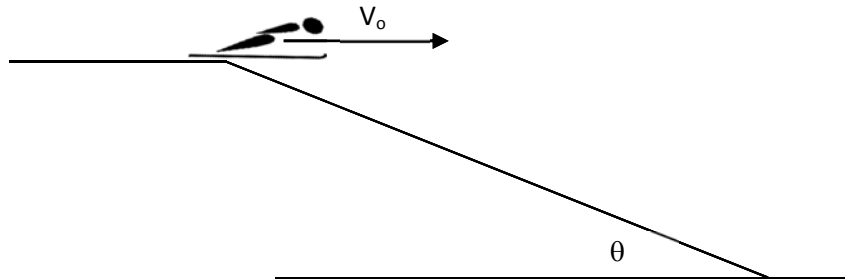


AP Physics - Kinematics Olympics

1. A ski jumper accelerates down a slope, levels off and leaves the ski track moving in the horizontal direction with a speed of 24.0 m/s. The landing incline below her falls off linearly with a slope of 38.0° below the horizontal.
 - A. Predict the distance from where she begins to free fall to where she lands on the incline below.
 - B. Sketch qualitative graphs of her displacement, velocity and acceleration vs. time.



**Problem 2 will be split into two separate motion problems on the unit test.
One for horizontal motion and another for vertical motion.**

2. Consider a cannon ball ($m = 10.0$ kg) launched with an initial velocity 100. m/s @ 0.00° from the top of a cliff, one thousand meters above the ground. An aerodynamic drag force, linearly proportional to the ball's velocity, acts on the ball as it moves towards the ground. Assume the aerodynamic drag coefficient is a constant $b = 78.3$ kg/s
 - A. Derive equations for the ball's horizontal and vertical velocity as functions of time.
 - B. Clearly sketch and label qualitative graphs of both velocity functions.
 - C. Derive equations for the ball's horizontal and vertical position as functions of time.
 - D. Clearly sketch and label qualitative graphs of both position functions.
 - E. Calculate the maximum horizontal displacement of the cannon ball during the fall.

F. Derive a total velocity function and be promoted to the position of a Disney Rock Star!