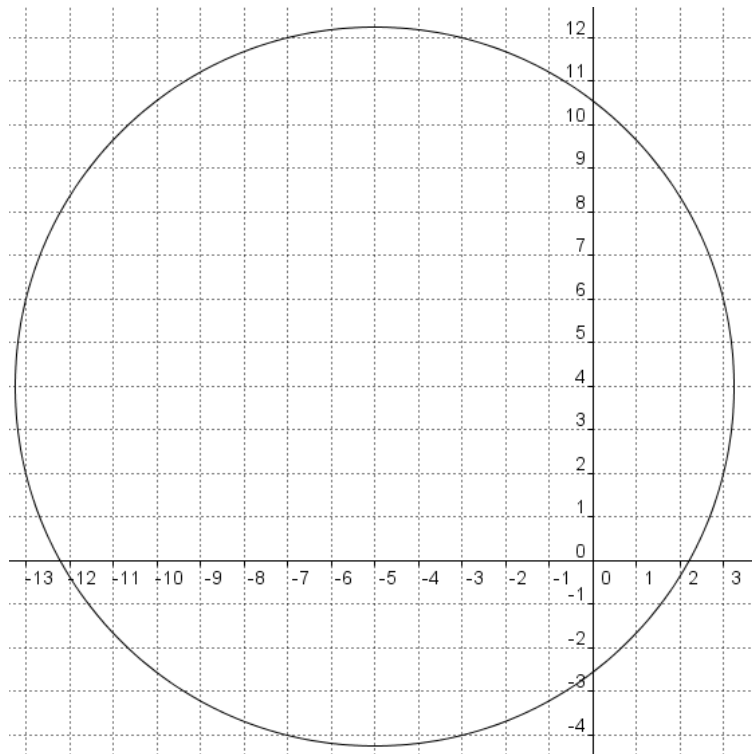


Equation of a Circle

We can summarize the properties of a circle that we know so far based on the concepts of length (or distance) and midpoint:

- the centre of a circle is the midpoint of the line segment that is its diameter
- the radius of a circle is the distance from the centre to any point on the circle
- the circumference of a circle is proportional to its radius: $C = 2\pi r$
- the area inside a circle is proportional to the square of its radius: $A = \pi r^2$

Example – Determine the centre, radius, circumference and area of the circle below.



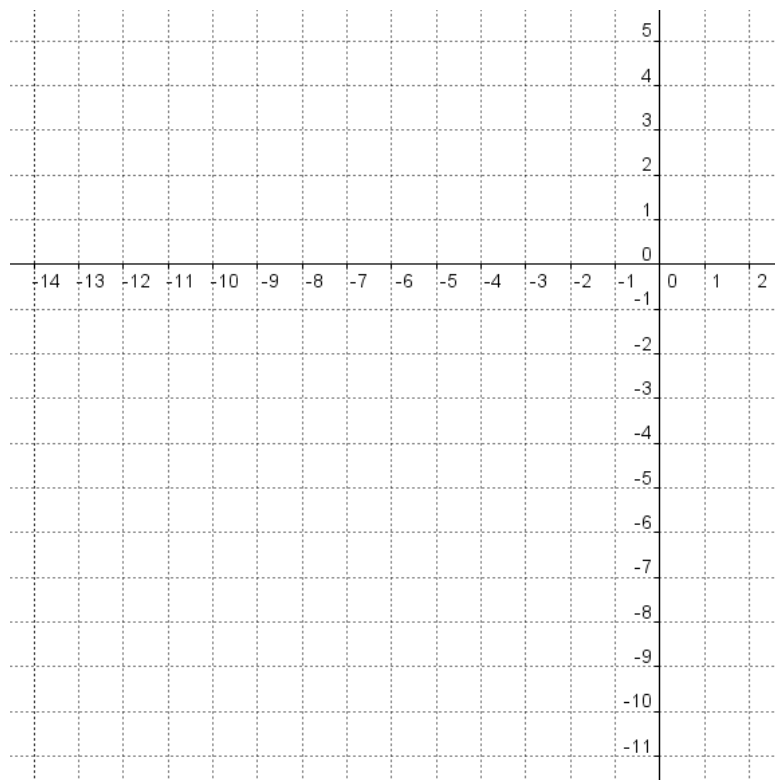
We can improve our understanding of the properties of a circle by considering the slope (rise and run) of the radius from the centre of the circle to a point on the circle.

Every point on a circle can be located by drawing a right angle triangle from the centre of the circle with a hypotenuse that is equal to the radius of the circle.

If we can locate one point on a circle based on its rise and its run from the centre of the circle, then we can locate:

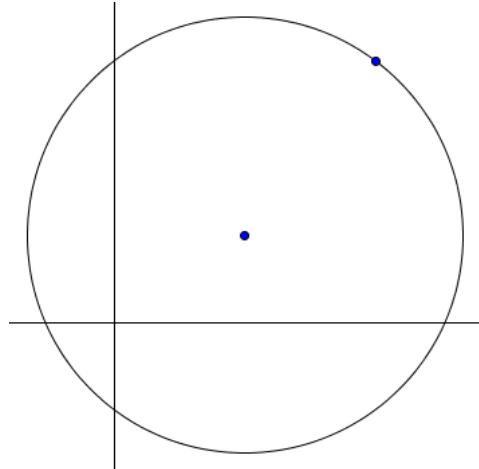
- another point in the same quadrant of the circle by reversing the rise and run
- two points in each quadrant of the circle by considering negative rise and run

Example – A circle has a diameter with endpoints at $(-3, 4)$ and $(-9, -10)$. Determine the centre of the circle and six other points on the circumference of the circle.



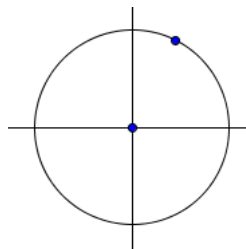
We can define a circle as the set of points (x, y) at equal distances from the centre.

We can apply the Pythagorean theorem in order to write the equation for any point (x, y) on a circle:

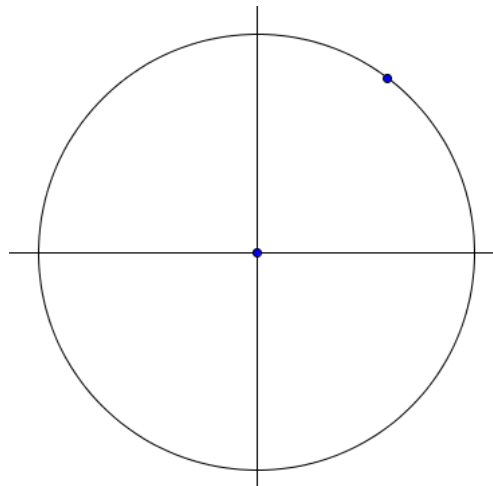


However, this equation represents a circle after it has been stretched and translated.

The base graph is the unit circle (radius equal to 1) with its centre at the origin $(0, 0)$:

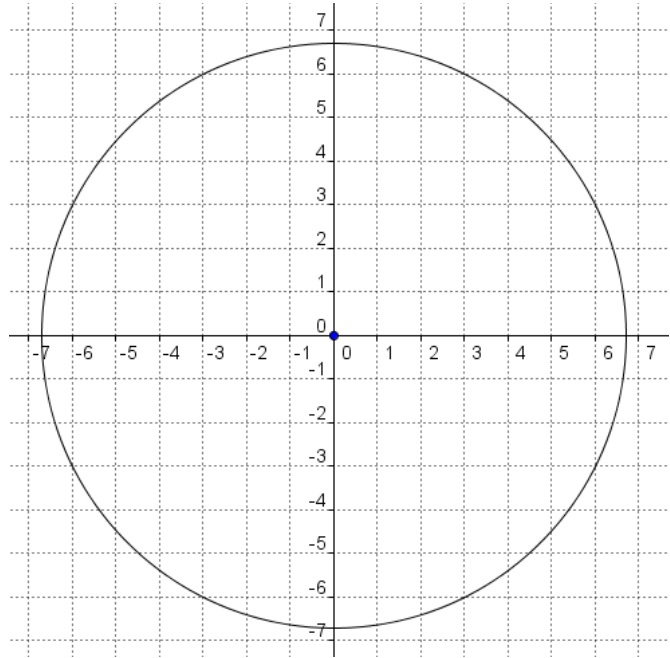


We can stretch the base graph in order to define all points located at a particular distance from the origin:



Example – Consider the circle shown in the graph below.

- a) Determine the equation of the circle.
- b) Determine the coordinates of any points where $x = 2$.
- c) Determine the coordinates of any points where $y = 2$.



Example – Determine whether each point is inside, outside or on the circumference of the circle $x^2 + y^2 = 73$.

a) (2, 9)

b) (6, -6)

c) (-5, 7)

d) (-8, -3)

Homework: Please solve the following problem, and answer:

Questions # 6, 14 and 15 on page 67

Question # 8 on page 89

Questions # 4, 7a, 8 on page 97

1. A circle has a diameter with endpoints at $(-3, 1)$ and $(11, -5)$. Determine the centre of the circle and six other points on the circumference of the circle.

