Announcements

1. **Tutorial schedule**
2. **Office hours**
3. **WebAssign problem sets due 9/4/03 at 11:59 PM. Extensions available upon request. (send email to natalie@wfu.edu)**
4. **Labs start this week – bring your lap tops to lab**
5. **Today's lecture – Chapt. 2 – 1 dimensional motion**

   Displacement

   Velocity

   Acceleration
6. **For Thursday – start reading Chapt. 3**

PHY 113 Tutoring Schedule

Sunday	Monday	Tuesday	Wednesday	Thurday
	4-6 PM (for Salsbury)		4-6 PM (for Holzwarth)	
7-9 PM (for Guthold)	7-9 PM (for Holzwarth)	7-9 PM (for Guthold)	7-9 PM (for Salsbury)	7-9 PM (for Guthold)

Rm. 107

Olin

Tutors:

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Fall 2003 Schedule
for N. A. W. Holzwarth

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8:00-9:30	Lecture preparation	Lecture preparation	Lecture preparation	Lecture preparation	Lecture preparation	Physics Research
9:30-10:45		PHY 113		PHY 113		
11:00-12:00	PHY 741	Faculty Mtg	PHY 741	Office hours	PHY 741	
12:00-1:00	Office hours	Office hours	Office hours	Physics Research	Office hours	
1:00 -3:30	Physics Research	Physics Research	Physics Research		Physics Research	
3:30-5:00				Physics seminar		

What we will learn today:

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

Special case of constant acceleration: *a(t) =a0*

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

v(t) = v0 + a0 t

x(t) = x0 + v0 t + ½ a0 t2 = x0 + ½ (v0 + v(t)) t

(v(t))2 = (v0)2 + 2 a0 (x(t) – x0)

Peer instruction question

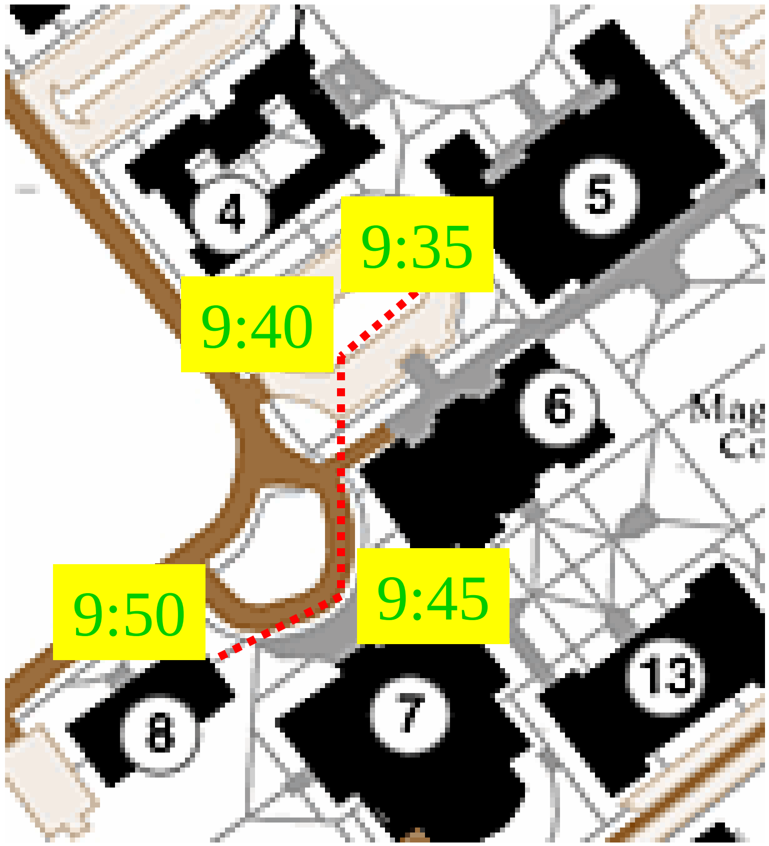
Suppose you are jogging at constant speed (v_{you} = 8 mi/h) around a circular track while I am jogging at constant speed around the same track (v_{me} = 4 mi/h). In the time that it takes you to go around the track once, how many times will I go around the track?

A. ½ B. 1 C. 2 D. 4

Displacement (position) versus time x(t)

1. Table (schedule)
2. Graph
3. Analytic formula

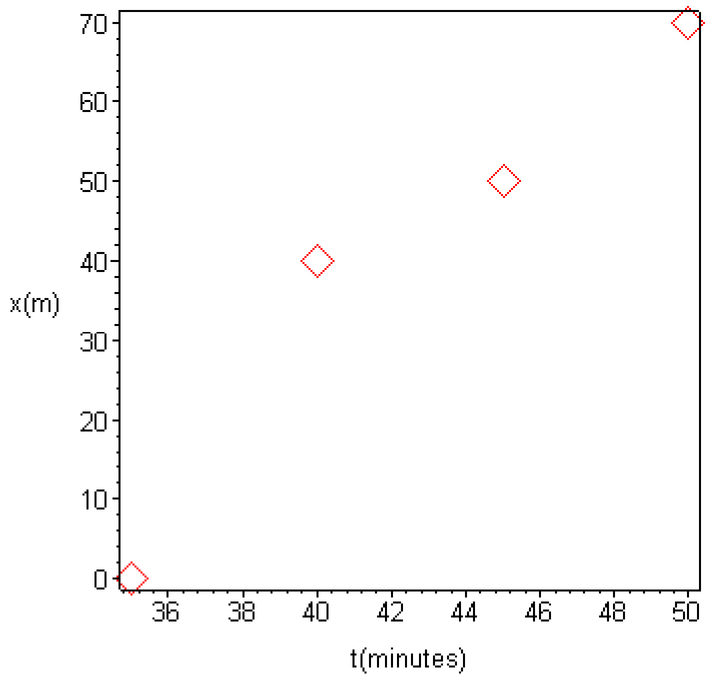
Example:

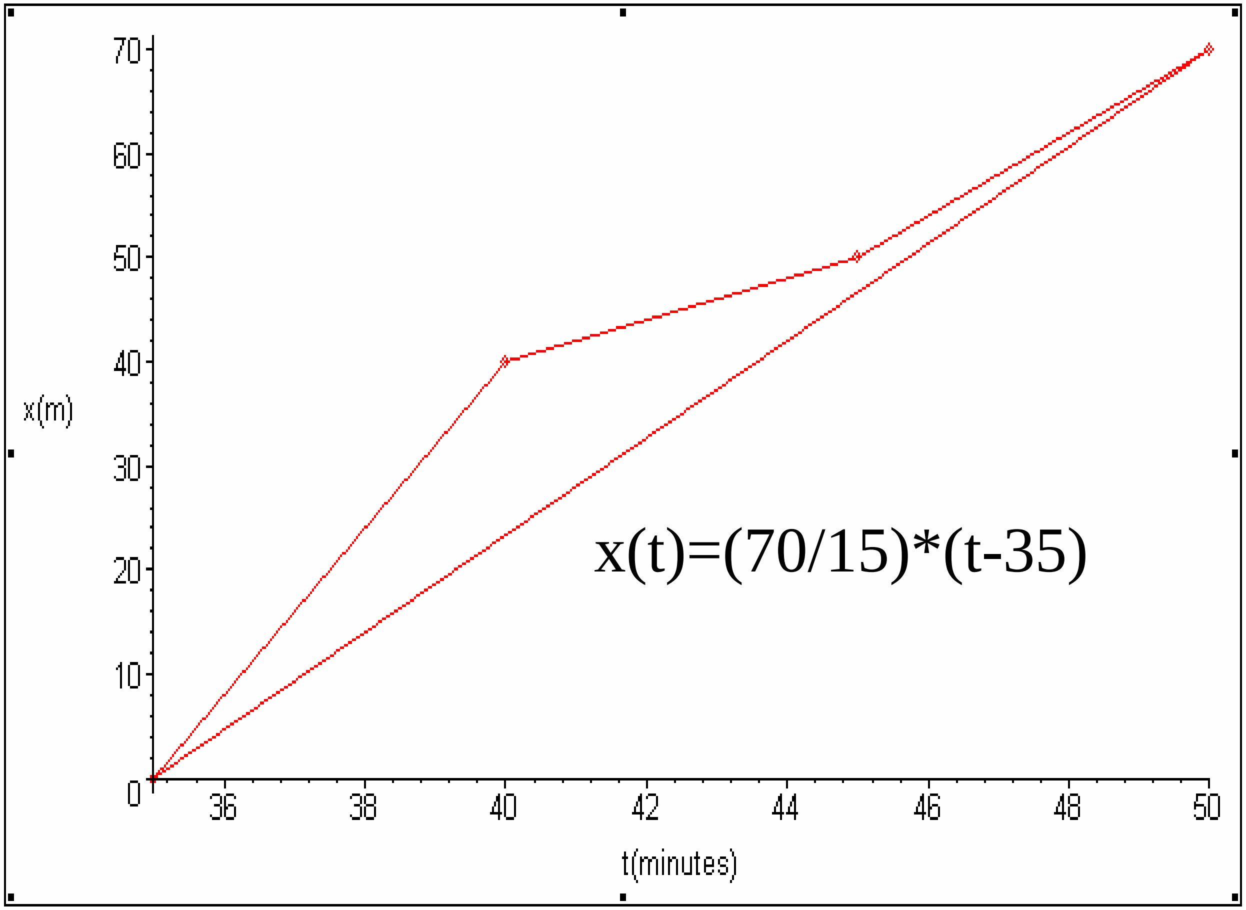


1. Tablular form

Time	Position
9:35 AM	0 m (Reynolda Hall)
9:40	40 m (Benson)
9:45	50 m (Library)
9:50	70 m (Olin)

2. Graph

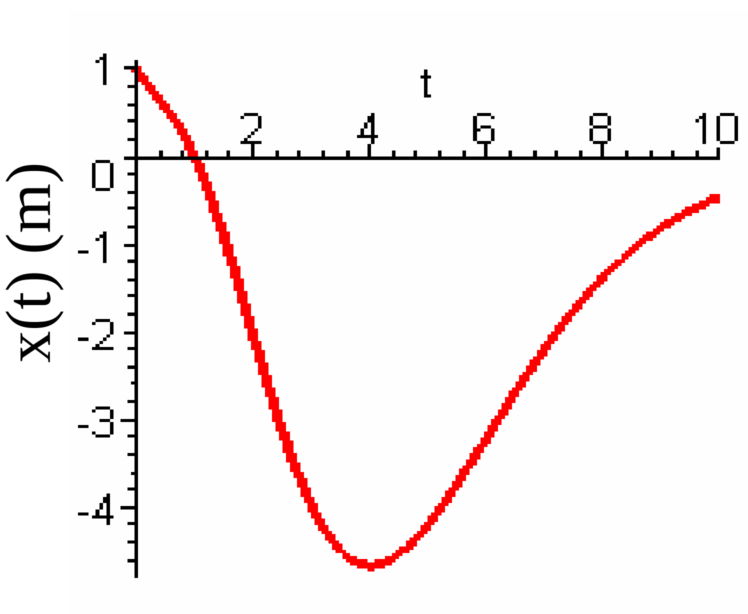


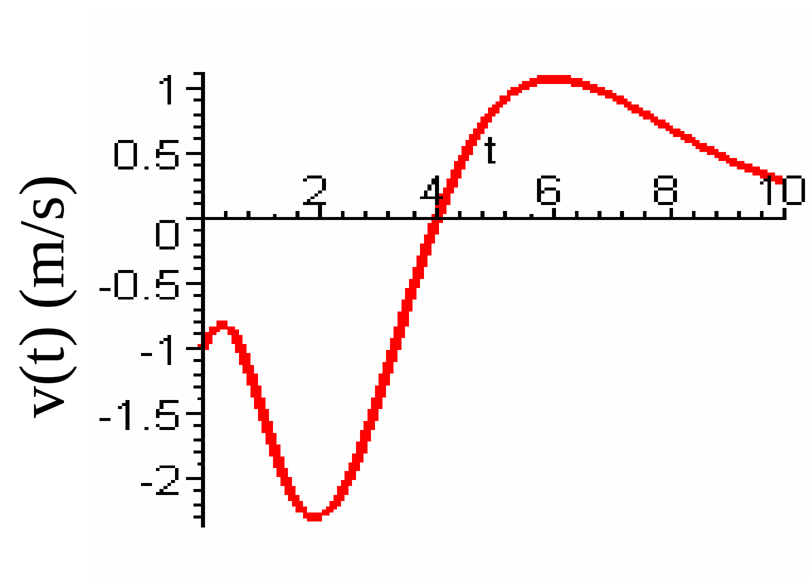


70
60
50
40
30
20
10
0
x(m)
36
38
40
42
44
46
48
50
t(minutes)
x(t)=(70/15)*(t-35)

Velocity – rate of change in displacement

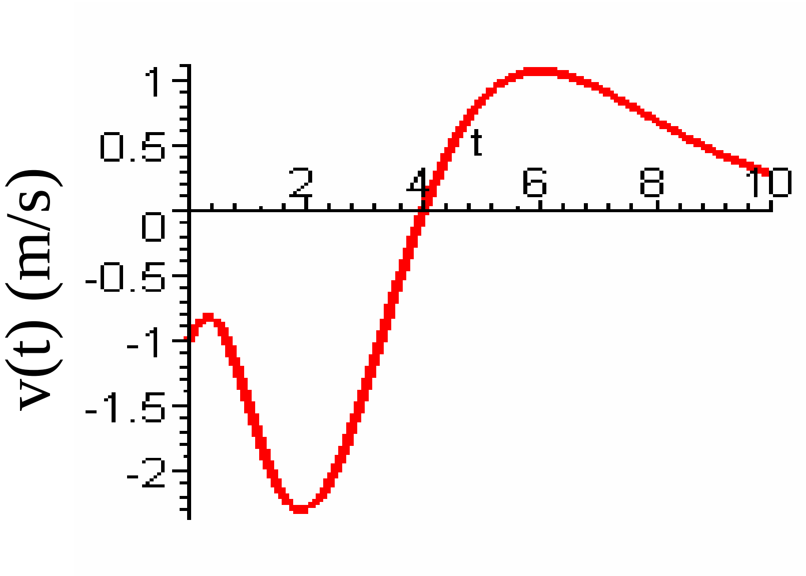
Instantaneous velocity: $v(t) = \dfrac{dx}{dt}$

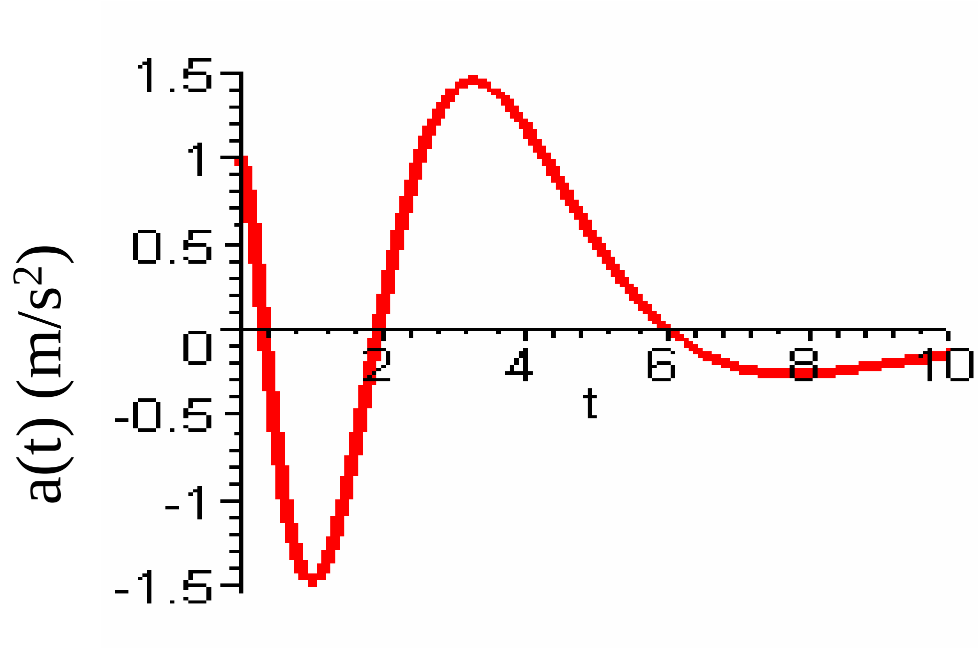




Instantaneous acceleration – rate of change in velocity

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





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

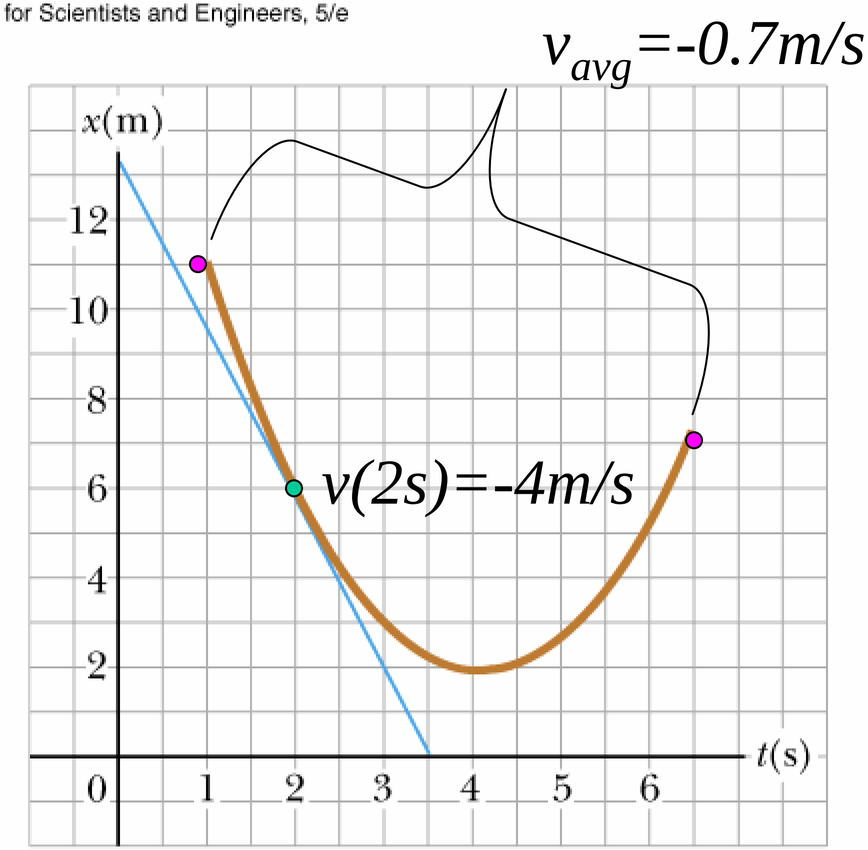
3. Acceleration $$a(t) = \frac{dv(t)}{dt}$$

Review of Online Quiz for Lecture 2
Motion in One Dimension -- Sept. 2, 2003

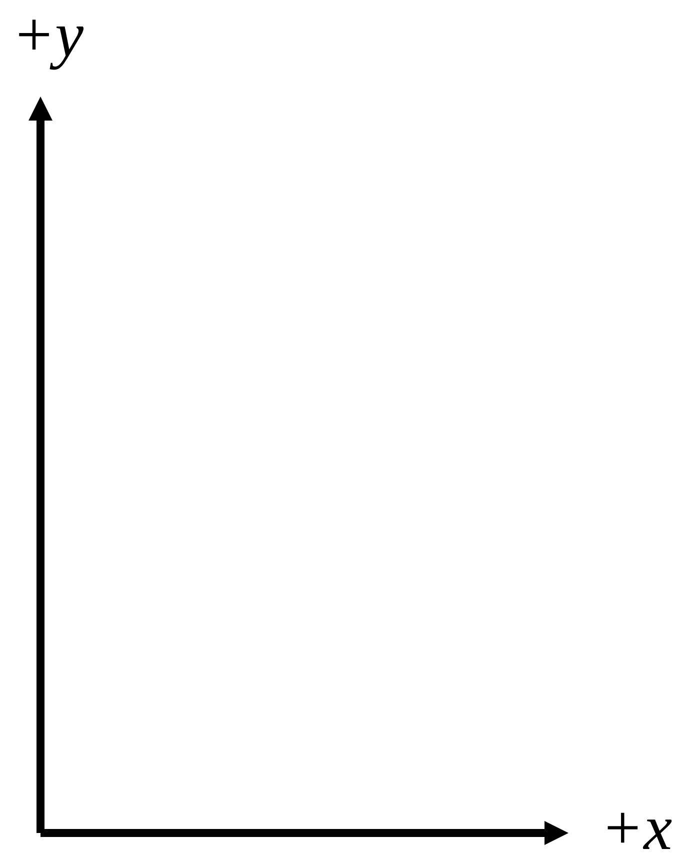
1. Suppose that you have 2 minutes before class begins and you are 300 *m* from Olin 101. What is should be your average velocity (in *m/s*) in order to get to class on time?
   (a) 150 (b) 15 (c) 5 (d) 2.5 (e) 1
2. Suppose you begin and end your trip at rest (v=0 m/s) and have a constant acceleration *a* for 1 minute followed by a constant negative acceleration -*a* for 1 minute. What is the value of *a* in *m/s2*?
   (a) 15 (b) 5 (c) 2.5 (d) 0.3333 (e) 0.0833
3. What is your maximum velocity (in *m/s*) during the trip?
   (a) 150 (b) 15 (c) 5 (d) 2.5 (e) 1

Graphical representations

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

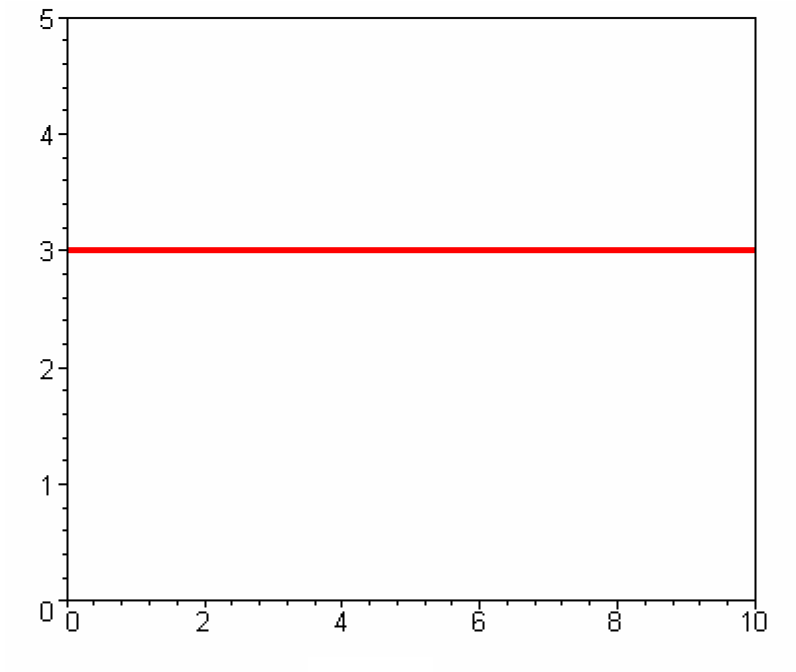


"O.K., there's the sun, so that direction is 'up.'"



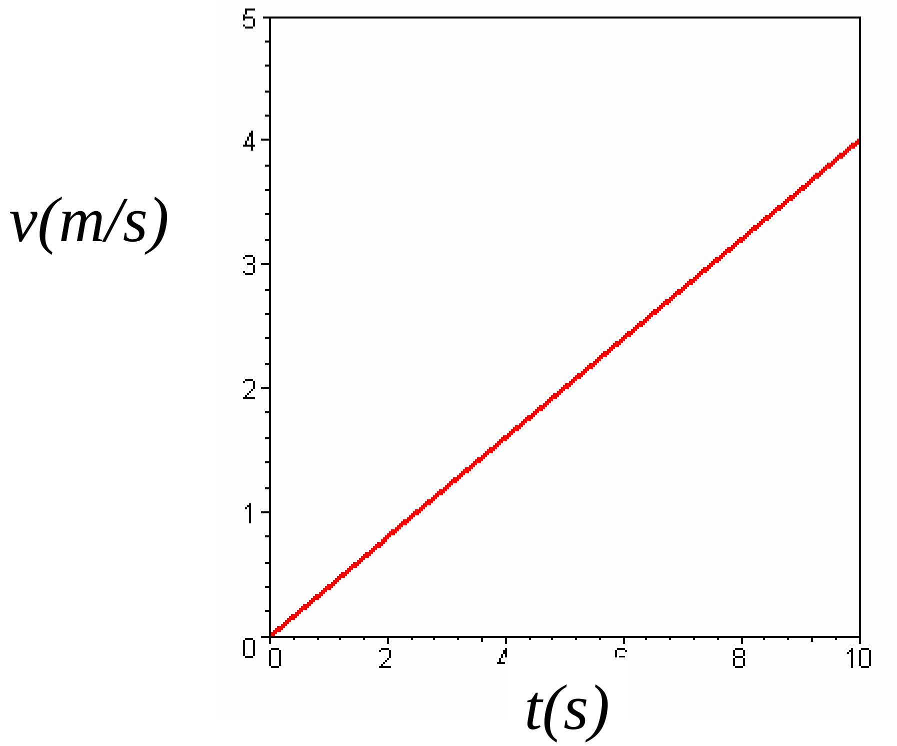
From: **The New Yorker**, Sept. 2, 2002

Graphical representations:

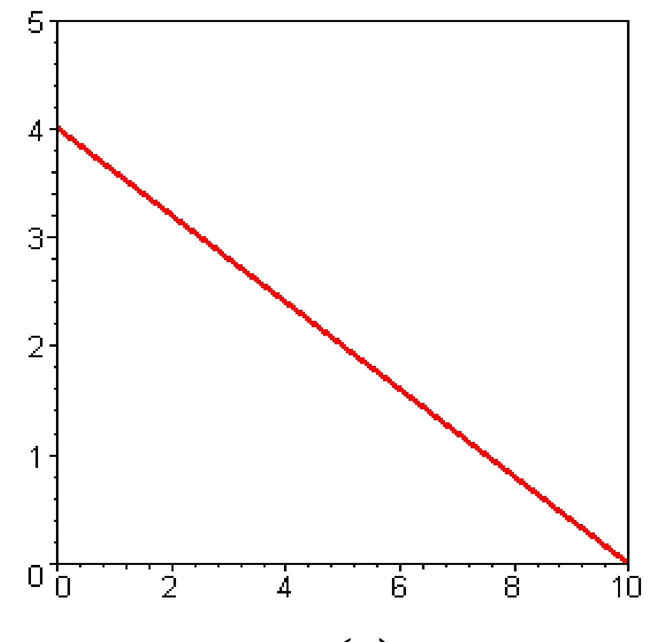


v(m/s)

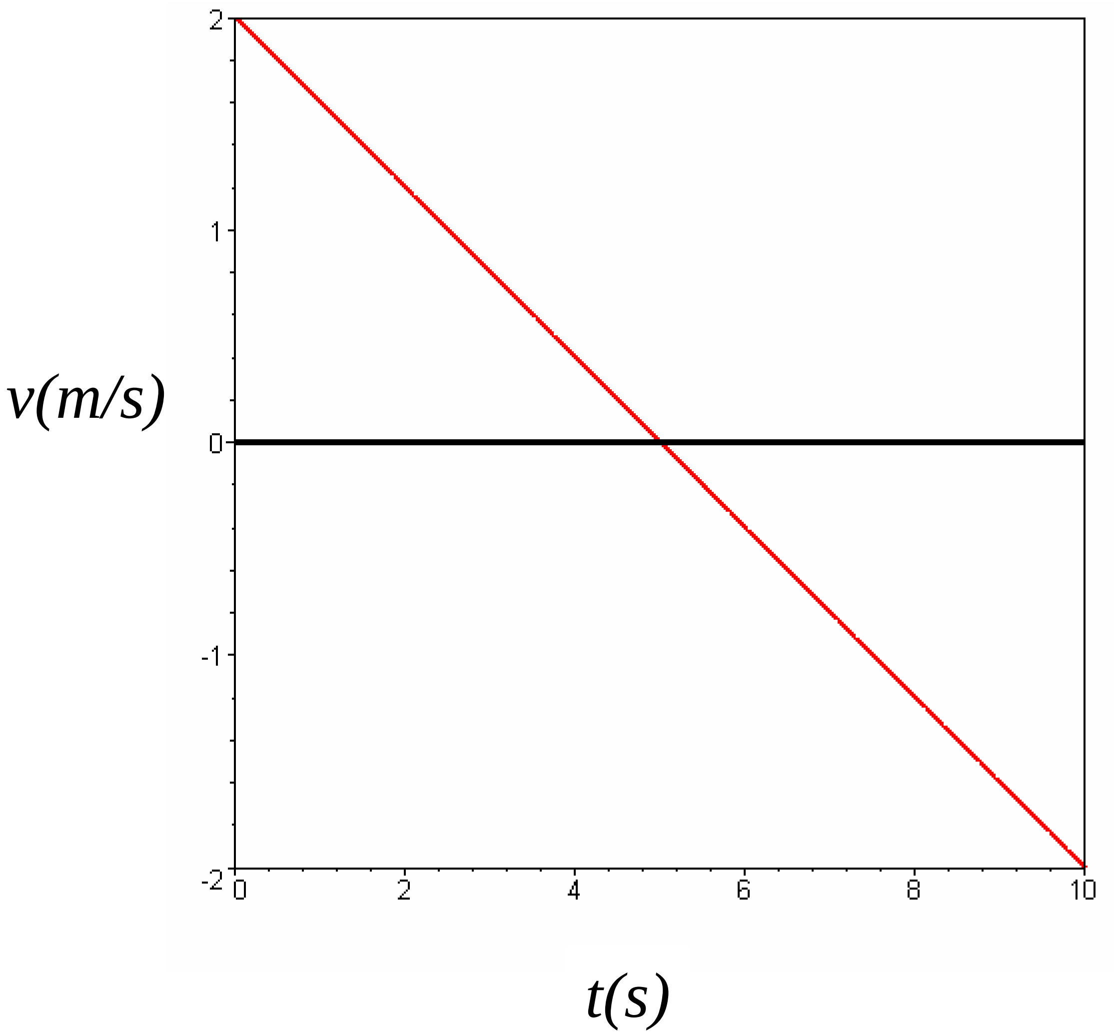
t(s)


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

v(m/s)



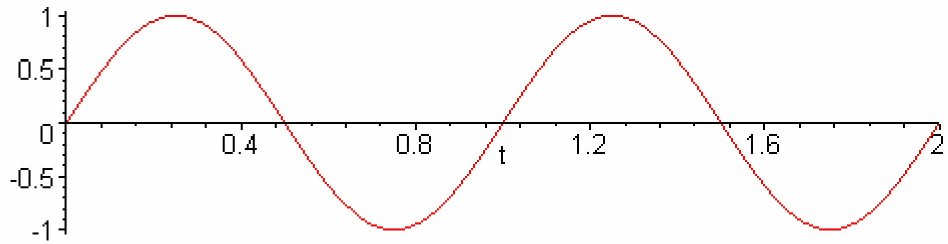
t(s)



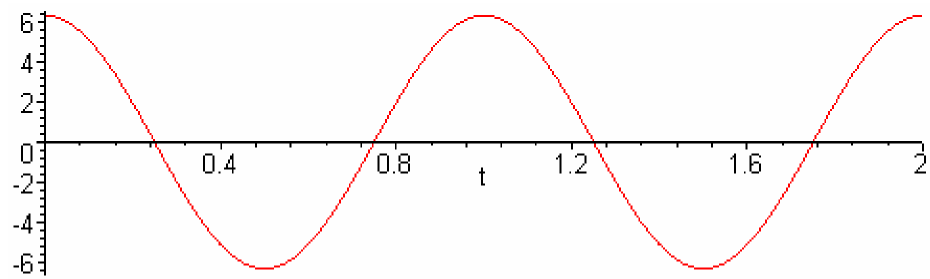
v(m/s)
t(s)
2
1
0
-1
-2
0
2
4
6
8
10

"Simple harmonic motion"

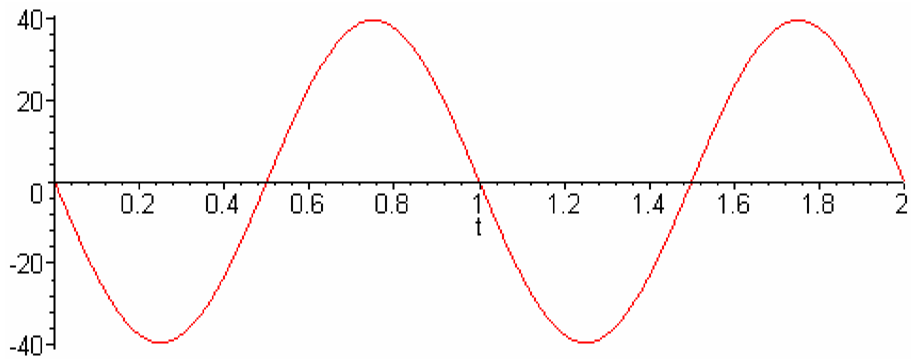
x (m)



v(m/s)



a(m/s^2)



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

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

$v(t) = v_0 + a_0 t$

$x(t) = x_0 + v_0 t + \frac{1}{2} a_0 t^2 = x_0 + \frac{1}{2} (v_0 + v(t)) t$

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

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/s²*, 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.).