Task. Find the distance covered by the bullet which is shot by a gun with an acceleration of $a = 8\ m/s^2$ and with a velocity of $v_0 = 600\ m/s$ taking the gravity $g = 10\ m/s^2$?

Solution. In fact there is not enough data to solve this problem. We also need the height h at which the bullet was shot and the angle α between the initial velocity and the surface of earth.

Assume that the angle is zero so the bullet is shot parallel to the surface of earth.

There is a gravitation force acting on the bullet, and so its motion can be regarded as a sum of two motions: vertical and horizontal. Horizontal motion has initial velocity $v_0 = 600\ m/s$ and constant acceleration $a = 8\ m/s$, so the distance covered by the bullet at time t is given by the formula

$$d(t) = v_0 t + \frac{at^2}{2}.$$

On the other hand, the vertical motion has zero initial velocity and constant acceleration $g = -10\ m/s^2$. Let h_0 be the initial height of the bullet. Then its height at time t is given by the formula:

$$h(t) = h_0 - \frac{gt^2}{2}.$$

Therefore the bullet will fall to the ground at time t such that

$$h(t) = h_0 - \frac{gt^2}{2} = 0,$$

whence

$$\bar{t} = \sqrt{\frac{2h_0}{g}}.$$

Then the distance covered by the bullet can be obtained by substituting $\bar{t}$ into the formula for d:

$$d(\bar{t}) = v_0 \bar{t} + \frac{a\bar{t}^2}{2},$$

so

$$d(\bar{t}) = v_0 \bar{t} + \frac{a\bar{t}^2}{2} = v_0 \sqrt{\frac{2h_0}{g}} + \frac{a}{2} \cdot \frac{2h_0}{g} = v_0 \sqrt{\frac{2h_0}{g}} + \frac{h_0 a}{g}.$$

Answer. There is not enough data for solving the problem. However is we assume that the bullet is shot parallel to earth surface at height h_0, then it will cover the distance

$$v_0 \sqrt{\frac{2h_0}{g}} + \frac{h_0 a}{g}.$$