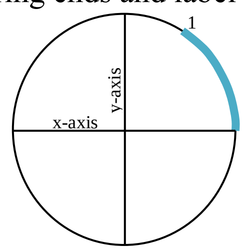
Paper Plate Radians Activity

Today we are going to learn a new way to measure angles instead of using degrees. We will be building off of the unit circle that we created on paper plates earlier in the unit.

1. Cut a piece of string that is the same length as the radius of the paper plate.
2. Starting at the point (1,0), lay the string along the outside of your paper plate. Put a hash mark on your plate where the string ends and label this mark as "1."



3. From this hash mark, measure another radius-length around the circle and mark that point "2." Continue doing this around the circle until you have marked 6 radius-lengths.
4. Imagine a line from your first hash mark to the center of the circle. The angle formed between the x-axis and this line could be measured in degrees with a protractor. However, instead of saying that this angle is about 57°, we will say that it is **1 radian**.
   a) What is the measure of the angle ***in radians*** between the x-axis and the line from your second hash mark to the center? __________
   b) The fourth hash mark? ___________
   c) The sixth? ___________
5. In a complete sentence, write your own definition of a radian or radian measure of angles.

   ____

   ____

6. About how many radians is a 180° angle, also known as a straight line? ___________

   Can you think of a mathematical value or constant that is close to the number you found? **Hint**: it's represented by a Greek letter, and is used to calculate the circumference of a circle. ___________

   Therefore, we can say that a straight line is ___________ radians.
7. Can you think of a relationship between radians and degrees?

   __________ Radians = ___________ Degrees
8. Now, let's label 90°, 180°, 270°, and 360° on our plates in radians. If 180° is equal to pi radians, what would an angle double the size, also known as 360°, be in radians?

   ____

   What about an angle that is half the size, also known as 90°? ___________

   So, what would 270° be in radians? ___________

9. So, let's fill in the rest of the angles in our unit circle with radians. Think about dividing the first 180° into 12 evenly spaced angles. This would give us 15°, 30°, 45° and so on. Since we are dividing our 180° by 12, we will do the same thing with radians. Therefore, the radian measure of 15° would be π/12. The radian measure of 30° would be 2π/12 which reduces to π/6. Continue finding the radian measure of the angles around your unit circle. Notice that when you go into quadrant III, you will just keep counting up in the numerator. For example, 195° would be 13π/12.

10. Let's figure out a way to convert between degrees and radians. From 7. We found that π = 180°. What relationship do we get when we divide both sides by pi? __________

    What relationship do we get when we divide both sides by 180°? __________

    So, putting it all together we can say: $= \frac{\quad}{\quad} = \frac{\quad}{\quad}$

10. Since we can multiply any number by 1 without changing its value, we can use these as our conversion factors for changing degrees to radians and radians to degrees.

    a) To convert from degrees to radians, you multiply the angle by __________

    b) To convert from radians to degrees, you multiply by __________

    Hint: think about units and how you could get degrees or π to cancel out.

Convert the following angles from radians to degrees. Please show your work.

a) π/12 = _____________
b) 2.12 = _____________
c) 5π/4 = _____________
d) 7π/6 = _____________
e) π/2 = _____________
f) 2π/3 = _____________
g) 7 = _____________
h) 11π/6 = _____________
i) 7π/4 = _____________
j) 11.23 = _____________

Convert the following angles from degrees to radians. Leave answers in the form of π. No decimals

a) 315° = ______________
b) 231° = ______________
c) 135° = ______________
d) 330° = ______________
e) 210° = ______________
f) 240° = ______________
g) 931° = ______________
h) 315° = ______________
i) 122° = ______________
j) 150° = ______________