Chapter 2 - Motion Along a Straight Line

Physics 206

Group 1 Problems:

Problem 1

Part a: $t = 46.4$ and 8.63 s

Part b: $t = 10 \pm \sqrt{-60}$ so they are never at the same point

Part c: $t = 5.66$ s

Problem 2

a) If the car was traveling the speed limit he would travel 1 km in the 60 seconds. If he actually makes it there in 60 seconds, the average velocity would be 60 km/hr. If he was going less than 60 at the start and the finish then he had to be going more than 60 somewhere in the middle.

b) He would need to travel 65.45 s.

c) No. They could start below 55, ramp up to above 60 and then back down.

Problem 3

$$t = -1.00 \text{ s}$$
$$v_y = 19.8 \text{ m/s}$$
$$\Delta t = 4.05 \text{ s}$$

Problem 4

$$\text{Part a) } v(t) = 100t - \frac{1}{3}t^3$$
$$x(t) = 50t^2 - \frac{1}{12}t^4$$
$$\text{Part b) } x(0.050) = 0.125 \text{ m so the frog missed the fly}$$

Problem 5

$$\text{Part a) } v(t) = 2t + 3t^2 - 12$$
$$x(t) = t^2 + t^3 - 12t + 4$$
$$\text{Part b) } v_{ave} = 18 \text{ m/s}$$
$$\text{Part c) } a_{ave} = 17$$

Group 2 Problems:

Problem 6 Geoff wins.

Problem 7

$$y_0 = \left(\frac{2}{\sqrt{2}-1}\right)^2 g$$
$$t_1 = \frac{2}{\sqrt{2}-1}$$
$$v_{1/2} = -\frac{2}{\sqrt{2}-1} g$$
$$v = -\left(\frac{2}{\sqrt{2}-1} + 2\right) g$$

Problem 8

$$\text{Part a) } v(t) = t + 1$$
$$a(t) = 1$$
$$\text{Part b) } v = 0 \text{ at } t = 0, \frac{1}{4} \text{ and } 2$$

c) Parabolic
d) To find the displacement you just need the two times and the integral will give you the displacement. To find the position at a time you need to know the position at some other time so that you can integrate and find a position function.

Problem 9

$$\text{Part a) } t = \frac{21+\sqrt{777}}{4}\text{ s} \approx 12.2\text{ s} \approx 0.00339\text{ hr}$$
$$\text{Part b) } \Delta x = 0.415\text{ miles}$$
$$\text{Part c) } v = 244\text{ mi/hr}$$

Problem 10 242 meters.

Group 3 Problems:

Problem 11

$$\text{Part a) } t_A = \sqrt{\frac{2H}{g}}$$
$$t_B = \sqrt{\frac{2H}{g}}\left(\frac{1}{2}+\sqrt{\frac{3}{4}}\right)$$
$$t_C = \sqrt{\frac{2H}{g}}\sqrt{2}$$
$$\text{Part b) } H_B = \frac{4}{2+\sqrt{3}}H_C$$
$$H_A = 2H_C$$

Problem 12 $\Delta x = 890$ m and 1380 m with the delay.

Problem 13 Dave gets hit by the egg.

Problem 14:

a) $t = \dfrac{v_s - \sqrt{v_s^2 - 2a_0 d}}{a_0}$

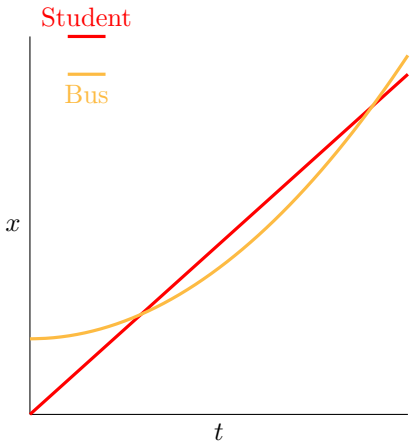
$\Delta x = \dfrac{v_s^2 - v_s\sqrt{v_s^2 - 2a_0 d}}{a_0}$

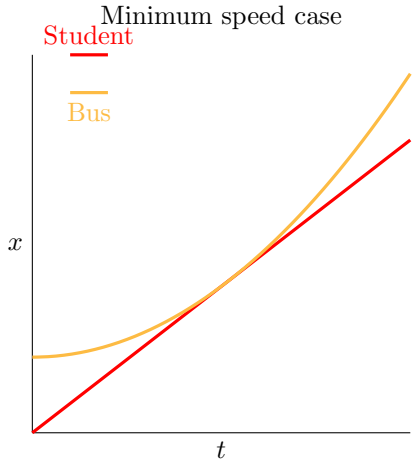
b) $v_b = v_s^2 - v_s\sqrt{v_s^2 - 2a_0 d}$

e) $v_s = \sqrt{2a_0 d}$

$t = \dfrac{v_s}{a_0}$

$x = \dfrac{v_s^2}{a_0}$





Problem 15a: $\Delta y = 276$ m
Problem 15b: $\Delta y = 228$ m