Goals:
1. To find the distance and midpoint between two points in a plane.
2. To find the equation of a circle given the center and radius.
3. To find the center, radius, and graph of a given circle's equation.

\[ \text{Joke (don't do this!)} \]

Find the distance and midpoint between two points:

\[ \text{Distance Formula} \]

\[ d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 \]

\[ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \]
Ex. Find the distance between the points whose coordinates are given. 

\((-5, 8), (-11, 12)\)

\[d = \sqrt{(-11-(-5))^2 + (12-8)^2}\]

\[d = \sqrt{(-6)^2 + 4^2}\]

\[d = \sqrt{36 + 16}\]

\[d = \sqrt{52}\]

\[= 2\sqrt{13}\]

Ex.

Find the midpoint of the line segment having the given endpoints. 

\((5, -5), (9, 9)\)

\[m.p. = (\bar{x}, \bar{y}) = \left(\frac{5+9}{2}, \frac{-5+9}{2}\right)\]
Ex. Determine the center and radius of the circle with the given equation.

a) \((x - 1)^2 + y^2 = \frac{1}{36}\)

\((x - 1)^2 + (y - 0)^2 = \left(\frac{1}{6}\right)^2\)

\(C(1, 0)\) \(r = \frac{1}{6}\)

b) \((x + 5)^2 + (y + 10)^2 = 5\)

\((x + 5)^2\) \((y + 10)^2 = 5\)
\[ r = \sqrt{5} \]

\[ x^2 + y^2 = 1 \]

\[ r = 1 \]

**Ex.** Find an equation of a circle that satisfies the given conditions. Write your answer in standard form.

Center \((0, \frac{4}{7})\), radius \(\sqrt{65}\)

\[ (x - h)^2 + (y - k)^2 = r^2 \]

\[ x^2 + \left(y - \frac{4}{7}\right)^2 = 65 \]

**Ex.** Find an equation of a circle that satisfies the given conditions. Write your answer in standard form.

Center \((-9, 5)\), passing through \((4, 10)\)
\[(x-h)^2 + (y-k)^2 = r^2\]
\[r = \sqrt{(4-4)^2 + (10-5)^2}\]
\[r = \sqrt{169 + 25}\]
\[r = \sqrt{194}\]

\[(x+9)^2 + (y-5)^2 = 194\]

**Review**

Quadratic Functions

\[f(x) = a(x-h)^2 + k\]
\[V(h, k)\]

\[f(x) = 2(x-1)^2 - 3\]
\[V(1, -3)\]