Example

James Bond is speeding through the countryside in his Aston Martin at 37 m/s. An unknown terrorist agent detonates an explosive device on a bridge ahead of Bond. Assuming a reaction time of 0.67 s and an acceleration of 5.0 m/s² produced by the brakes, what minimum distance must exist between Bond and the destroyed bridge?

Given Information

$X_0 = ?$ (How far is Bond from the bridge?)

$X = 0\,m$ (Bridge located at the origin.)

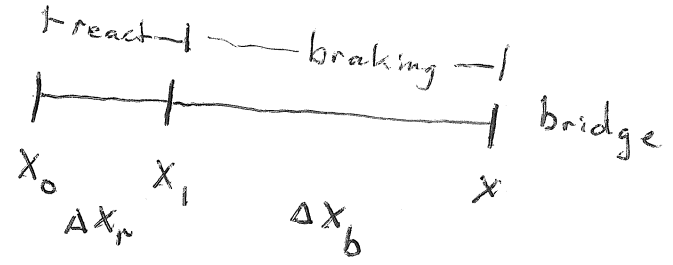
$a = -5.0\,m/s^2$

↑ (Bond must slow down. We assume he is moving in the + direction.)

$V_0 = 37\,m/s$

$V = 0\,m/s$

$t_{\text{constant velocity}} = 0.67\,s$



$\Delta X_{Total} = \Delta X_r + \Delta X_b$

$=$

Equations

$\Delta x = v \Delta t$ constant velocity

Accelerated motion

$\Delta x = v_0 \Delta t + \frac{1}{2} a \Delta t^2$

$v^2 = v_0^2 + 2a \Delta x$

$\Delta x = \frac{v^2 - v_0^2}{2a}$

$= v_0 \Delta t + \frac{v^2 - v_0^2}{2a}$

$= 37 m/s (0.67 s) + \frac{0 m/s^2 - (37 m/s)^2}{2(-5.0 m/s^2)}$

$\Delta X_{Total} = 161.69 m$

160 m