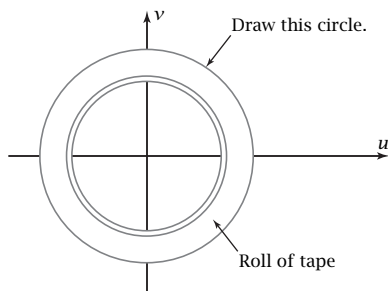


**Exploration 3-4b: Radian Measure of Angles**

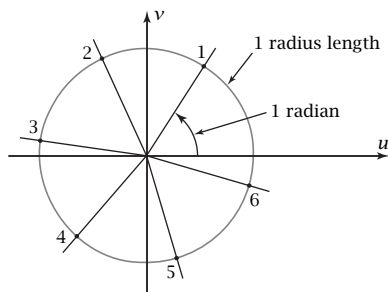
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**Objective:** Discover how angles are measured in radians by wrapping a string around a circle.

- At the board, plot horizontal and vertical  $u$ - and  $v$ -axes. Obtain a roll of masking tape and place it with its center at the origin. Draw a circle on the board by tracing around the outside of the roll.



- Remove the roll of tape from the board. Mark a "ruler" on a piece of string, with units equal to the radius of the circle you drew. Then attach the string to the roll of tape.
- Put the roll back on the board in such a way that the starting point on the string is on the positive side of the  $u$ -axis. Wrap the string counterclockwise around the tape roll. Make marks on the board at the points 1, 2, 3, 4, 5, and 6 on the string. Then remove the tape roll again.
- Draw rays through the points you marked on the board, like this:



- The central angles formed by the rays you drew have measures of 1, 2, 3, . . . **radians**. By measuring with a protractor, find out approximately how many degrees are in 1 radian.
- An angle of 6 radians is not quite a complete revolution. How many radians would it take to make a complete revolution? Provide the exact value.

- You should have answered  $6.28$  radians" for Problem 6. The fact that there are  $360^\circ$  in a complete revolution gives you a way to transform degrees to radians, and the other way around. Calculate exactly the number of degrees in 1 radian. How does the measured value in Problem 5 compare with this exact answer?

- Calculate the exact number of degrees in 3 radians. Show a 3-radian angle on your board drawing. How close is the degree measure of your drawn angle to the exact value?

- Explain why the size of a radian would be the same no matter what size circular object you use in place of the roll of tape in **Problem 1**.

- What did you learn as a result of doing this Exploration that you did not know before?