

Definitions

$$\text{acceleration} = a = 1 \frac{m}{s^2}$$

$$\text{charge time} = t_c$$

$$\text{travel time} = t_x$$

$$\text{speed} = v = at_c$$

$$\text{distance} = x = vt_x$$

$$\text{record distance} = x_r$$

$$\text{time} = t = t_c + t_x$$

Inequality

$$x > x_r$$

$$vt_x > x_r$$

$$at_c t_x > x_r$$

$$at_c(t - t_c) > x_r$$

$$-at_c^2 + att_c > x_r$$

$$t_c^2 - tt_c + \frac{x_r}{a} < 0$$

The roots of the quadratic equation are:

$$t_c = \frac{t \pm \sqrt{t^2 - 4\frac{x_r}{a}}}{2}$$

The solution of the inequality is:

$$t_c \in \left[\frac{t - \sqrt{t^2 - 4\frac{x_r}{a}}}{2}, \frac{t + \sqrt{t^2 - 4\frac{x_r}{a}}}{2} \right]$$