

MEEG 2013 [Quiz #1.m02.072](#)

A particle in rectilinear motion is given an acceleration $a = 24t - 72$, where a is measured in in./s^2 and t is in seconds. If $x_0 = 75$ in. and $v_0 = 0$, determine (a) the time t_1 when the velocity is again zero, (b) the total distance traveled x_T during $0 \leq t \leq 10$ s.

$$a = \frac{dv}{dt} = 24t - 72 \qquad \int_0^v dv = \int_0^t (24t - 72) dt$$

$$v = 12t^2 - 72t = 12t(t - 6) = 0$$

$$t = 0 \text{ or } 6 \qquad \therefore t_1 = 6 \text{ s} \quad \textcircled{5}$$

$$v = \frac{dx}{dt} = 12t^2 - 72t \qquad \int_{75}^x dx = \int_0^t (12t^2 - 72t) dt$$

$$x = 4t^3 - 36t^2 + 75$$

$$x_0 = 75$$

$$x_6 = 4(6)^3 - 36(6)^2 + 75 = -357$$

$$x_{10} = 4(10)^3 - 36(10)^2 + 75 = 475$$

$$x_T = |x_6 - x_0| + |x_{10} - x_6| = |-357 - 75| + |475 - (-357)| = 1264$$

$$x_T = 1264 \text{ in.} \quad \textcircled{5}$$