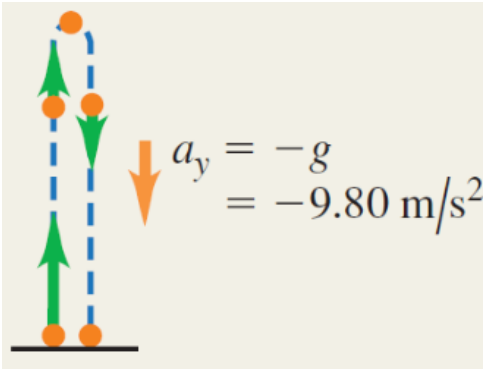
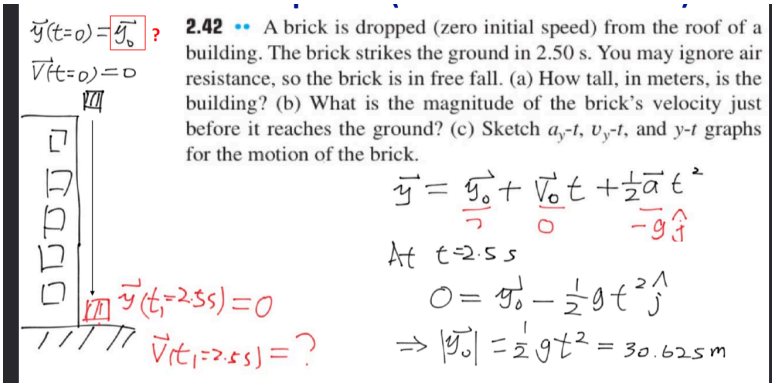
2. Kinematics

Problem Set 1 Solutions



VECTORS AND DIRECTIONS

- Final displacement will be the bottom as it is FALLING. Or, the height is taken as the INITIAL displacement.
- The g is negative according to the direction of the dimension $y = \hat{j}$.



Displacement

$$\Delta x = x_2 - x_1$$

Average Velocity

$$v_{av-x} = \frac{\Delta x}{\Delta t}$$

Instantaneous Velocity

- Instantaneous Velocity is defined as the limit of the average velocity as the time interval Δtbecomes infinitesimally small:

$$\vec{v}_x = \lim_{\Delta t \to 0} \frac{\Delta \vec{x}}{\Delta t} = \frac{d\vec{x}}{dt}$$

- The instantaneous speed of an object, which is a scalar quantity, is defined as the absolute magnitude of the instantaneous velocity.
- Whenever you are integrating always pay attention to the **initial displacement** (it comes as the constant $+c$).

$$x = x_0 + \int_{t_1}^{t_2} v_x \, dt$$

Average Acceleration

$$a_{av-x} = \frac{v_{2x} - v_{1x}}{t_2 - t_1 1} = \frac{\Delta v}{\Delta t}$$

Instantaneous Acceleration

$$a_x = \lim_{\Delta t \to 0} \frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt}$$

Always pay attention to the initial velocity (it comes as the constant v_0)

$$v_x = v_0 + \int_{t_1}^{t_2} a_x \, dt$$

Equations of Motion with constant acceleration

$$v_x = v_{0x} + a_x t$$

$$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$$

$$v_x^2 = v_{0x}^2 + 2(x - x_0)$$

$$x - x_0 = \left(\frac{v_{0x} + v_x}{2} \right) t$$