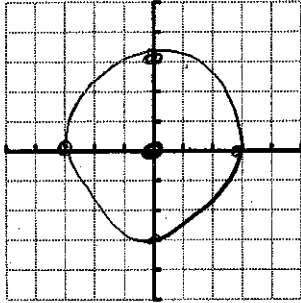


Standard Form:

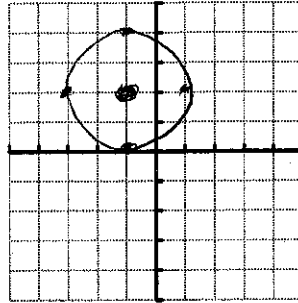
$x^2 + y^2 = r^2$	center: $(0, 0)$	radius = $r$
$(x - h)^2 + (y - k)^2 = r^2$ 	center: $(h, k)$ opposite signs $\uparrow$	radius = $r$

1. Identify the center and radius of each circle and graph.

a.  $x^2 + y^2 = 9$   $\therefore (0, 0)$   
 $r = 3$



b.  $(x+1)^2 + (y-2)^2 = 4$   
 $C: (-1, 2)$   
 $r = 2$



$ax^2 + bx + c = 0$

$\frac{b}{2} = \frac{-12}{2}$

$= -6$

2. Write the equation of the circle in standard form. Identify the center and radius.

a.  $x^2 + y^2 - 12x - 8y + 36 = 0$

$x^2 - 12x + 36 + y^2 - 8y + 16 = -36 + 36 + 16$

$(x-6)^2 + (y-4)^2 = 16$

$C: (6, 4) \quad r = 4$

b.  $2x^2 + 2y^2 + 8x = -20y - 40$

$x^2 + y^2 + 4x = -10y - 20$

$x^2 + 4x + 4 + y^2 + 10y + 25 = -20 + 4 + 25$

$(x+2)^2 + (y+5)^2 = 9$

$C: (-2, -5)$

$r = 3$