

Potentially useful information:

$$\begin{aligned}v_{av} &= \frac{\Delta x}{\Delta t} \\v &= \frac{dx}{dt} \\a_{av} &= \frac{\Delta v}{\Delta t} \\a &= \frac{dv}{dt} = \frac{d^2x}{dt^2}\end{aligned}$$

$$\begin{aligned}\Delta x &= \int_{t_1}^{t_2} v \, dt \\ \Delta v &= \int_{t_1}^{t_2} a \, dt\end{aligned}$$

Constant Acceleration

$$\begin{aligned}v &= v_0 + a(t - t_0) \\x &= x_0 + v_0(t - t_0) + \frac{1}{2}a(t - t_0)^2 \\v_{av} &= \frac{1}{2}(v_0 + v) \\v^2 &= v_0^2 + 2a(x - x_0)\end{aligned}$$

$$\begin{aligned}\vec{v} &= \frac{d\vec{r}}{dt} \\\vec{a} &= \frac{d\vec{v}}{dt}\end{aligned}$$

Projectile Motion

$$\begin{aligned}R &= \frac{v_0^2}{g} \sin 2\theta_0 \quad \text{impact at same height as launch} \\y &= x \tan \theta_0 - \frac{g}{2v_0^2 \cos^2 \theta_0} x^2\end{aligned}$$

Circular Motion

$$\begin{aligned}a_c &= \frac{v^2}{r} \\a_t &= \frac{dv}{dt} \\T &= \frac{2\pi r}{v}\end{aligned}$$

Data

$$\begin{aligned}g &= 9.81 \, \text{m/s}^2 \\v_S &= 343 \, \text{m/s} \quad \text{speed of sound} \\c &= 2.998 \times 10^8 \, \text{m/s} \quad \text{speed of light} \\1 \, \text{mi} &= 1.609 \, \text{km}\end{aligned}$$