W02D1_4 Table Problem: Initial and Final Conditions Projectile Motion

A physics instructor has set up a projectile gun a horizontal distance 5 m away from a target that is 1 m above the ground. The instructor fires the projectile with an initial speed 10 m·s⁻¹ at an angle of 15° with respect to the horizontal. At the instant the projectile leaves the gun, it is initially at the same height above the ground as the target. Ignore air resistance. Let \( g = 10 \text{ m·s}^{-2} \).

a) Write down a vector expression for the initial velocity of the projectile. Clearly indicate your choice of coordinate system along with your choice of unit vectors.

b) Write down a vector expression for the position and velocity of the projectile when it has returned to the same height that it was fired out.