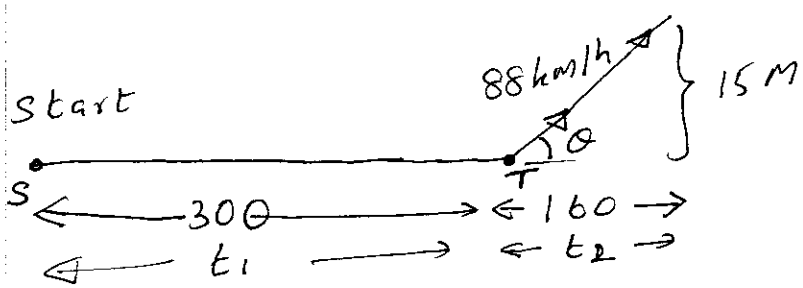
Solutions 2 HW set #2 9-18-2006

Q: 3.10 It may or may not be zero. If the projectile have horizontal motion, velocity at the highest point is the horizontal velocity component. At the highest point only the vertical component of velocity is zero.

Q 3.11

Average velocity = 0 because, there is 0 displacement.
Average acceleration = 0, because there is no velocity change in one revolution.

P 3.47



a) S to T motion $\rightarrow v^2 = v_0^2 + 2ax$

$$\left(88 \times \frac{1000}{3600}\right)^2 \frac{m^2}{s^2} = 2a \cdot 300$$

$$\therefore a = 0.996\ m/s^2 \simeq 1\ m/s^2$$

b) $\tan\theta = \frac{15}{160}$ $\quad \therefore \theta = \tan^{-1}\frac{15}{160} = 5.35^\circ = 5.4^\circ$

c) Rate of climb = Vertical velocity $= 88 \frac{km}{h} \sin\theta = 2.28\ m/s$

d) $x = \left(\frac{v+v_0}{2}\right) t_1 \Rightarrow 300 = \frac{88}{2} \times \frac{1000}{3600} \cdot t_1$ $\quad \therefore t_1 = 24.54\,s$

$$\rightarrow 160 = 88 \times \frac{1000}{3600} \cos\theta \times t_2$$

$$\therefore t_2 = 6.57\,s$$

$$\therefore \text{total time} = t_1 + t_2 = \underline{31.11\,s}$$

Prob 3.59

$$\rightarrow x = V_0 \cos\alpha_0\, t \quad \cdots \quad (1)$$

$$\downarrow v^2 = V_0^2 + 2gh \Rightarrow V_y^2 = (-V_0 \sin\alpha_0)^2 + 2gh = V_0^2 \sin^2\alpha_0 + 2gh$$

$$\therefore v_y = \sqrt{V_0^2 \sin^2\alpha_0 + 2gh} \quad \cdots \quad (2)$$

$$\downarrow V = V_0 + at \Rightarrow V_y = -V_0 \sin\alpha_0 + gt$$

$$\therefore t = (V_y + V_0 \sin\alpha_0)/g \quad \cdots \quad (3)$$

(3) in (1) $\Rightarrow$

$$x = \frac{V_0 \cos\alpha_0}{g}\left(V_y + V_0 \sin\alpha_0\right) = \frac{V_0 \cos\alpha_0}{g}\left(V_0 \sin\alpha_0 + V_y\right)$$

$$= \frac{V_0 \cos\alpha_0}{g}\left(V_0 \sin\alpha_0 + \sqrt{V_0^2 \sin^2\alpha_0 + 2gh}\right)$$