**Activity 6.1.6 The Unit Circle**

Using a circle that has a radius of 1 unit is important because then the arc length equals the radian measure of the angle, and we are not confined to using only degrees as the domain for trigonometric functions. Also, because of similarity of geometric figures, if we understand what happens on a circle of radius 1 unit, then we can multiply by a constant of proportionality when we want to use circles that are larger or smaller than a unit circle.

The unit circle is graphed on the coordinate plane below. The **equation** of the **unit circle** is$x^{2}+y^{2}=1$**.**

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1. What is the center of the unit circle?
2. What is the radius of the unit circle?
3. Label the coordinates of the 4 points where the axes intersect the circle.
4. What is the largest value that *x* or *y* can be?
5. What is the smallest value that *x* or *y* can be?
6. Fill in the table of values for the relation $x^{2}+y^{2}=1$. An example is shown below:

|  |  |
| --- | --- |
| *x* | *y*Example: If *x* =$ \frac{1}{2 }$, find y.Solution: Substitute$ \frac{1}{2 }$ in for *x* and then solve for *y*.$$\frac{1}{4}+y^{2}=1$$(Rename 1 = $\frac{4}{4}$ , 4 is the common denominator)$$ y^{2}=\frac{4}{4}-\frac{1}{4}$$$$ y^{2}=\frac{3}{4}$$$$\sqrt{y^{2}}=\sqrt{\frac{3}{4}}$$$\left|y\right|=\frac{\sqrt{3}}{2}$ $so y= -\frac{\sqrt{3}}{2 } or y=\frac{\sqrt{3}}{2}$. |
| 0 |  |
|  | 0 |
| $$\frac{1}{2}$$ | $-\frac{\sqrt{3}}{2 }$ or$ \frac{\sqrt{3}}{2}$ |
| $$-\frac{1}{2}$$ |  |
| $$\frac{3}{5}$$ |  |
| $$-\frac{3}{5}$$ |  |
|  | .25 |
|  | -.25 |
| $$\frac{1}{\sqrt{2}}$$ |  |

1. Sketch a graph of $x^{2}+y^{2}=1$, and plot 8 of the points from the table in problem 6 above.



1. Is the unit circle a function? Why or why not?
2. Which of the following points are on the unit circle? Justify your answers.

a. (0.6, 0.8) b. (3,4) c. $\left(\frac{2}{7}, \frac{5}{7}\right)$

1. The point $\left(\frac{12}{13}, \frac{5}{13}\right)$ is on the unit circle. Use symmetry about the *x*- and *y-*axis to name 3 other corresponding points on the circle.
2. The point $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ is a point on the unit circle. If you go half way around the circle in either direction starting at this point, what are the coordinates of the point you end up at?
3. Besides using the *x*- and *y*-coordinates to locate or describe a point on the unit circle, we can use an arc measured in standard position. Suppose a bug moves in a counter clockwise direction around the circle starting at (1,0). The length of the radius is 1 unit. In which quadrant is the bug when it has traveled a distance of:

1. 1 unit?

1. 2 units?

1. 5 units?

1. 7 units?
2. Use a point to indicate the position of the bug on the circle for each of the above distances of 2, 5 and 7 units.(The first one is done for you.)