

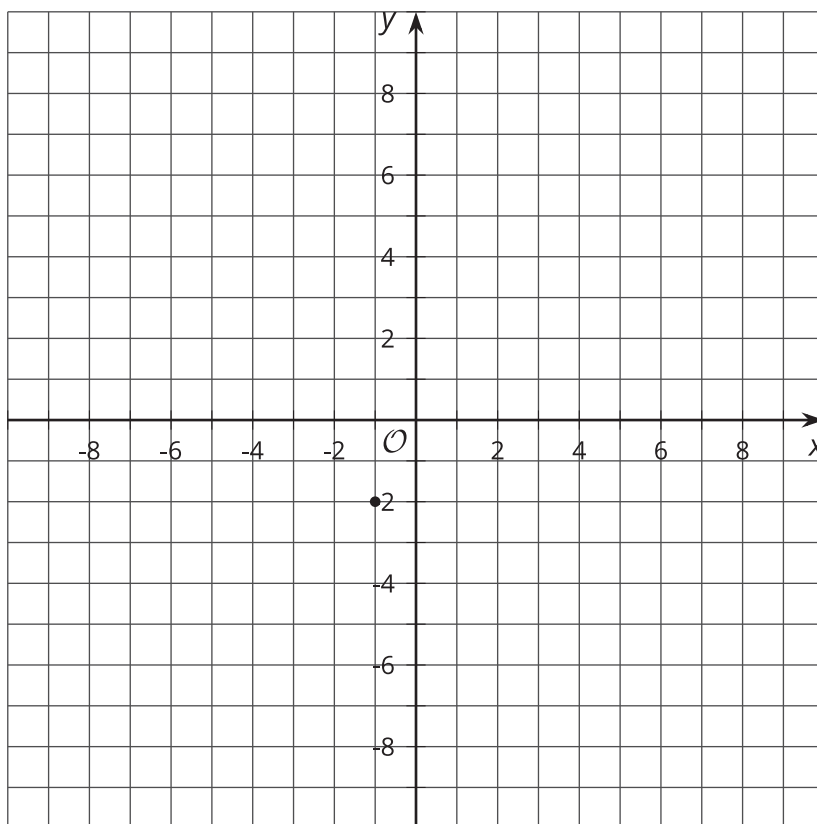


# Connecting Distance and Circles

Let's look at points a given distance away from a particular point.

## 1.1 A Distance Away

Plot as many points as you can that are a distance of 5 away from the point  $(-1, -2)$ .

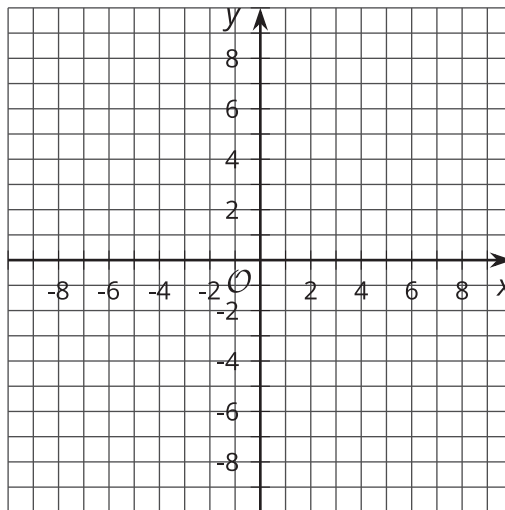


## 1.2 Plot a Distance Away

Here is a list of points.

$(0, 8.5)$   $(0, -6.5)$   $(-10, 0)$   $(2.5, 6)$   $(6, 8)$   $(-4, -7.5)$   $(-4, 7.5)$   $(-6, -8)$   $(-2.5, -6)$   
 $(7.5, 4)$   $(8, 6)$   $(-6, 2.5)$   $(-6, -2.5)$   $(-8, 6)$   $(7.5, -4)$

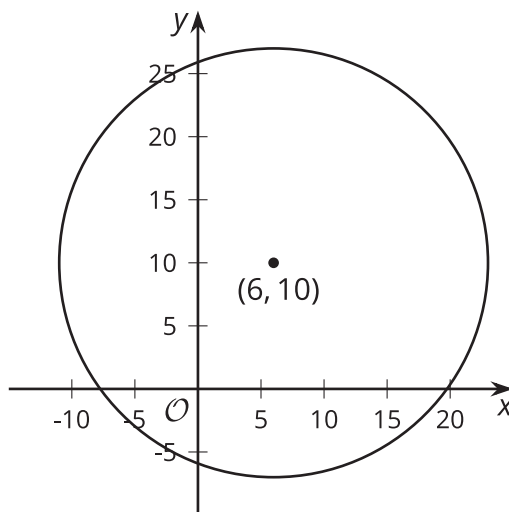
- Sort the points according to their distance from the origin.
- Your teacher will assign you to work with the points that are 6.5 units, 8.5 units, or 10 units from the origin.
  - Plot the points on the coordinate plane.



- Find at least 2 more points the same distance from the origin that do not lie on either the  $x$ - or  $y$ -axis, and plot them on the plane.
- Use a compass to draw a circle centered at the origin with a radius that is the same as the distance you were assigned.

## 1.3 Circling the Problem

The image shows a circle with its center at  $(6, 10)$  and radius of 17 units.



1. The point  $(14, 25)$  looks like it might be on the circle. Verify if it really is on the circle. Explain or show your reasoning.
2. The point  $(22, 3)$  looks like it might be on the circle. Verify if it really is on the circle. Explain or show your reasoning.
3. In general, how can you check if a particular point  $(x, y)$  is on the circle?

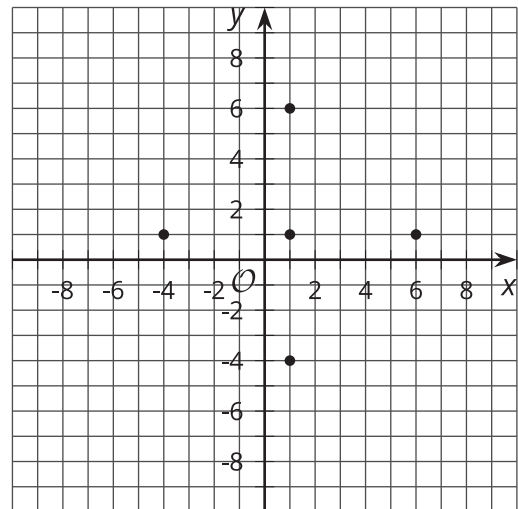
### Are you ready for more?

Circle  $P$  has a center at point  $P$  at  $(-4, 4)$  and a radius of 5. Circle  $Q$  has a center at point  $Q$  at  $(2, 4)$  and a radius of 5.

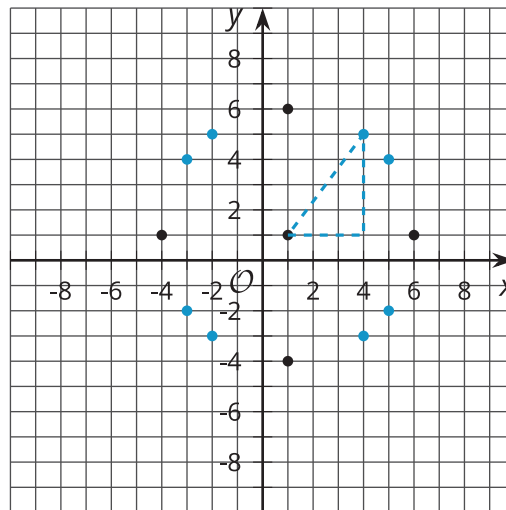
1. Graph the circles. Include points  $P$  and  $Q$ .
2. Draw the perpendicular bisector of  $PQ$ .  
How do you know it is the perpendicular bisector?
3. Find the points of intersection of the circles.

### Lesson 1 Summary

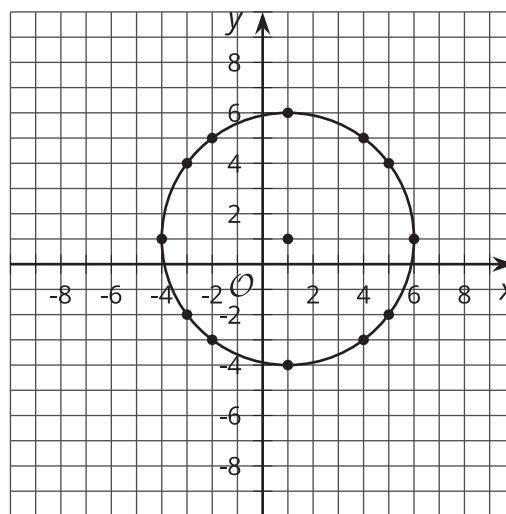
Let's find some points that are a distance of 5 away from the point  $(1, 1)$  and plot them on a grid. We can use gridlines to find 4 points:



We can use the Pythagorean Theorem to help us find some more points. Recall that for a right triangle with a hypotenuse of 5, we can make a right triangle with legs 3 and 4. This means that if the horizontal and vertical distances between the points are 3 and 4, then the distance between them will be 5. We can find 8 more points this way!



As we fill in more points, it looks like the points are forming a circle around the point  $(1, 1)$ , and in fact, they are. The circle has a radius of 5, which makes sense since we know that a circle is the set of all points a given distance away from a central point. In this case, that given distance is 5.



How can we check whether a point lies on this circle if we are not sure? Let's check the point  $(3, -3.5)$ . We can use the Pythagorean Theorem to test the distance between the center of the circle and the point:  $\sqrt{(3 - 1)^2 + (-3.5 - 1)^2} = 4.38$ , which is not equal to 5. That means the point is close to the circle, but does not lie on the circle.

We can say that for a circle of radius  $r$  and center  $C$ , if a point  $P$  is a distance of  $r$  away from  $C$ , it will lie on the circle. If point  $P$  is not a distance of  $r$  away from  $C$ , then it will not lie on the circle. Another way to say this is that for a circle of radius  $r$  and center  $C$ ,  $P$  will lie on the circle if and only if it is a distance of  $r$  away from  $C$ .