107. (First problem in **Cluster 2**)

(a) Since $v_y^2 = v_{0y}^2 - 2g\Delta y$, and $v_y = 0$ at the target, we obtain $v_{0y} = \sqrt{2(9.8)(5.00)} = 9.90$ m/s. Since $v_0 \sin\theta_0 = v_{0y}$, with $v_0 = 12$ m/s, we find $\theta_0 = 55.6°$.

(b) Now, $v_y = v_{0y} - gt$ gives $t = 9.90/9.8 = 1.01$ s. Thus, $\Delta x = (v_0 \cos\theta_0)t = 6.85$ m.

(c) The velocity at the target has only the v_x component, which is equal to $v_{0x} = v_0 \cos\theta_0 = 6.78$ m/s.