Kinematic Equations

PH 111

$\vec{v} = \vec{v}_0 + \vec{a}t$

$\vec{x} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$ Assumed solution of $\vec{v}_{avg} = \frac{\vec{v} + \vec{v}_0}{2}$

$\vec{v}^2 = \vec{v}_0^2 + 2\vec{a}\vec{x}$ the form $x = vt$

Only work when acceleration is constant

2B - A car traveling at 20 m/s accelerates at a uniform rate of 4 m/s^2 over a distance of 50 m. How much time is required to cover the distance?

$\vec{x} = {}^{+}50\text{ m}$ (assume motion $\rightarrow +$)

$\vec{a} = {}^{+}4\text{ m/s}^2$ Looking for t

$\vec{v}_0 = {}^{+}20\text{ m/s}$

$50 = 20t + \frac{1}{2}(4)t^2 \Rightarrow t^2 + 10t - 25 = 0$

$t = \cancel{-12.1}\ \boxed{2.1\text{ s}}$

Free fall objects

Acting under gravity only

$\vec{g} = -9.8\text{ m/s}^2$ (downward)

$\vec{v}_y = \vec{v}_{0y} + \vec{g}t$

$\vec{y} = \vec{v}_{0y}t + \frac{1}{2}\vec{g}t^2$

$\vec{v}_y^2 = \vec{v}_{0y}^2 + 2\vec{g}y$