Set #3 - for Wednesday October 16

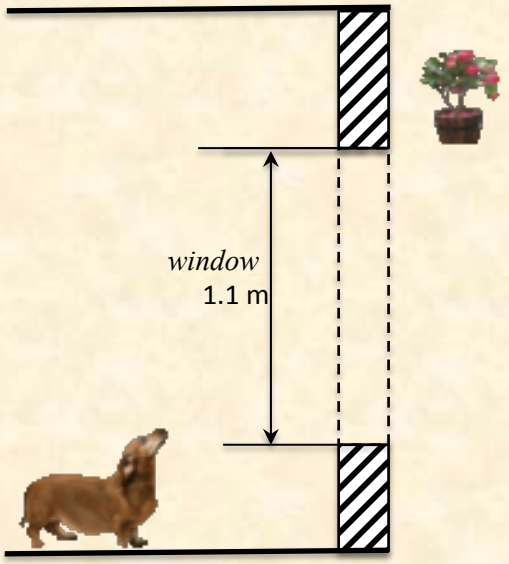
Read RHK Ch.2, Ch 4 (4.1, 4.3, 4.4)
K&K Ch.1 (1.6, 1.7, 1.8)
Feynman V.1 Ch. 3 & Ch. 8

Solve

From RHK	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

Problem 1. An unmarked police car traveling a constant $80.0\ \mathrm{km/h}$ is passed by a speeder traveling 100 km/h. Precisely $t_1 = 1.00\ \mathrm{s}$ after the speeder passes, the policeman steps on the accelerator; if the police car's acceleration is $3.00\ \mathrm{m/s^2}$. At what time t_2 the police car overtakes the speeder (assumed moving at constant speed)?

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



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Problem 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 $\mathrm{m/s^2}$. What are the units of k?

Problem 4. A boat travels at constant velocity $\vec{v}_0$ 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.

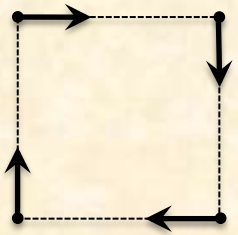
Problem 5. Using identity $\varepsilon_{ijk}\varepsilon_{klm} = \delta_{il}\delta_{jm} - \delta_{jl}\delta_{im}$, show that the identities (a) and (b) follow.

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

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

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

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



Extra Credit. Four point size turtles are initially located in the vertices of a square with the side length d (see the picture above). Each turtle moves clockwise at a constant speed v. Each turtle is continuously adjusting direction of motion so that the velocity has direction towards next turtle. Will the turtles meet? If you answered "No", then explain "why?". If you answered "Yes", then explain "when?" and "where?"

Good Luck, Dr. B