Are angles always measured in degrees?

1) Take a roll of tape and start at any location on the circumference of your circular disk. Wrap the tape all the way around the circumference of your disk until you reach the place where you started, then cut the tape. We will call this the circumference tape. Carefully remove the circumference tape and lay it flat on your table so that it is easier to work with.

2) Measure the length of the radius of your disk. Then start at one end of the circumference tape, mark where one radius length ends. Continue marking at one radius intervals until you get to the end of your circumference tape.

3) Count the number of radius lengths it took to get all the way around your circle. Did it come to be an exact number? Compare the number of radius lengths you got with the number your table members got. Were their numbers consistent with yours?

4) Apparently there is a relationship between a circle's circumference and it radius. using what you know about radius length and how it relates to the circumference of a circle, explain your answer to step #3.

5) Place your disk on a sheet of paper and trace around it. (If your disk is too large, it's ok to use one of your tablemates' s disks that do fit). Carefully mark the center (P) of the circle on your paper. Place the circumference tape back on the disk. Transfer the radius length marks (from step #2) onto the traced circle. Label the position for the start of the tape as A and the first radius mark ab B. Draw the segments $\overline{PA}$ and $\overline{PB}$.

6) If you assume the radius of the circle you just drew is one unit, what is the length of arc AB? (Note: AB is actually an arc (a part of the circumference of the circle, and not a segment)). You have just defined a new angle measure that is based on the length of a radius. As a result, it is more easily applied to higher mathematics than a degree, which is based on the number of days in a year. A RADIAN is nothing more than RADIis ANgle! In other words, if you take the length of 1 radius and lay it on the circumference of the circle, the angle that is formed by the arc's endpoints and the center of the circle has a measure of 1 radian.

7) Assuming that the radius of your disk is one unit, what is the exact circumference?

8) Look again at the circle you traced on your paper. Let the length of the radius of the circle equal

1 unit. (A circle with a radius of one is called a unit circle).

a) How many degrees did you go around the circle in order to mark off 2π radius lengths (radians) on your paper?

b) A radian is a unit of angle measure. The central angle of a full circle is 360 degrees. How many radians is this?

9) When we measure angles in the unit circle, we measure from standard position (the positive x-axis) as shown in the diagram. Sketch the unit circle and show an angle with a measure of approximately 3 radians starting from standard position.

10) We want to develop a method for comparing degrees and radians.

a) How many degrees of angle measure are there in one half of a circle?

About how many radians of angle measure are there in one half of a circle?

Exactly how many radians of angle measure are there in one half of a circle?

b) Write an equation that relates radians and degrees using the half circle.

c) Use this relationship to convert $\frac{\pi}{3}$ radians into degrees.

d) How many radians are there in 200˚? Give an exact value using π in your answer.

11) You should now have an intuitive sense of about how many degrees are in one radian, since you know there are about π radians in one half of a circle and about 2π radians in a whole circle.

a) Now find how many degrees are in one radian accurate to three decimal places.

b) How many radians are in one degree, accurate to three decimal place?

c) Which is the larger unit, a degree or a radian? Are they very close in size, or very different?

12) Convert the degree measures to radians. Use π to give the exact value.

a) 180˚ b) -36˚ c) 210˚

13) Convert the radian measures to degrees.

a) $\frac{3\pi}{2}$ b) $-\frac{7\pi}{6}$ c) $\frac{5\pi}{4}$