ANSWERS TO HOMEWORK SET #1

Q.2.6

Average velocity = $v_{ave} = \frac{\Delta x}{\Delta t}$ ← displacement.

Average speed = $\frac{\text{total distance travelled}}{\Delta t}$

∴ v_{ave} = average speed, only when displacement = distance travelled.
ie: Object have to move in the same direction during the time Δt.
Or velocity does not change sign!

P2.8 $x(t) = \alpha t^2 - \beta t^3$, $\alpha = 1.5\, m/s^2$, $\beta = 0.0500\, m/s^2$

Need to find v_{ave}, since $\vec{a}$ is not constant, we need to find displacement.

t sec	x(t) m
0	0
2	6 − 0.4 = 5.6 m
4	24 − 3.2 = 20.8 m

∴ $v_{ave}(0 \to 2) = \frac{\Delta x(0,2)}{\Delta t} = \frac{x(2) - x(0)}{2} = \frac{5.6}{2} = \underline{\underline{2.8\, m/s}}$

$v_{ave}(0,4) = \frac{20.8 - 0}{4} = \underline{\underline{5.2\, m/s}}$

$v_{ave}(2 \to 4) = \frac{20.8 - 5.6}{2} = \underline{\underline{7.6\, m/s}}$

P 2.21

Motion →

Point 1 v_1 — Point 2 $v_2 = 15$ m/s

$\Delta x = 70$ m

$t = 7$ s

Need to find v_1, v ✓, Δx ✓, a, t ✓

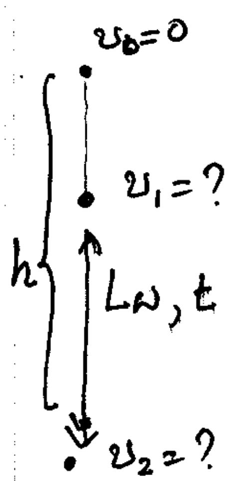
$\vec{\Delta x} = \left(\frac{v + v_1}{2}\right) t \Rightarrow$

$70 = \left(\frac{15 + v_1}{2}\right) 7 \Rightarrow$ $\underline{\underline{v_1 = 5 \text{ m/s}}}$

$\vec{v} = v_1 + at \Rightarrow 15 = 5 + a \times 7$

$\therefore a = \underline{\underline{\frac{10}{7} \text{ m/s}^2}}$

Flower pot problem in MP



Since L_w and t are given, it hints to use an equation with time.

Assume time to reach window bottom is t_2

V, V_0 ✓, a ✓, (t), (y) i.e. $y = v_0 t + \frac{1}{2} a t^2$

↓ 0 to point ① $h - L_w = 0(t_2 - t) + \frac{1}{2} g (t_2 - t)^2$

$h - L_w = \frac{g}{2}(t_2^2 - 2t_2 t + t^2)$ --- ①

↓ 0 to point ② $h = \frac{g}{2} t_2^2$ --- ②

②-① ⟹ ~~$L_w =$~~ ② ⟹ $t_2 = \sqrt{2h/g}$ in ①

$\frac{2}{g}(h - L_w) = \frac{2h}{g} - 2\sqrt{\frac{2h}{g}} \cdot t + t^2$

$\therefore \sqrt{\frac{2h}{g}}\, t = \frac{1}{2}\left[\frac{2L_w}{g} + t^2\right]$

$\therefore h = \frac{g}{2}\left[\frac{L_w}{gt} + t/2\right]^2 = \underline{\underline{\frac{1}{2g}\left[\frac{L_w}{t} + \frac{gt}{2}\right]^2}}$