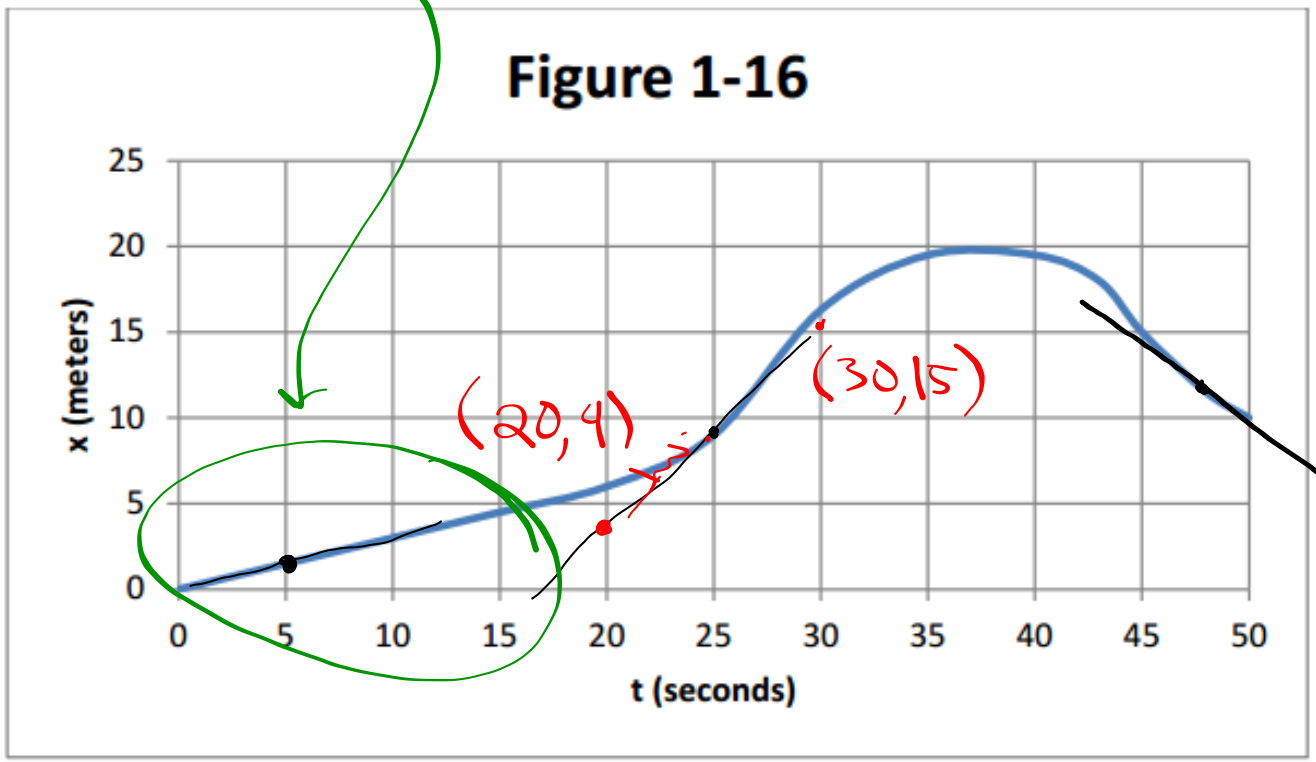
The position of a rabbit along a straight tunnel as a function of time is plotted in Figure 1-16.

1. What is its instantaneous velocity at time t=25 s? $\approx 1.1 \frac{m}{s}$
2. What is its position at time t=42 s? 18–19 m or so
3. Identify a section of the graph where acceleration is 0.

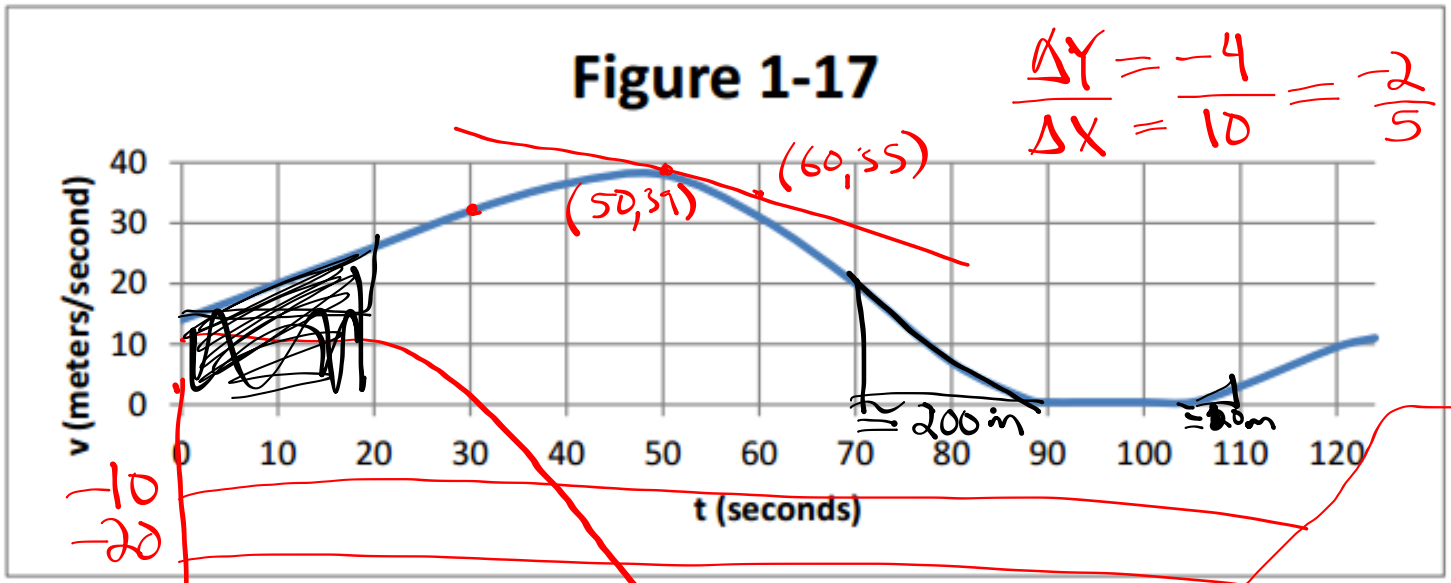


$slope = \frac{y_2 - y_1}{x_2 - x_1}$

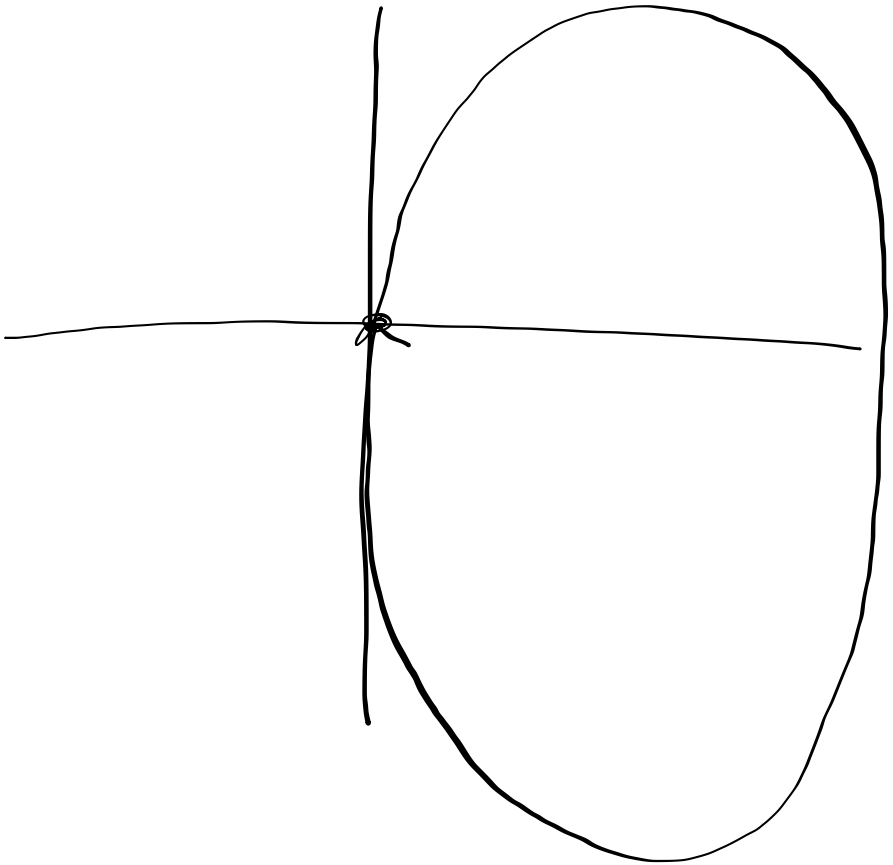
$\frac{11}{10} \approx 1.1$

Figure 1-17 shows the velocity of a train as a function of time.

4. What is its instantaneous velocity at time t=30 s? 32 m/s
5. What is its instantaneous acceleration at time t=50 s? ≈ −0.4 m/s²
6. What is the train's displacement between 70-110 s? ≈ 200m
7. What is the train's position at time t=20 s? Explain your answer.



$\frac{\Delta Y}{\Delta X} = \frac{-4}{10} = \frac{-2}{5} = -.4$



A man walks 340.0 ft at 2.80 ft/sec, and travels another 340.0 ft at 3.80 ft/sec.

a.) How long does it take him to cover the 680.0 ft? [211 sec]

b.) What, then, is his average speed for the trip? [3.22 ft/sec]

c.) Why isn't his average speed 3.30 ft/sec? Explain.

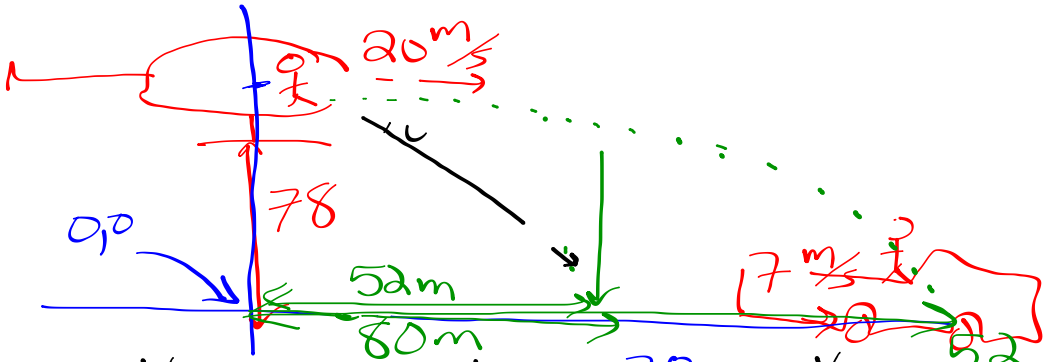
$$s = \frac{d}{t}$$

340 @ 2.8 ft/s 121.4 s

340 @ 3.8 ft/s 89.5 s

$$s = \frac{680}{210.9} \simeq 3.22 \text{ ft/s}$$

Police agents flying a constant 20 m/s horizontally in a helicopter wish to drop a care package into a detective's convertible traveling 7 m/s on a highway 78 meters below the helicopter. At what angle (with the horizontal) should the car be relative to the helicopter when the care package is dropped? *This is a relatively difficult problem



$X_{0P} = 0$
$X_P = 80m$
$v_{0xP} = 20 \frac{m}{s}$
$v_{xP} = 20 \frac{m}{s}$
$a_{xP} = 0$
$t = 4$

$y_{0i} = 78$
$y_f = 0$
$v_{0yP} = 0$
$v_{yP} =$
$a_{yP} = -9.8$
$t = 4$

$X_{0c} = 52$
$X_c = 80$
$v_{0c} = 7$
$v_c = 7$
$a_c = 0$
$t = 4$

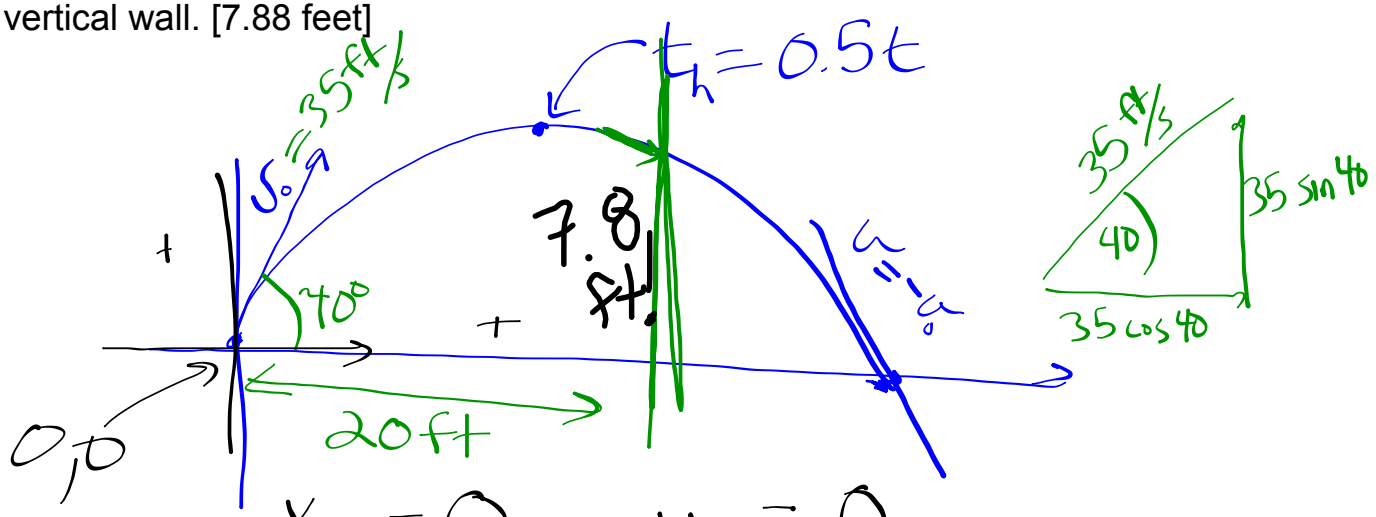
$X = X_0 + v_0 t + \frac{1}{2} a t^2$

$0 = 78 + -4.9t^2$

$-78 = -4.9t^2$

$t \simeq 4s$

Freddy Frog makes a super leap at 35.0 ft/sec at an angle of 40.0 degrees to the horizontal. How high up a wall, 20.0 feet away, will Freddy land? He sticks to the vertical wall. [7.88 feet]



$x_0 = 0$ $\quad y_0 = 0$

$x = 20$ $\quad y = 7.8$

$v_{0x} = 26.8$ ft/s $\quad v_{0y} = 22.5$ ft/s

$v_x = 26.8$ ft/s $\quad v_y =$

$a_x = 0$ $\quad a_y = -32.2$ ft/s^2

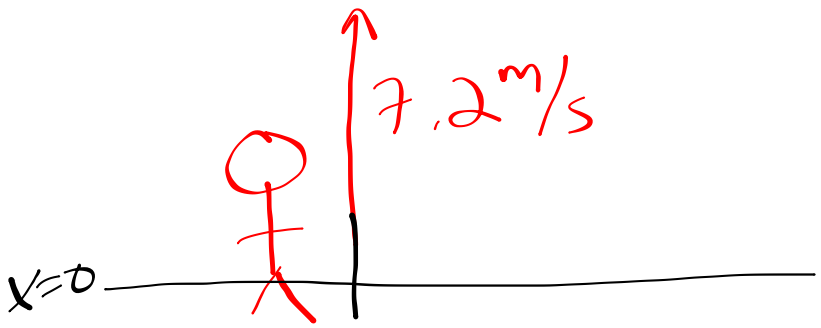
$t = .75$ s $\quad t = .75$ s

$$t = \frac{20}{26.8} = 0.75\text{s}$$

$$y = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$y = (22.5)(.75) + (-16.1)(.75^2)$$

Noel Ivator jumps straight up at 7.20 m/sec. How long will he remain in the air?
[1.47 sec]



$x_0 = 0$
$x = 0$
$v_0 = 7.2 \frac{m}{s}$
$v =$
$a = -9.8 \frac{m}{s^2}$
$t =$

$x = x_0 + v_0 t + \frac{1}{2} a t^2$

$0 = 7.2t + -4.9t^2$

$t(7.2 - 4.9t) = 0$

$7.2 - 4.9t = 0$

$-4.9t = -7.2$

$t = 1.47\ s$