

Elementary Graphing, Distance Formula, & Graphs of Circles

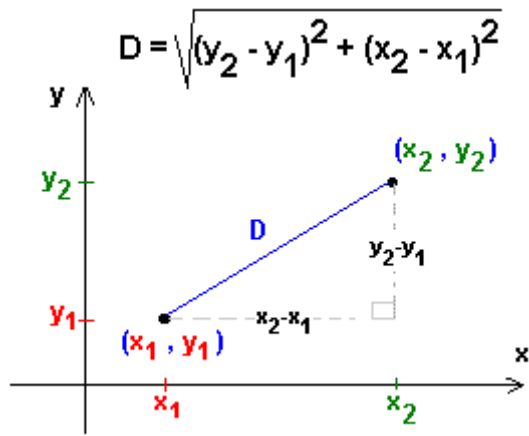
Graphing in the plane consists of plotting coordinate pairs. In this section we will see how the distance formula is used.

Graphing Points

When graphing a point (x, y) , the first coordinate defines the location on the horizontal axis and the second coordinate defines the location on the vertical axis. So a point $(3, -5)$ would have a horizontal coordinate of 3 and a vertical coordinate of -5 .

The Distance Formula

The distance formula states:



where D is the distance between (x_1, y_1) and (x_2, y_2) . As may be seen in the graph above, the distance from point to point really is the hypotenuse of a right triangle of sides length $(x_2 - x_1)$ and $(y_2 - y_1)$.

To use the Distance Formula, simply plug the values of (x_1, y_1) and (x_2, y_2) into the formula.

Example: Find the distance from $(4, -1)$ and $(-2, 2)$.

Plug the values from $(\overset{x_1}{4}, \overset{y_1}{-1})$ and $(\overset{x_2}{-2}, \overset{y_2}{2})$ into

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

To get

$$D = \sqrt{(2 - (-1))^2 + (-2 - 4)^2}$$

$$D = \sqrt{45}$$

or $3\sqrt{5}$ if you simplify the radical.

Equation of a Circle

A circle of radius r , centered at (h,k) is defined as all points (x, y) that are “ r ” units from the center (h,k) . If we apply the distance formula to this relationship, where the distance from (h,k) to (x, y) is r , we get the formula

$$(x - h)^2 + (y - k)^2 = r^2$$

Example: If a circle has a center at $(3,-1)$ with radius 2, what is its equation?

Here, $h=3$, $k = -1$, and $r = 2$. We substitute these values into the circle formula to get

$$(x - 3)^2 + (y - (-1))^2 = 2^2 \text{ which simplifies to}$$

$$(x - 3)^2 + (y + 1)^2 = 4$$

And here is the graph of this circle:

