Problem 2.1: A car is traveling at 6.70 m/s (15 miles/h) when the driver applies the brakes. The car "decelerates" at a constant rate of 4.00 m/s^2 until coming to a halt. Calculate the

a) distance of the car travels while decelerating

b) distance required to stop if the car is initially traveling at 13.4 m/s (30.0 miles/h).

c) time taken to come to rest (for the v_i= 6.70 m/s case)

2.1

a) Δx $\quad v_f^2 - v_i^2 = 2a\Delta x$

$$\Delta x = \frac{v_f^2 - v_i^2}{2a} = \frac{0^2 - (6.7)^2}{2(-4)} = 5.61\ m$$

b)

$13.4 = 2(6.7)$

$$\Delta x' = \frac{v_f^2 - v_i^2}{2a}_{same} = \frac{0 - [2(v_i)]^2}{2a} = -\frac{4v_i^2}{2a}_{a=-4}$$

$\Rightarrow$ 4 times Same $= 4\Delta x$

(c)

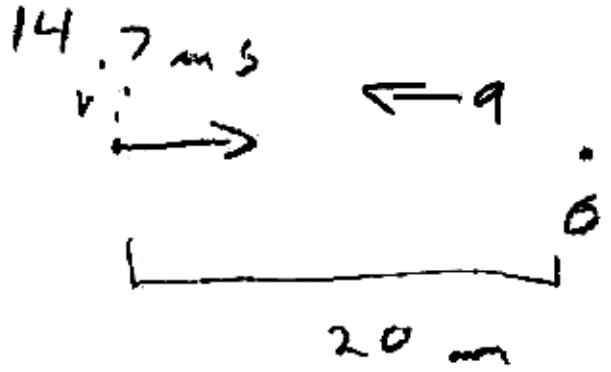
$\Delta x = \bar{v}\,\Delta t$

$\bar{v} = \frac{(6.7 + 0)}{2}$ ← rest

$5.61 = \frac{(6.7 + 0)}{2}\Delta t$

$$\Delta t = \frac{2(5.61)}{6.7} = 1.67\ s$$

Problem 2.2: A car is traveling at 14.7 m/s decelerates to a stop in a distance of 20.0 m. How much time does it take to do so?



2.2

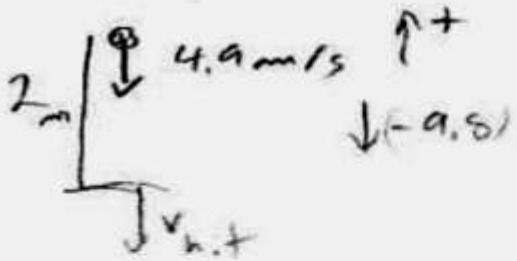
$$\Delta x = \bar{v}\,\Delta t = \left(\frac{14.7+0}{2}\right)\Delta t = 20$$

$$\Delta t = \frac{20}{14.7/2} = 2.72$$

Problem 2.3 : A stone is thrown vertically <u>downward</u> with an initial speed of 4.90 m/s from a height of 2 m. Find:

a) the velocity of the stone just before it strikes the ground

b) the time that the stone is in the air.



$$v_f^2 - v_i^2 = 2a(\Delta y)$$

$$v_f^2 - (-4.9)^2 = 2(-9.8)(-2)$$

$$v_f^2 = (4.9^2) + 2(9.8)(2)$$

$$v_f^2 = 24.01 + 39.2$$

$$v_f^2 = 63.3$$

2.3

$$v_f = \pm 7.96$$

$$y = y_0 + v_{0,y}t + \frac{1}{2}at^2$$

$$y = (2) - 4.9t - \frac{1}{2}gt^2 = 0$$

Solve for t

$$\Delta y = \bar{v}\,\Delta t$$

$$(-2) = \frac{(v_f + v_i)}{2}\Delta t$$

$$= \frac{(-7.96 - 4.9)}{2}\Delta t$$

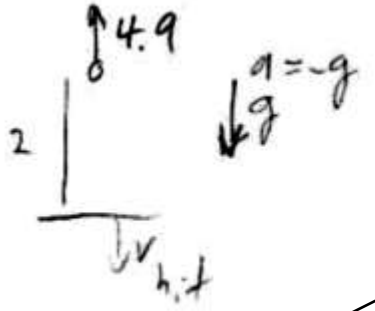
$$\Delta t = \frac{4}{7.96 + 4.9}$$

$$\Delta t = .31\ s$$

Problem 2.4: A stone is thrown vertically <u>upward</u> with an initial speed of 4.90 m/s from a height of 2 m. Find

a) the velocity of the stone just before it strikes the ground

b) the time of flight



$v_f^2 - v_i^2 = 2a(\Delta y)$

-4.9 again $\qquad -2$ again

$v_f \Rightarrow$ as before !!

a) v_f same as 2.3

2.4

b) $y = 2 + 4.9t - \frac{1}{2}gt^2 = 0$

solve

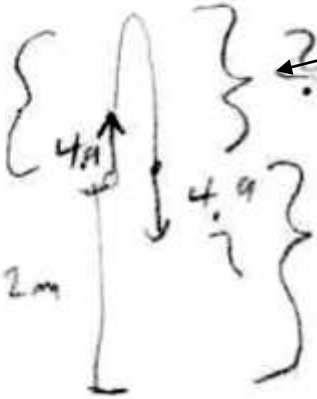
Last week

$v = v_i + at$

$-4.9 = (4.9)(-g)\,t$

$-2(4.9) = -9.8\,t$

$t = \frac{-9.8}{-9.8} = 1\text{s}$



1 s up and down

$\Delta t = .31$ s from before

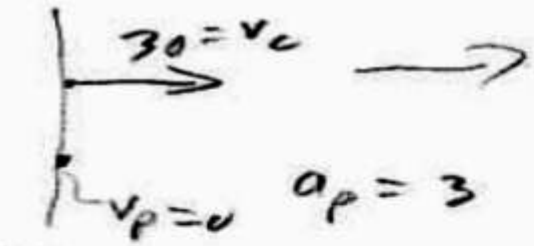
1 s +.31 s = 1.31 s total

Problem 2.5 : A car traveling at a constant speed of 30 m/s passes a police car which is at rest. The police officer accelerates at a constant rate of 3.0 m/s^2 until he pulls next to the speeding car. Assume that the police car starts to move at the moment the speeder passes his car. Determine

a) the time required for the police officer to catch the speeder

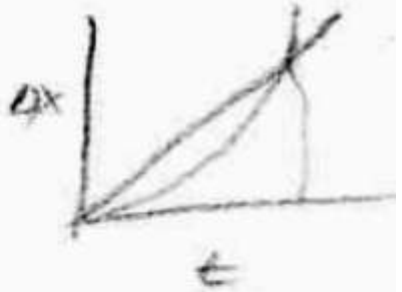
b) the distance traveled during the chase

c) the average speed for both cars.



$\Delta x = (30)t$

$\Delta x = \frac{1}{2}(3)t^2$



$30t = \frac{1}{2}(3)t^2$

$t = \frac{2(30)}{3} = 20\ s$

2.5

a)

2.5

b) $\Delta x = 30\ (20) = 600\ m$ (Δt)

c) $\bar{v} = \frac{\Delta x}{\Delta t} = \frac{\text{same}}{\text{same}} = \text{same} = 30\ m/s$