Purpose: In this problem set, you will explore circles mathematically. A solid foundation here will ease the transition into angles and trigonometry.

1. Reach into the depths of your memory (or your notes...or Google...) and recall the distance formula. The distance between two points (x_1, y_1) and (x_2, y_2) is given by:

2. To define a circle, we want to collect all points some fixed distance, r, away from a specific point, (h, k).

   (a) Write out a formula that gives points (x, y) that are 2 units away from $(1, 3)$.

   (b) Write out a formula that gives points (x, y) that are r units away from (h, k).

   (c) You may have a square root in your answer to (b). If so, square both sides. Now you have the usual equation for a circle!

Definition: A **circle** is the collection of all points that are a fixed distance (radius) away from a given point (center). A circle of radius r and center (h, k) is described by the equation

3. Graph all points that are a distance of 3 away from the point $(1, 2)$.
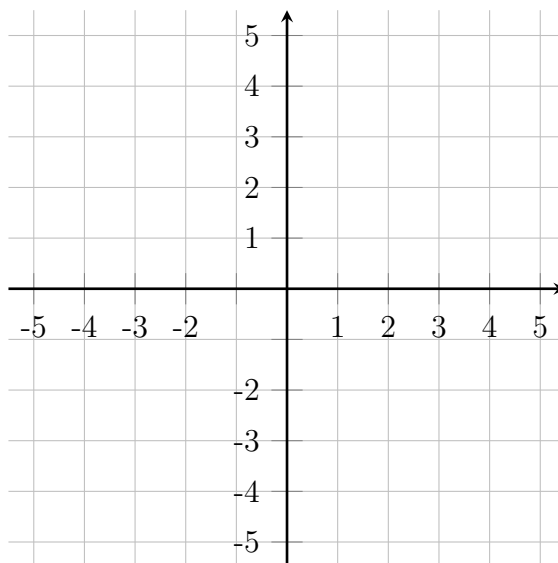
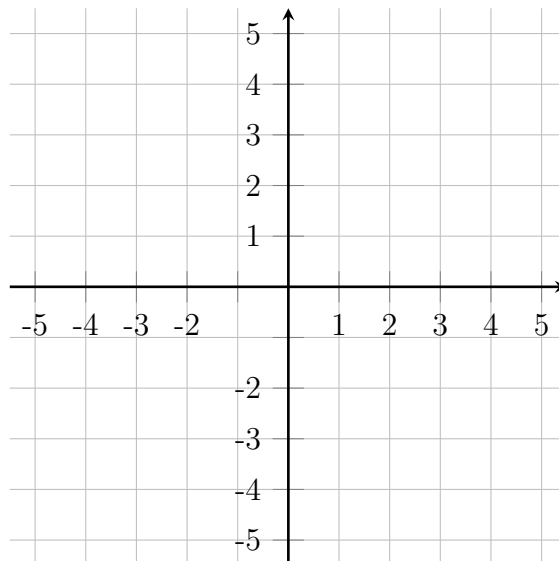4. Write an equation for the circle graphed below.
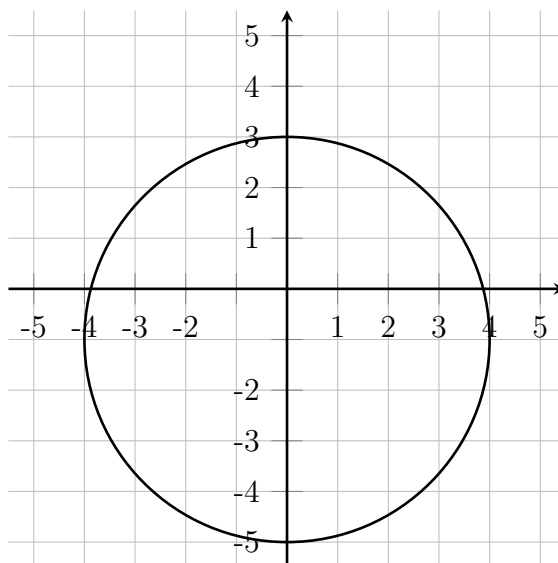
5. The points $(-4, -3)$ and $(2, 1)$ are the endpoints of the diameter of a circle.

    (a) What is the center of the circle?

    (b) What is the radius of the circle?

    (c) Write an equation for the circle.

    (d) Sketch the graph of the circle.

6. Consider the circle given by $(x-2)^2 + (y+5)^2 = 9$.

    (a) What is the center of the circle?

    (b) What is the radius of the circle?

    (c) What is the diameter of the circle?

    (d) What is the circumference of the circle?

    (e) What is the area enclosed by the circle?

7. Goal: Given the general form of the equation of a circle, $x^2 + y^2 - 8x + 6y + 16 = 0$, find the standard form.

   (a) Rearrange the terms so that the x's are paired, the y's are paired, and all of the constants are on the right hand side.

   (b) Looking just at the x terms, complete the square. You should have something like $(x + a)^2 +$ (stuff with y) $= b$.

   (c) Looking just at the y terms, complete the square.

   (d) You should now have an equation that is the standard form for the given circle. What is the center? The radius?