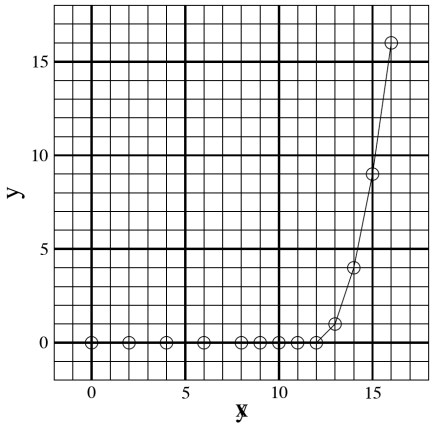
Physics 131.01 Monday September 27, 2010 Quiz number 3

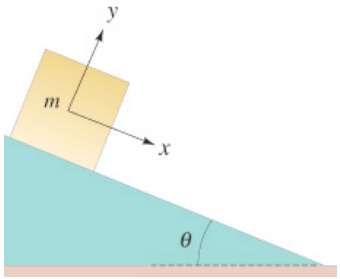
1. **Motion diagram.** The circles represent the position of a particle in meters at moments separated by 1 sec. The mass of the particle is 3.0 kg.



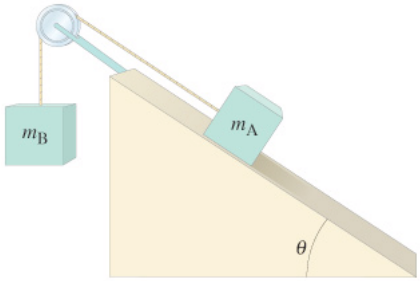
a. What is the net force on the particle when x=2 m? $\vec{F} = 0$
b. What is the direction of the force when x=8m? negative x.
c. What is the velocity when x=6m? $\vec{v} = (v_x, v_y)$=(0,2m/s)
d. What is the velocity when x=13m? (1,1.5) m/s NOTE: if you just give the magnitude, 1.8 m/s, that is NOT enough.
e. What is the direction of the force when x=13m? positive y
f. What is the magnitude of the force when x=13m? 6N. NOTE: the y velocity increases from 1 m/s (a half second before) to 3 m/s (a half second later) so a_y=2 m/s^2.

2. **Sliding down an incline.** The mass m=4.0 kg, and the angle θ = 25. degrees.

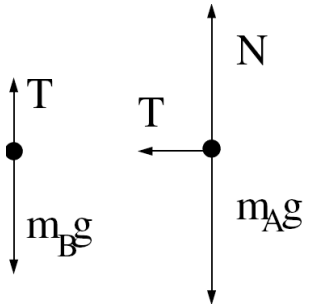
a. What is the ~~direction and magnitude of the~~ force of gravity in the coordinates x,y as drawn parallel and perpendicular to the incline?
$\vec{F} = (mg\sin\theta, -mg\cos\theta)$=(17N,-36N)
b. What is the ~~magnitude and direction of the~~ normal force?
$\vec{N} = (0, mg\cos\theta)$=(0,36N)
c. If there is no friction, what is the acceleration? a_x=gsinθ=4.1m/s. a_y = 0.
d. If the coefficient of friction μ = 0.20, what is the frictional force?
f_x = -μmgcosθ = -7.1N. F_y=0.
e. What is the acceleration now? a_x = gsinθ-μgcosθ =2.4 m/s^2



3. **Two coupled masses**. The mass m_A is 10.0 kg, and m_B is 8.0 kg. The angle θ is 0 degrees. You can treat the two masses separately, and consider each to have a one-dimensional motion. There is an unknown tension T in the cord. There is no friction.



a. Draw the free body diagram for m_B. What is the direction of a for this mass? up Choose this as the positive direction for this mass.
b. Draw the free body diagram for m_A. What is the direction of a for this mass? left Choose this as the positive direction for this mass.



c. Note that the two masses must have the same acceleration. Write two equations, one for the acceleration of each mass (Newton's equation).
$m_A a = T$ $m_B a = m_B g - T$ from these you can eliminate T, getting $(m_A + m_B)a = m_B g$
d. Find the acceleration. $a = m_B g/(m_A + m_B)$=4.4 m/s^2.