Answer Key – Rolling Into Radians Questions

1. Compare the two graphs your group produced. Identify at least one way the graphs are alike and at least one way the graphs are different.

Answers may vary.
Same — both graphs have the same shape, the same *y*-intercept
Differences — scales on both axes are different

2. Your Graphic Artist should draw a smooth curve through the dots on both graphs if he/she has not already done so. Explain why a smooth curve makes sense for this graph.

A smooth curve makes sense, because even though you didn't measure height at every point along the measuring tape, you could. Another answer might be that the height of the dot varies continuously as the can rolls.

3. Your group should be able to identify a pattern in the data. Extend the pattern to the left on both graphs. What would the negative values on the horizontal axis represent in the context of the can rolling on the table or floor?

Negative values for *d* would indicate the can rolling in the opposite direction.

4. How would your first graph have been different if you had used a truck tire instead of a can? How would it have been different if you had measured using different units?

A truck tire is (probably) much larger than the can, so the scaling on both axes would have been very different. Likewise, using different units, even for the can used by the group, would have resulted in different scales.

5. The period of a function is the shortest horizontal distance on the graph over which the entire pattern repeats. What is the period of your first graph (use the axes on your graph to estimate)? What are the units of the period?

Answers depend on the size of the can. It should be between 6 and 6.5 times the radius. The units for the period would be the same as the units of measure (inches or centimeters). Students who realize that the circumference is the period might calculate the period directly; if they do, make sure they connect that measurement its representation on the graph.

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6. The amplitude of a periodic function is the maximum vertical displacement from the axis of oscillation, and the axis of oscillation is a horizontal line halfway between the maximum and minimum values of the function. What is the amplitude of your first graph (again, use the axes on your graph to estimate)? What are the units of the amplitude?

The amplitude is equal to the radius, and units for amplitude would be the same as the units of measure for the radius.

7. What are the period and amplitude of your second graph? What are their units?

The period of the second graph is 2π, and its amplitude is 1. Technically, there are no units for either, since the process of dividing measurements of length (d and h) by another measurement of length (r) will "cancel out" the units.
The graphs are said to be "unit-less."

8. Compare your answers for Questions 5, 6, and 7 with answers from other groups. Write a sentence or two explaining why the comparison worked out the way it did.

Answers may vary. Students should realize that different groups used different sized cans and possibly different units of measure, so answers for Questions 5 and 6 — which depend on both size of can and unit of measure — will differ. The answers for Question 7 should be the same, since dividing all measurements by the radius removes both the size of the can and the unit of measurement from consideration.

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