9/11/19
Sols

71 (a)

$x(4) = 12 - 24 + 3.2(16)$

$x(8) = 12 - 48 + 3.2(64)$

$\Delta x = x(8) - x(4) = -24 + 3.2(64) - 3.2(16)$

$= 204.8 - 24 - 51.2 = 129.6$

$\rightarrow \boxed{\Delta X = 130\text{ m}}$

(b) $v(t) = \frac{dx}{dt} = \frac{d}{dt}\left[12 - 6t + 3.2t^2\right]$

$= -6 + 6.4t$

$v(3) = -6 + 6.4(3) = 13.2 \text{ m/s}$

(c) $v(t_0) = -6 + 6.4(t_0) = 0 \rightarrow 6.4t_0 = 6$

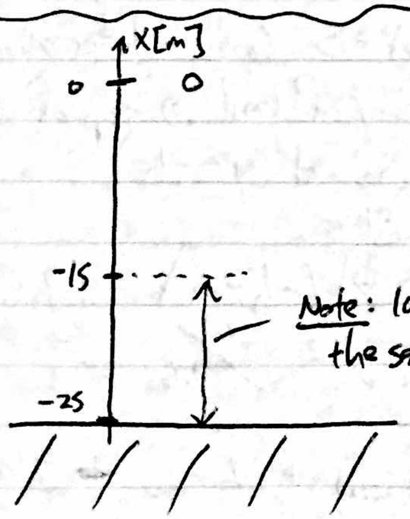
$t_0 = \frac{6}{6.4} = 0.94\text{ s}$

$\rightarrow \boxed{t_0 = 0.94\text{ s}}$

NOTE: How to best handle sig figs.?

(d) $a(t) = \frac{dv}{dt} = \frac{d}{dt}\left[-6 + 6.4t\right] = \boxed{6.4 \ \frac{m}{s^2}}$

73



Note: 10 m above the ground is the same as having fallen Y = -15 m

(a) $V_0 = 0, \quad a = -9.8 \text{ m/s}^2$

$V^2 = 0 + 2(-9.8)(-15 + 0)$

$= 294$

$\rightarrow \boxed{V = -17.1 \ \frac{m}{s}}$

(b) $-25 = 0 + 0 + \frac{1}{2}(-9.8)t^2$

$5.1 = t^2$

$\rightarrow \boxed{t = 2.3\text{ s}}$

Note: Be careful/consistent w/ your sign conventions!

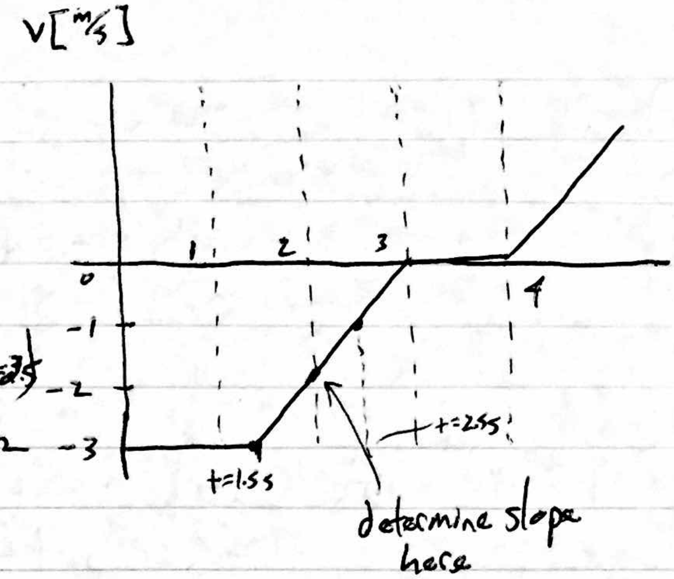
92 Estimating slopes at diff. time points

- slope = rise/run

slope @ $t=2$ (i.e. rise vs run from t=1.5s to t=2.5s)

$$= \frac{-1-(-3)\ m/s}{2.5-1.5\ s} = \frac{2}{1} = 2\ m/s^2$$

$\longrightarrow$ $\boxed{a(2) = 2\ m/s^2}$

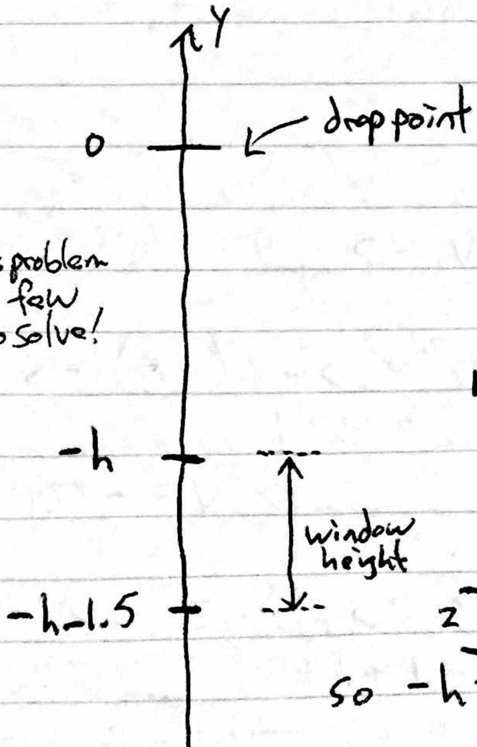


- similarly for the other time points: (though you would need to explicitly show on HW or test!)

$\boxed{a(4.5) = 3\ m/s^2, \quad a(6) = 0\ m/s^2, \quad a(8) = -1.8\ m/s^2}$

<u>Note</u>: Estimating slope at t=8s is a bit trickier since you have to estimate v(9) (i.e. it is a bit ambiguous)

93



NOTE: This problem requires a few "steps" to solve!

- Given t_w (time to cross window, ie. cover distance $y=-h$ to $y=-h-1.5$) and $v(t=0)=0$. Goal: determine h
- Let V_T be velocity of ball @ top of window (i.e. when ball is at $y=-h$)

1] since ball initially at rest:

$$V_T^2 = 0 + 2(-9.8)(-h-0) = 19.6h$$

$$\Rightarrow h = V_T^2/19.6\ [m]$$

2] $Y_{\text{bottom of wind.}} = Y_{\text{top of wind}} + V_T t_w + \frac{1}{2} g t_w^2$

so $-h-1.5 = -h + V_T(0.18) - 4.9 t_w^2$

$$\Rightarrow V_T = \frac{4.9t_w^2 - 1.5}{0.18} = -7.45\ m/s$$

3] $h = \frac{(-7.45)^2}{19.6} = 2.8$

$\boxed{\Rightarrow \text{ball dropped 2.8 m above window}}$