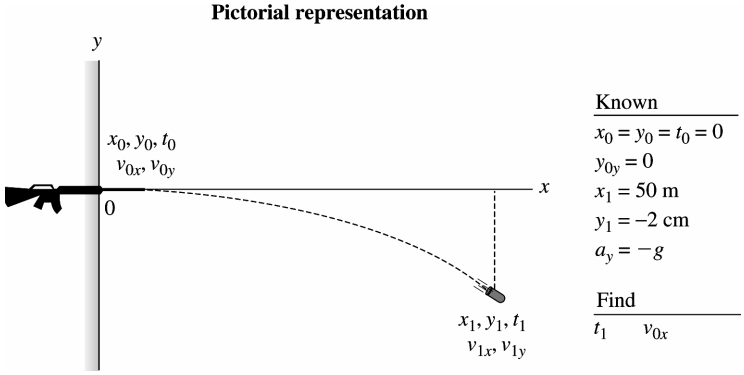
4.12. Model: The bullet is treated as a particle and the effect of air resistance on the motion of the bullet is neglected.

Visualize:

Pictorial representation



Solve: **(a)** Using $y_1 = y_0 + v_{0y}(t_1 - t_0) + \frac{1}{2}a_y(t_1 - t_0)^2$, we obtain

$$(-2.0\times10^{-2}\text{ m}) = 0\text{ m} + 0\text{ m} + \tfrac{1}{2}(-9.8\text{ m/s}^2)(t_1 - 0\text{ s})^2 \Rightarrow t_1 = 0.0639\text{ s}$$

(b) Using $x_1 = x_0 + v_{0x}(t_1 - t_0) + \frac{1}{2}a_x(t_1 - t_0)^2$,

$$(50\text{ m}) = 0\text{ m} + v_{0x}(0.0639\text{ s} - 0\text{ s}) + 0\text{ m} \Rightarrow v_{0x} = 782\text{ m/s}$$

Assess: The bullet falls 2 cm during a horizontal displacement of 50 m. This implies a large initial velocity, and a value of 782 m/s is understandable.