Finding Empirical Solutions Using Microsoft Excel

Step 1: Watch Pre-lab Lecture for Experiment 1

This lecture involves solving the following 2-D kinematic problem

> A cannon with a muzzle speed of 1,000 m/s is used to start an avalanche on a mountain slope. The target is 3,000 m from the cannon horizontally and 800 m above the cannon. Determine the angle, above the horizontal, that the cannon should be fired.

In the space provided below, write out the mathematical expression for the vertical displacement (y) based on the horizontal displacement (x), the angle (θ), and the acceleration in the vertical direction (a_y) provided in the pre-lab lecture.

Provide the cell location for the value used for the independent variables

Cell location of x =
Cell location of v_i =
Cell location of a_y =
Cell location of θ =

Taking the mathematical expression for y from above, determine the Excel equation necessary to determine y.

Provide the two acceptable angles (in degrees) that were determined using Solver in Excel.

θ = θ =

Step 2: On a separate Excel worksheets, solve the following problem from scratch using the approach outlined in the previous steps. Don't not waste time trying to reduce this expression or rearranging this equation for the variable of interest (T).

> The acceleration of an object undergoing simple harmonic motion can be described by the equation
>
> $$a(t) = -A\left(\frac{2\pi}{T}\right)^2 \cos\left(\frac{2\pi}{T}t\right)$$
>
> where $a(t)$ is the acceleration of the object over time (in m/s^2), A is the amplitude of motion (in m), T is the period of oscillation (in s), and t is the time (in s). Given that the amplitude of the object is 2.34 m and the acceleration after 3.45 s is 1.89 m/s^2, determine the period of oscillation.

Keep in mind that in using the function provided, a maximum feasible period exists and that as period of oscillation decreases, the acceleration range increases. This means that the periods that fit the criteria may become more difficult to find at lower values (see graph below).

Step 3: Determine six correct periods and submit the complete spreadsheet with six correct answers included to the instructor. Do not bother rounding off your answers.