Physics 200 (Stapleton) Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Projectile Launcher Project

Goal: apply physics formulas to the real life problem of attacking targets with medieval siege weapons

Requirements:

1. Create a single Google spreadsheet with an individual tab for each of the following:
   1. **Initial Speed Calculator:** calculates the initial speed of a projectile launched horizontally from a surface of given height and traveling a given horizontal distance. In other words, if you enter the horizontal distance traveled (in meters) and the height of the launch point (in meters), the calculator gives you the initial speed in meters per second.
   2. **Trajectory (flight path) Simulator, with graph:**
      1. For a projectile with a given release angle and initial speed, this spreadsheet calculates the x and y position at every moment in time during a projectile’s flight.
      2. This sheet should include a graph showing x position vs. y position. This graph shows the theoretical flight path of the projectile. X position should be plotted on the x axis.
   3. **Launcher Speed Calibration Graph:** shows the relationship between the distance the launcher is stretched and the initial speed of the projectile. The initial velocity should be on the Y axis, and the stretch distance should be on the X axis. You can create your own scale for stretch distance (x axis).
2. Calibrate your launcher. One way to do this is by shooting horizontally at a variety of power settings and recording distance traveled and initial height. For each distance, use the initial speed calculator that you created. Use the data to creating a calibration graph of muzzle velocity vs launcher setting.
3. Use your spreadsheets to solve the three practice problems below. Each problem will require you to choose a combination of launch angle and stretch distance that will allow you to hit a target with your launcher. For the problems below, do not use your launcher data. Use the data on the back of this sheet.
4. Compete in the contest. You will get two shots at each target. The best shot will be kept as your score. Your score will be your % error (miss distance \* 100% / distance to target). Low score wins.

Practice Problems: For each problem, provide a satisfactory launch angle, muzzle velocity, and launcher setting. Use the graph on the back of this sheet to determine the launcher setting for a given velocity.

1. The target and release point are at equal elevations. The horizontal distance from launcher to target is 5m. There is a 1m tall wall positioned at the midpoint between the launch pad and the target.

2. Horizontal distance to target = 3.5m. Target is 1.2m above release point.

2. Target and release point are at equal elevations. Horizontal distance to target is 4m. There is a wall positioned between the target and the launcher. The wall is 1m away from the target. The wall contains an open window. The window is 0.5m tall, spanning a height between 0.75m and 1.25m.