

Projectile Motion SAMPLE Lab

Purpose: To determine what launch angle gives the greatest distance when a projectile is launched over a cliff.

Theory: When a projectile is launched over a level plane, the horizontal range is given by

$$\Delta x = \frac{v_1^2}{g} \sin 2\theta$$

where v_1 is the initial speed

and θ is the launch angle

Analysis of the above equation shows that the greatest Δx value is obtained at a launch angle of 45° . To determine if this is still true when the vertical displacement is not zero, different angles will be tried over a cliff edge.

Method:

1. Start the PROJECTL program. Press <PRGM> and select PROJECTL off the menu. Your screen will display "prgmPROJECTL". Press <ENTER>.
2. At the welcome screen that appears, press <ENTER> again.
3. Select "Set cliff" from the main menu and then "Set cliff hght" from the following menu. Enter a value of -100 m for the cliff height. The negative means the net displacement in the Y direction will be downwards.
4. Select "Set cliff dist" from the cliff menu. Enter a value of 0 (zero). This will place the launcher right at the edge of the cliff. Select "Return to main" to return to the main menu.
5. Select "Set init vel" from the main menu. For speed, enter 30 m/s and for angle start by entering 0.
6. Select "Fix Window" from the main window and set the following values:
Xmin = -20
Xmax = 180
Ymin = -120
Ymax = 50
7. Select "Run Simulation" from the main menu. The path is plotted on the screen. When the plot is complete you can use the left and right arrow keys to move the cursor along the curve and read the values. To find the horizontal distance travelled, press <ENTER> and read it off the next screen.
8. Record the angle and horizontal distance values. Analyze these values as instructed by your teacher to determine the angle at which the maximum distance occurs.