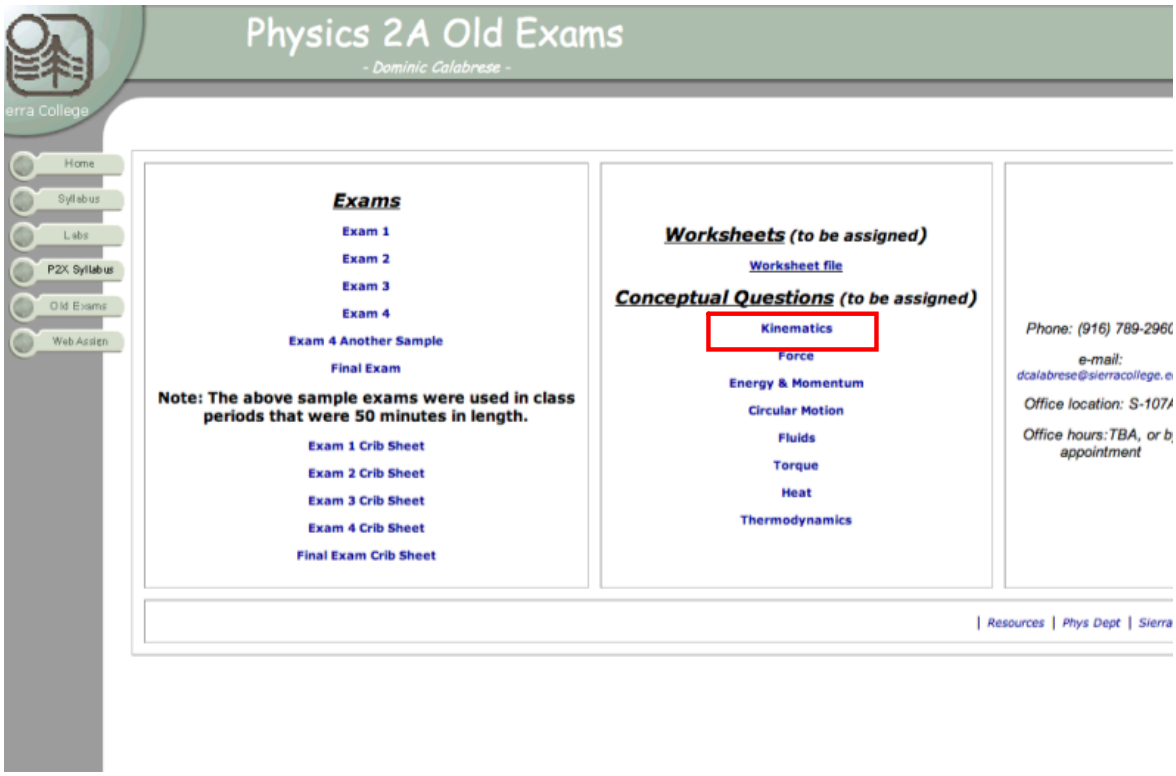
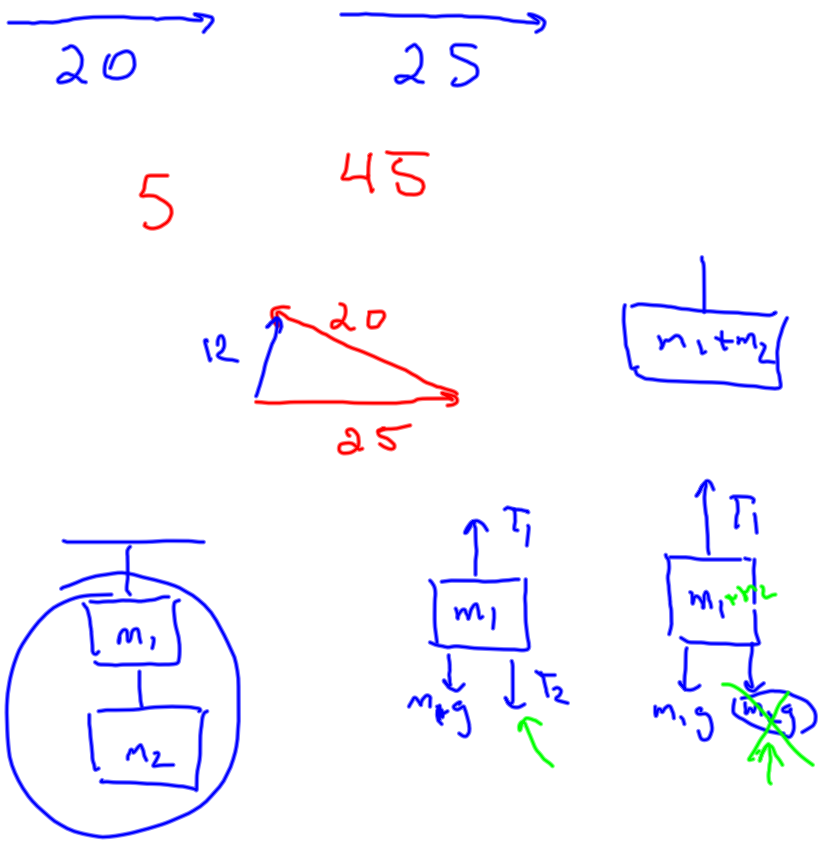
Reminders 9-17-07:
-Next Homework Due 9/23!!!
-Kinematics Conceptual Questions Due Wed. 9/19.
- Pick up graded papers in basket outside S-107A
-Conceptual Quiz on 9/19 Chapter 2.
-Exam 1 Mon. 9/24, Sect. 3.1,3.2,4.1,4.2, & Ch 2.
-You must know exam policy.
-Phi Theta Kappa Dr. Harry Houpis
-Save all files onto a USB Stick/Flash Drive.
-Obtain software from desktop of computers in lab.
Objectives: hhoupis@sierracollege.edu
-Motion at Constant Acceleration
-Examples, Examples, Examples
-Newton's Laws Revisited

Aug 26-10:24 PM



Sep 9-10:58 PM



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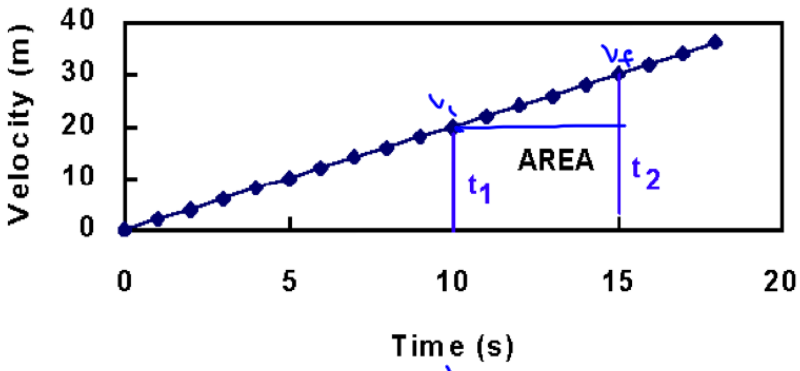

Rectangle $= v_i(t_2 - t_i)$

Triangle $= \frac{1}{2}(t_2 - t_i)(v_f - v_i)$

$$\Delta x = v_i \Delta t + \frac{1}{2}\Delta t(v_f - v_i)$$

$$= v_i \Delta t + \frac{1}{2}\Delta t(a\Delta t)$$

$$= \boxed{v_i \Delta t + \frac{1}{2} a (\Delta t)^2}$$

let $t_i = 0$ so that

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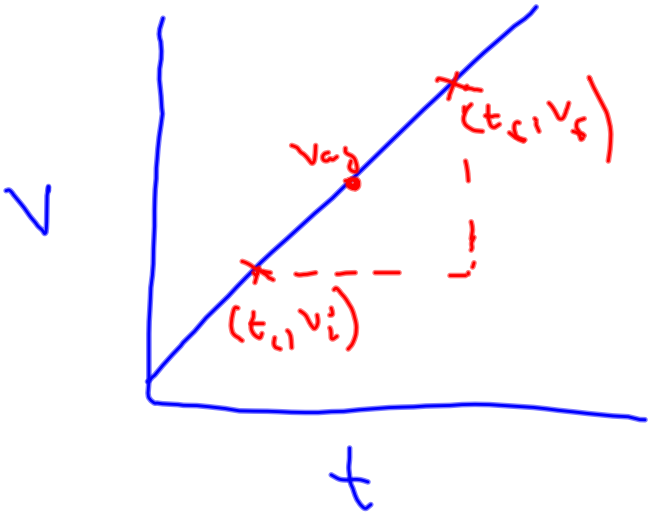

$$v_{avg} = \frac{v_i + v_f}{2} = \frac{\Delta x}{\Delta t}$$

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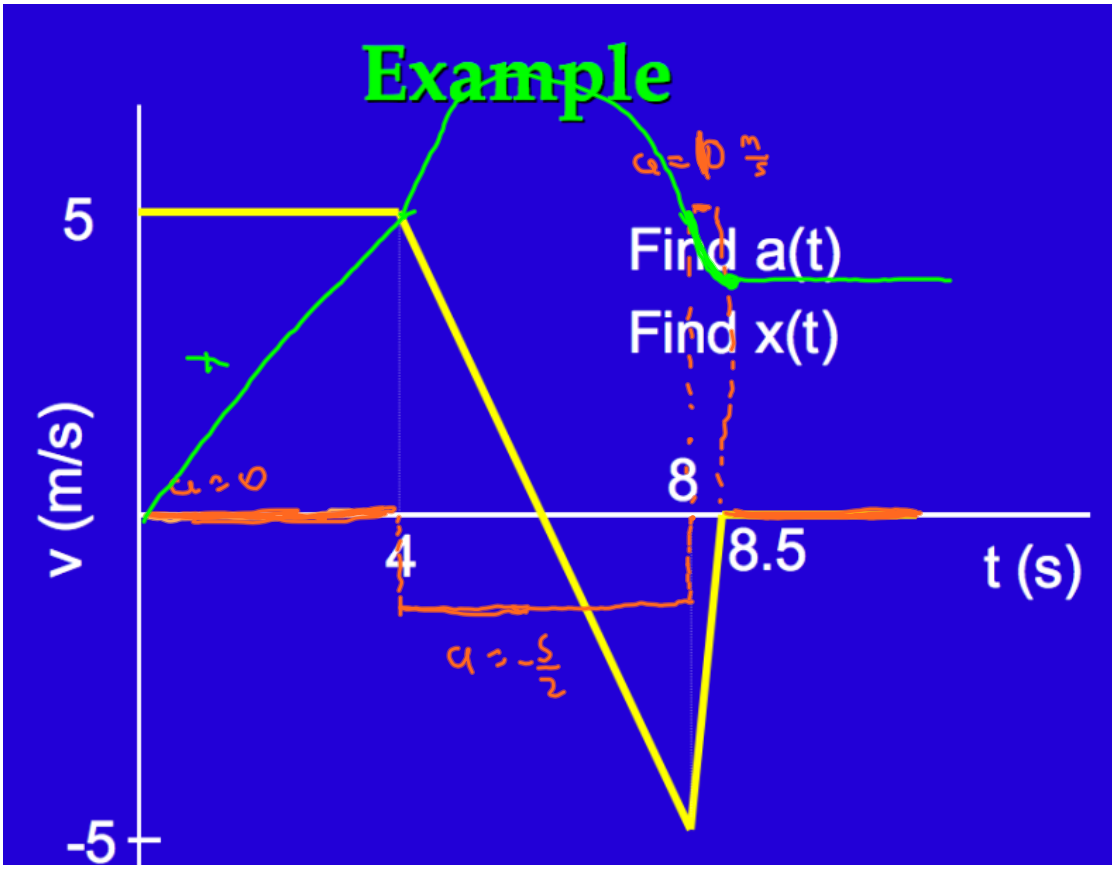

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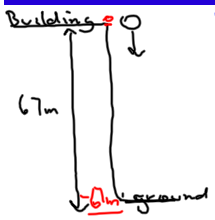
Example

- An object is dropped from a 67 m high building. Ignore air friction.
  - How long will it take to get to the ground?
  - What will the average velocity be from the top of the building to the bottom?



$v_i = 0$

$a = -9.80 \frac{m}{s^2}$

$\Delta y = -67m$

$\Delta y = \frac{1}{2} a t^2$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-67m)}{(-9.80 \frac{m}{s^2})}}$

$= 3.7s$

$v_{avg} = \frac{\Delta y}{\Delta t} = \frac{-67m}{3.7s} = -18.1 \, m/s$

$v_f = at = (-9.80 \frac{m}{s^2})(3.7s) = -36.3 \frac{m}{s}$

$v_f = \sqrt{2a\Delta y} = \sqrt{2(-9.80 \frac{m}{s^2})(-67m)} = -36.3 \frac{m}{s}$

$v_f = 2v_{avg} = -36.3 \frac{m}{s}$

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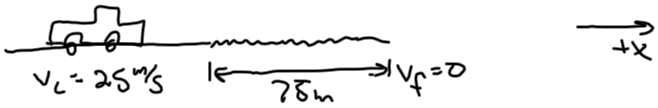
- An object is traveling at the rate of 25 m/s. It reaches a surface that slows it down. It comes to a complete stop after traveling 75 m.
  - What is the acceleration of the object?
  - How long does it take to come to a complete stop?
- Discuss alternative ways to solve the problem.



$v_f^2 - v_i^2 = 2a\Delta x$

$a = \frac{v_f^2 - v_i^2}{2\Delta x} = \frac{0 - (25 \frac{m}{s})^2}{2(75m)} = -4.2 \frac{m}{s^2}$

$v_f = v_i + at$ $\quad \frac{v_f - v_i}{a} = t$

$\frac{0 - 25 \frac{m}{s}}{-4.2 m/s^2} = 6.0s$

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A motorist drives along a straight road at a constant speed of 9.00m/s. When she is 22.0m in front of a parked motorcycle police officer, the officer starts to accelerate at 2.00m/s² to overtake her. Assuming the officer maintains this acceleration, determine the total displacement of the officer as he overtakes her.

$x_{police} = x_{car}$

$x_{police} = \frac{1}{2}at^2 \qquad x_{car} = v_{car}t + 22$

$\frac{1}{2}at^2 = vt + 22$

$t^2 = (9.0\,m/s)t + 22$

$t^2 - 9t - 22 = 0$

$(t-11)(t+2) = 0 \qquad t = 11\,s$

$\Delta x = \frac{1}{2}(2.0)(11)^2 = 121\,m$

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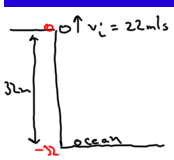
- A rock is thrown upward from a cliff. The initial velocity of the rock is 22 m/s. The cliff is 32 m above the surface of the ocean.
- What is the *velocity* of the rock when it is 32 m above the ground while it's on the way down? Do you actually need to do a calculation? $-22\,m/s$
- What are the acceleration and velocity of the rock at its highest point? $a = -9.80\,m/s^2 \quad v_{top} = 0$
- What is the *speed* of the rock when it hits the water?
- How long does the rock take to hit the water?
- Discuss alternative methods to solve the latter 2 questions.



$\Delta y = -32\,m$
$v_i = 22\,m/s$
$a = -9.80\,m/s^2$

$v_f = +33.3\,m/s$

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

$v_f = \sqrt{v_i^2 + 2a\Delta y} = \sqrt{(22)^2 + 2(9.80)(32)}$
speed $= 33.3\,m/s$

$v_f = v_i + at \qquad t = \frac{v_f - v_i}{a}$

$= \frac{(-33.3 - 22)\,m/s}{-9.80\,m/s^2} = 5.65\,s$

$\Delta y = v_i t + \frac{1}{2}at^2$

$-32\,m = (22\,m/s)t + \frac{1}{2}(-9.80\,m/s^2)t^2$

$4.9t^2 - 22t - 32 = 0$

$t = \frac{22 \pm \sqrt{(22)^2 - 4(-32)(4.9)}}{2(4.9)}$

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