Flying Pig and Centripetal Motion

Introduction:
In this lab you will investigate the concepts and equations of centripetal acceleration and centripetal force. Your experimental apparatus will consist of a flying pig, a meter stick, and a “pig slighter” which will allow you to determine the radius of the pig’s orbit. Along the way, you will also learn a bit about how forces and accelerations have components along perpendicular directions, and how simple trigonometric ratios can allow you to find the essential components.

Procedure:
1. Tape down scratch paper on the surface of your table so that it covers the middle.
2. With the pig sitting still, use the pig-slighter to mark the spot on your scratch paper that the pig is hanging above.
3. Have your instructor turn on the pig. Use the pig-slighter to map out its location on your scratch paper as it goes around.
4. Use a meter stick to measure the radius of your pig’s circle.

Radius ________________

5. The length of the pig’s string is .88m (verify this if possible).
6. Use the “sin⁻¹” button on your calculator to figure out the angle θ in the picture above.

Type \( \sin^{-1} \left( \frac{R}{0.88} \right) \) where x is in meters, and R is the radius you measured above.

\[ \theta = \text{___________ degrees.} \] Does your answer seem reasonable? If no, see your instructor!

7. Now use a stopwatch to measure the time it takes for the pig to make ten revolutions. Divide this time by ten to calculate the time for one revolution.

Time for ten revolutions ________________

Time for one revolution ________________

8. Calculate the distance the pig travels in one revolution

Distance = 2\( \pi \)r

Distance ________________

Calculate the speed the pig travels at \( v = \frac{d}{t} \)

Speed ________________

9. What is the centripetal acceleration of the pig as it circles? Use the equation

\[ a_c = \frac{v^2}{R} \]

\( a = \text{_______________} \text{ m/s}^2 \)

10. The acceleration due to gravity is 9.80 m/s². On a piece of graph paper, draw a triangle with 9.8 squares vertically and \( a_c \) squares horizontally. Then use a protractor to measure the angle.

\[ \theta = \text{_________________________ degrees (measured with protractor)} \]

How close is it to your angle from question 6? Percent difference = ______________.

Should your results of 6 and 10 be equal? Explain.