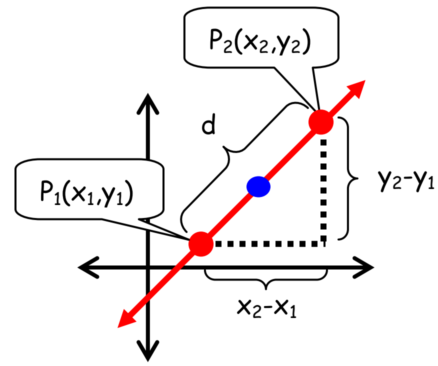
Section 1.9 (Distance and Midpoint Formulas; Circles)

Using the Pythagorean Theorem ($a^2 + b^2 = c^2$), we can find the distance between 2 points $P_1(x_1,y_1)$ and $P_2(x_2,y_2)$ in the rectangular coordinate system.

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



Example: Find the distance between (-4 , 9) and (1 , -3)

Using this distance formula, we can derive a formula to find the midpoint of a line segment connecting 2 points as midpoint $= \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$.

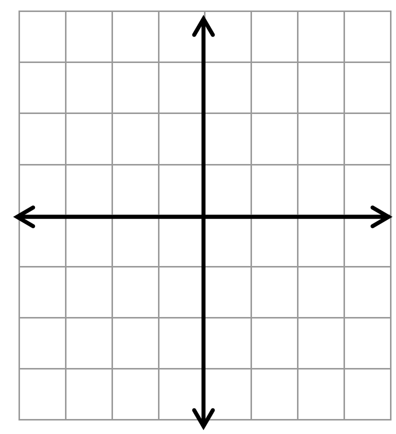
Example: Find the dist. between the given points and the midpoint of the line segment connecting them.

P = (4,-6) and Q = (-2,5)

P = $(3\sqrt{3}, \sqrt{2})$ and Q = $(-\sqrt{3}, \sqrt{2})$

Example: Starting at the origin (0,0) plot the following

a) Point that is 2 units away on the right (2,0)
b) Point that is 2 units away up (0,2)
c) Point that is 2 units away on the left (-2,0)



If we were to plot all points that were 2 units away from the origin, it would make a circle of radius 2.

A ***circle*** is the set of all points that are equidistant from a fixed point called the ***center***. The fixed distance from the circle's center to any point on the circle is called the ***radius***.

The ***standard form*** of the equation of a circle with center point (h,k) and radius r is

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

Examples: Write the standard form of the equation of the circle with…

Center (0,0) and radius 4

Center (-2,3) and radius 2

Example: Find the center and radius of the circle whose equation is…

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

Center = (

Radius =

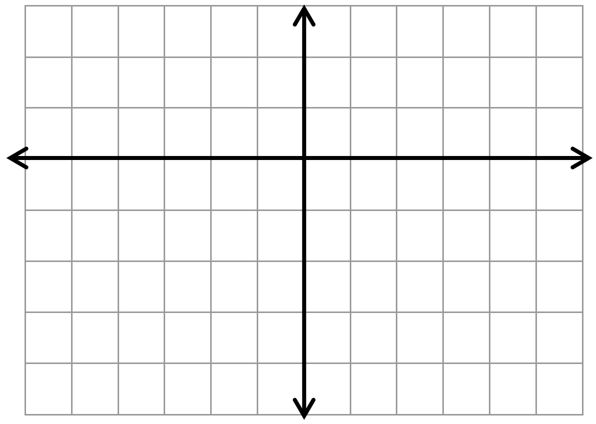
$(x + 3)^2 + y^2 = 1$

Center = (

Radius =

Book problems: 9,15,17,21,25,29,31,35,37,41,45,49

<u>Example</u>: Graph each circle in the above example



Discuss the following stuff only if time allows

<u>Example</u>: Multiply out an example from above and set equal to 0

The ***general form*** of the equation of a circle is $x^2 + y^2 + Dx + Ey + F = 0$ -- D, E, and F are real numbers

We've shown above that by multiplying out an equation in standard form and setting it equal to 0. You can also do the reverse by taking an equation in general form and converting it to general form. To do this, we complete the square on x and y (to review completing the square, you can also see section P.7, pgs. 92-93)

<u>Example</u>: Write in standard form

$$x^2 + y^2 + 4x – 6y – 23 = 0$$

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