Task. Two particles are released from same height at an interval of 1 second. How long after the first particle begins to fall will the two particle be 10m apart? ($g = 10\ m/s^2$)

Solution. Notice that each particle moves zero initial velocity and constant acceleration $g = 10\ m/s^2$. Hence the distance passed by the first particle at time t is given by the formula:

$$h_1(t) = \frac{gt^2}{2}.$$

The second particle is released at $t = 1$ s, so the distance passed by the second particle at time $t \geq 1$ s is given by the formula:

$$h_2(t) = \frac{g(t-1)^2}{2}.$$

We should find t such that

$$h_1(t) - h_2(t) = 10\ m.$$

Thus

$$\frac{gt^2}{2} - \frac{g(t-1)^2}{2} = 10$$

$$\frac{g}{2}\left(t^2 - (t-1)^2\right) = 10$$

$$t^2 - t^2 + 2t - 1 = 10 \cdot \frac{2}{g}$$

$$2t = 10 \cdot \frac{2}{g} + 1$$

$$t = \frac{10}{g} + \frac{1}{2}$$

Substituting $g = 10\, m/s^2$ we obtain that

$$t = \frac{10}{10} + \frac{1}{2} = 1 + 0.5 = 1.5\ s.$$