Announcements

1. Labs start this week (Monday labs start today)
2. New office hours (12-1 most days); almost any other time by appointment
3. WebAssign homework assignments 1,2,3 due Sept. 4.
4. Tutorials start this week in Olin 107.

On line quiz

Suppose that you are stopped at a stop light. When the light changes, you accelerate at a constant rate of 3 m/s^2.

1. What will be your speed after 3*s*?

(a) 1 *m/s* (b) 4.5 *m/s* (c) 9 *m/s* (d) 13.5 *m/s* (e) none of these.

2. How far will you have traveled after 3*s*?

(a) 3 *m* (b) 13.5 *m* (c) 27 *m* (d) 81 *m* (e) none of these.

3. How are you traveling (choose all that are possible)?

(a) by foot (b) by bike (c) by car (d) by airplane (e) none of these.

Summary of key concepts

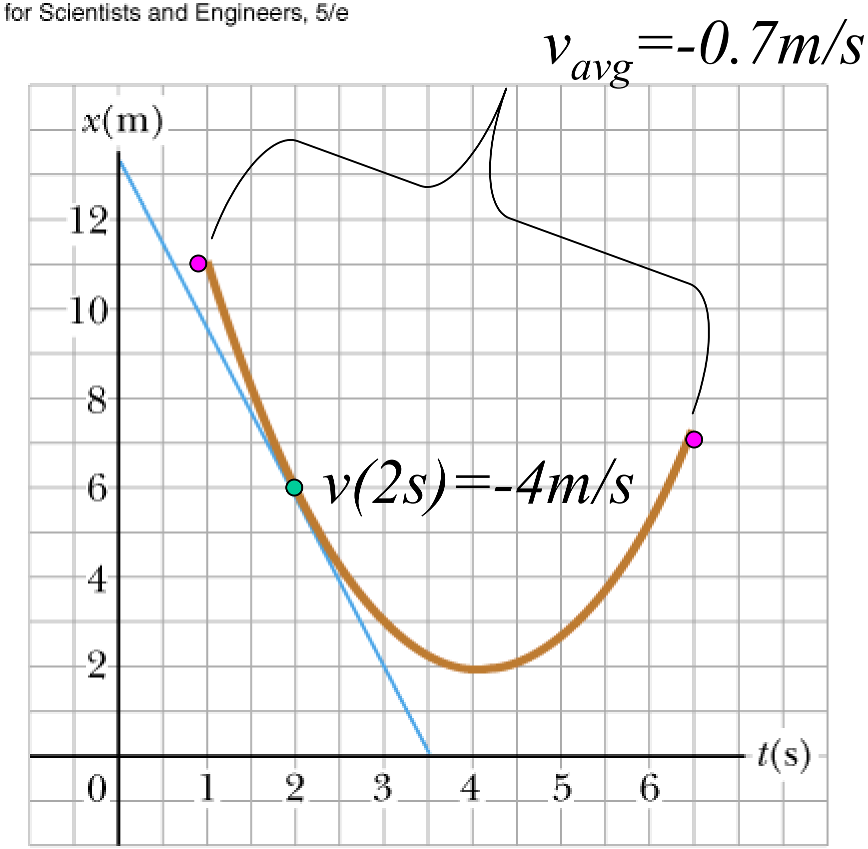
1. Displacement $$x(t) = \int_0^t dt' v(t') = \int_0^t dt' \int_0^{t'} dt'' a(t'')$$

2. Velocity $$v(t) = \frac{dx(t)}{dt} = \int_0^t dt' a(t')$$

3. Acceleration $$a(t) = \frac{dv(t)}{dt}$$

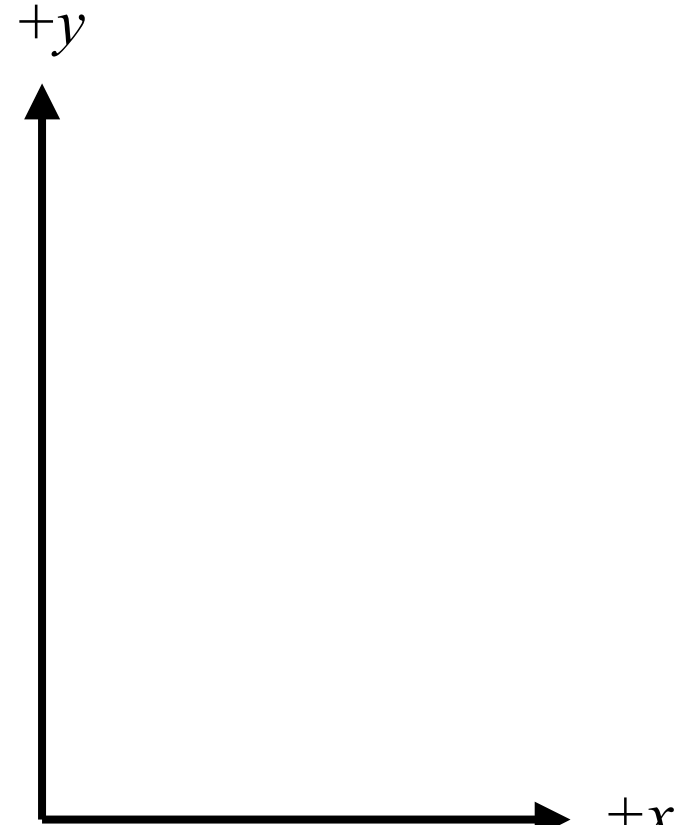
Graphical representations

Serway, Physics for Scientists and Engineers, 5/e
Problem 2.9



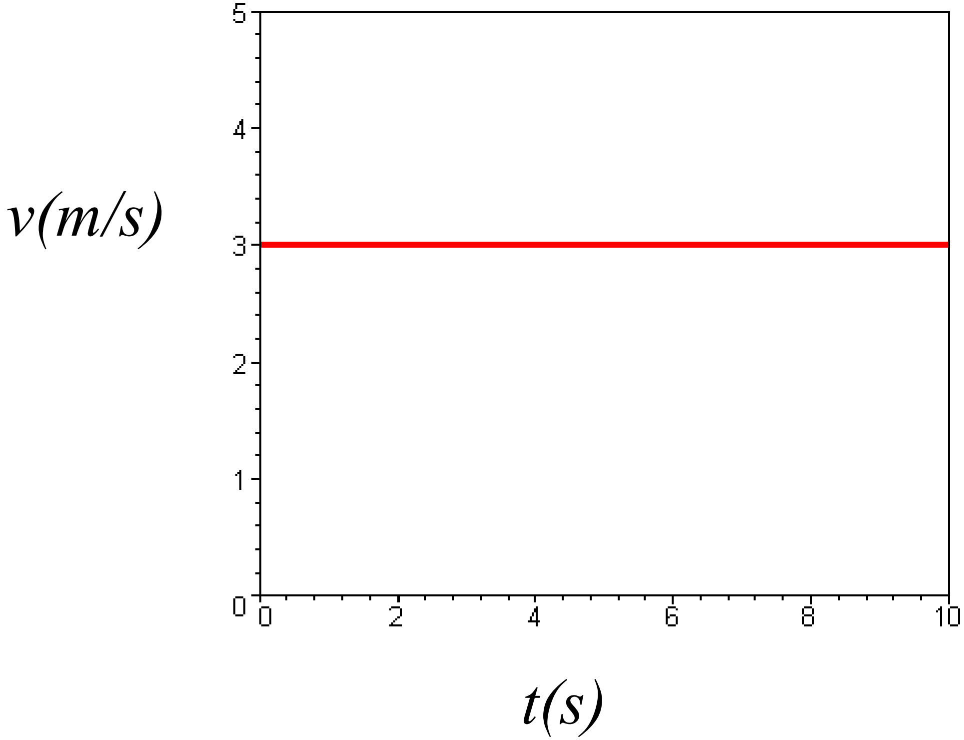
Harcourt, Inc.

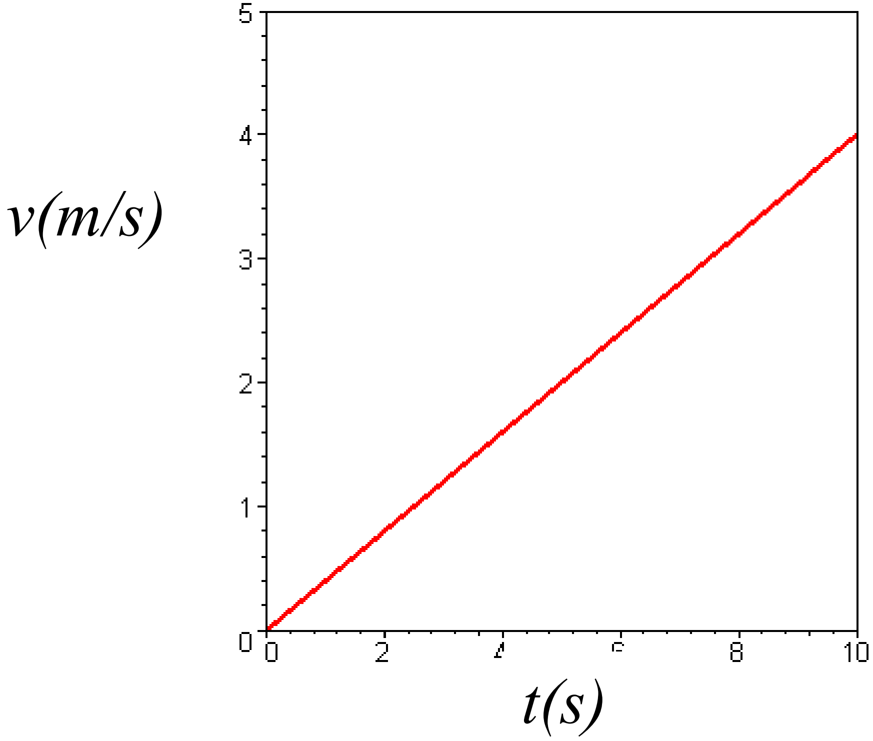
"O.K., there's the sun, so that direction is 'up.'"



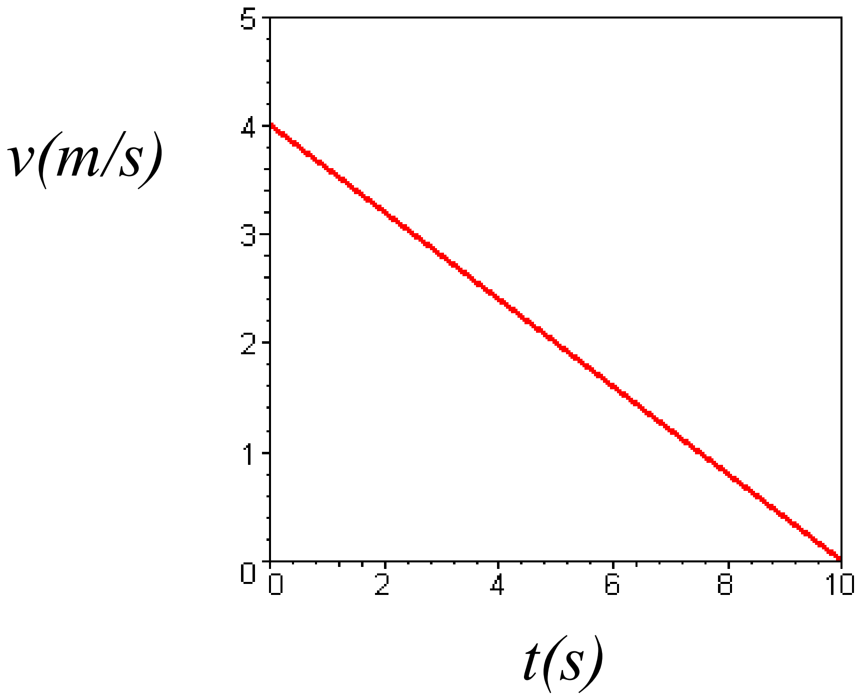
From: **The New Yorker**, Sept. 2, 2002

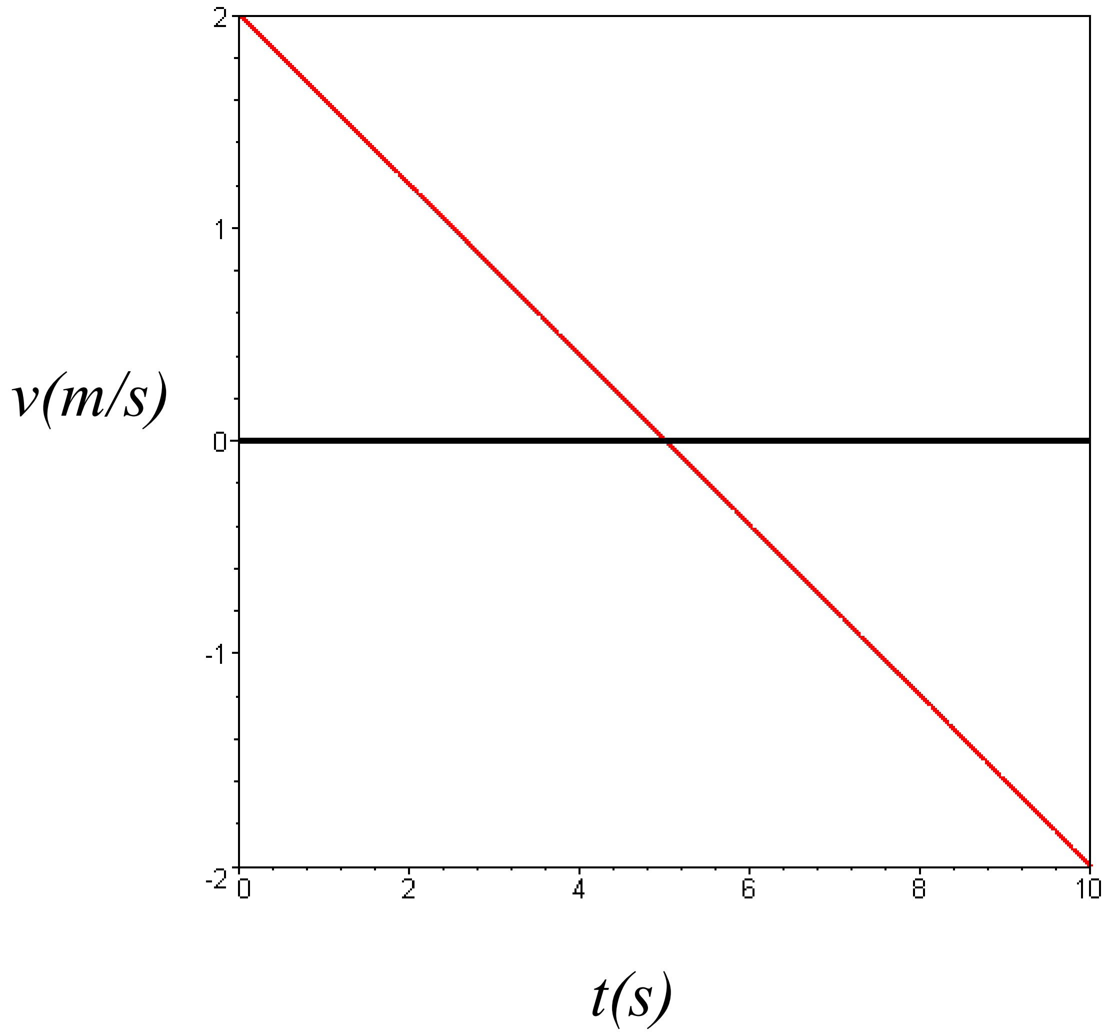
Graphical representations:





v(m/s)
5
4
3
2
1
0
0
2
8
10
t(s)

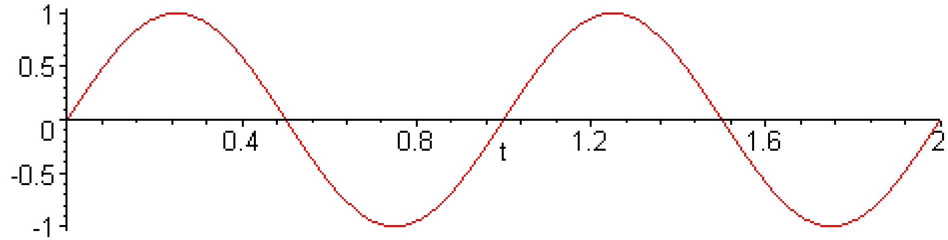

v(m/s)
t(s)
0
1
2
3
4
5
0
2
4
6
8
10



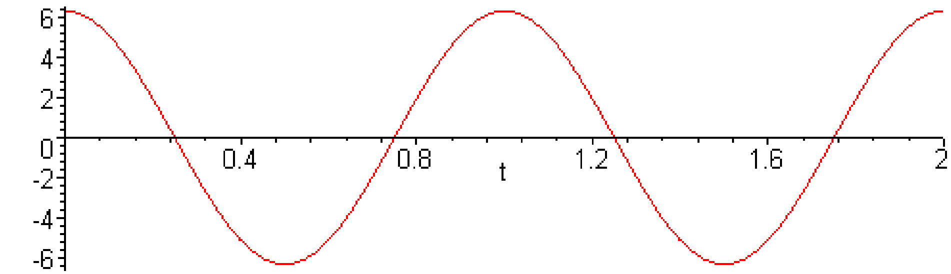
2
1
0
-1
-2
0
2
4
6
8
10
v(m/s)
t(s)

"Simple harmonic motion"

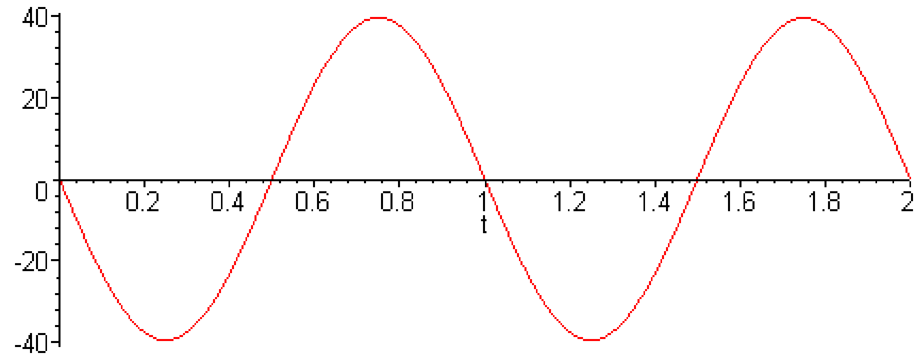
x (m)



v(m/s)



a(m/s²)



Special case of constant acceleration: $a(t) = a_0$

(assume that initial time is $t=0s$)

$v(t) = v_0 + a_0 t$

$x(t) = x_0 + v_0 t + ½ a_0 t^2 = x_0 + ½ (v_0 + v(t)) t$

$(v(t))^2 = (v_0)^2 + 2 a_0 (x(t) - x_0)$

Peer instruction question

Suppose you are driving on a level road at a speed of v_0=*60mi/h=26.8m/s,*

when you notice an object in the road ahead of you. If you step on the breaks immediate and achieve a constant deceleration of

$a=-4.9m/s^2$, you will find that you travel a distance Δx_0 before coming to a complete stop. Now suppose that your initial speed was only v_1=*30mi/h=13.4m/s,* the deceleration is the same and the braking distance is Δx_1.

What is $\Delta x_{1/}\Delta x_0$?

(a) ¼ (b) ½ (c) 1 (d) 2

Sample problem:

Suppose a fiend is standing on top of a tall building (h=200 m). At t=0s, he drops a precious urn which then has a constant downward accelerations of $a=9.8 m/s^2$. At t=2s, Rocket Man arrives for the rescue. He dives off the building (initial downward velocity of 0), fires his rocket, and saves the urn.

1. If Rocket Man disregards his own safety and the rocket acceleration is constant, what must that acceleration be?
2. If Rocket Man catches the urn at 100 m and then decelerates, what are the accelerations and decelerations of his rocket (assuming both are constant).

3. Problem solving steps

1. Visualize problem – labeling variables
2. Determine which basic physical principle applies
3. Write down the appropriate equations using the variables defined in step 1.
4. Check whether you have the correct amount of information to solve the problem (same number of knowns and unknowns.
5. Solve the equations.
6. Check whether your answer makes sense (units, order of magnitude, etc.).