Physics CS 31 **Fall 2010**

Set #3 - for Wd Oct. 13

Read HR&K	Ch. 2, Ch. 4 - Sects. 4.1, 4.3, 4.4
Read K&K	Ch. 1 - Sects. 1.6, 1.7, 1.8 and Note 1.1 (p. 39-47)
Read Feynman Vol. 1	Ch. 3 & Ch. 8 (motion)

From HR&K:

Ch. 2 Exercise 37, Problems 11, 18, 26.

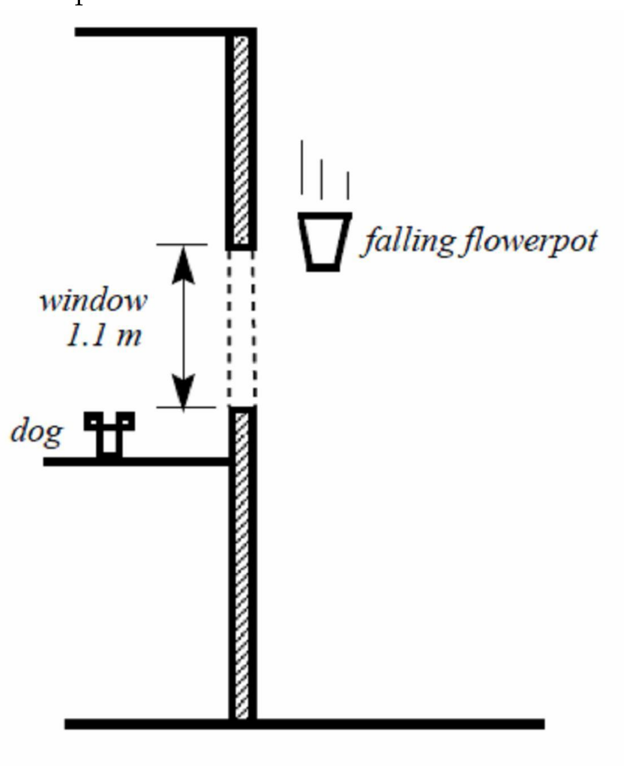
Ch. 4 Exercise 3 (And, part (d) Find the magnitude of the average velocity and the average speed between $t = -1.0$ s and $t = 1.0$ s. Explain why they are not the same.)

From K&K:

Ch. 1 Problems 1.12, 1.13, 1.16.

1. An unmarked police car traveling a constant 80 Km/h is passed by a speeder traveling 100 Km/h. Precisely 1.00 s after the speeder passes, the policeman steps on the accelerator; if the police car's acceleration is 3.00 m/s^2, how much time passes before the police car overtakes the speeder (assumed moving at constant speed)?

2. A dog sees a flower pot sail up and then back down past a window 1.1 m high. If the total time the pot is in sight is 0.74 s, find the height above the top of the window to which the pot rises.



3. The acceleration of a particle is given by $a = kt^{3/2}$, where k is a constant. Find the position $x(t)$ if $x = 0, v = 2$ m/s at $t = 0$. Note: t is measured in seconds and a in m/s^2. What are the units of k?

4. A boat travels at constant velocity $\vec{v}_{\mathrm{o}}$ when the motor is on. At $t = 0$ the motor is turned off and the acceleration of the boat due to the resistive force of the water is $\vec{a} = -kv^{-1/2}\vec{v}$ (with $k > 0$ a constant).

a) Find $\vec{a}(t), \vec{v}(t)$ and $\vec{r}(t)$.

b) Find the time and the distance to stop.

5. Using the identity $\varepsilon_{ijk}\varepsilon_{klm} = \delta_{il}\delta_{jm} - \delta_{jl}\delta_{im}$, show that the identities (a) and (b) follow.

(a) $\varepsilon_{ijk}\varepsilon_{ljk} = 2\delta_{il}$

(b) $\varepsilon_{ijk}\varepsilon_{ijk} = 6$

(c) Evaluate: $\delta_{ij}\varepsilon_{ijk}$

(d) Express in subscript notation: $\hat{a} \cdot \hat{r}$

(*sum over repeated indices is implied*).