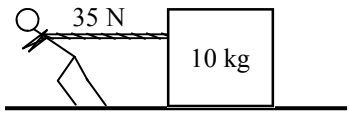
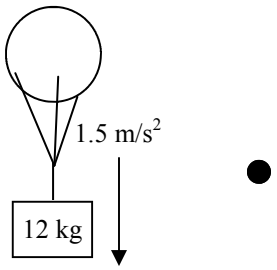
B-Day: Due Mon., Nov 1
A-Day: Due Tues., Nov 2

2010-11 PreAP Forces 4



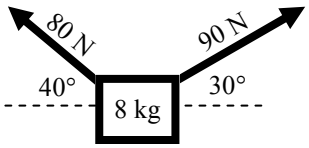
1. Slim Jim pulls with 35 N on a 10 kg box across the floor at constant speed.
   A. Draw all of the forces acting on the box.
   B. What is the force of friction on the box?

   C. Write the equation for friction and calculate the coefficient of friction between the box and the floor.



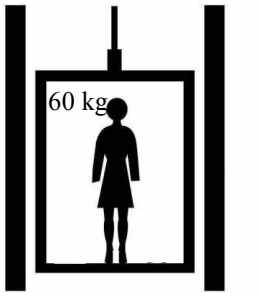
2. A 12 kg box is suspended by a balloon. It accelerates downward at 1.5 m/s^2.
   A. On the given dot, draw a force body diagram of the mass.

   B. Calculate the tension in the rope.



3. A. Pretend that the 90N and 80N forces are "Crazy". Draw Crazy's path.
   B. Draw "Lazy's" path. This is the direction of the net force.
   C. * Calculate the net force acting on the 8 kg object.

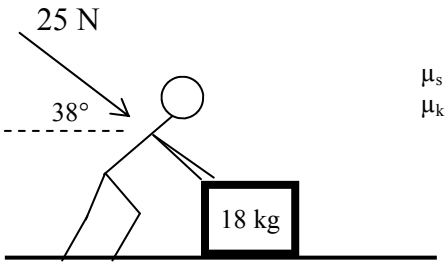
   D. Calculate the acceleration of the object.



See "Normal Force" notes if you need help.

4. A 60 kg lady is on an elevator and experiences a normal force of 820 N.
   A. What is the acceleration of the elevator?

   B. If the elevator is moving down, is it stopping or starting?



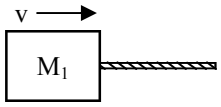
$\mu_s = 0.12$
$\mu_k = 0.08$

5. Slim Jim is pushing down on a 18 kg box with 25 N at an angle of 38º. (*Help on p3, Forces 3*)
   A. Which is stronger Jim's force on the box or the box's force on Jim?
   B. On the diagram, calculate the normal force and forces of friction on the box.

   C. Decide if the box will slide or not.
   D. Calculate how much additional force is necessary or the acceleration of the box.

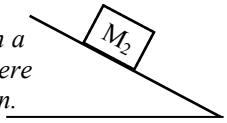
6. A 26 kg object weighs 180 N on the planet Zorg.
   A. Write the equation for weight.
   B. What is the mass of the object?
   C. What is the acceleration due to gravity on Zorg (*what is "g" also known as the gravitational field*)?

Looking down on the object. There is friction.



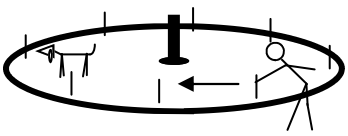
x-equation y-equation

Object on a ramp. There is friction.



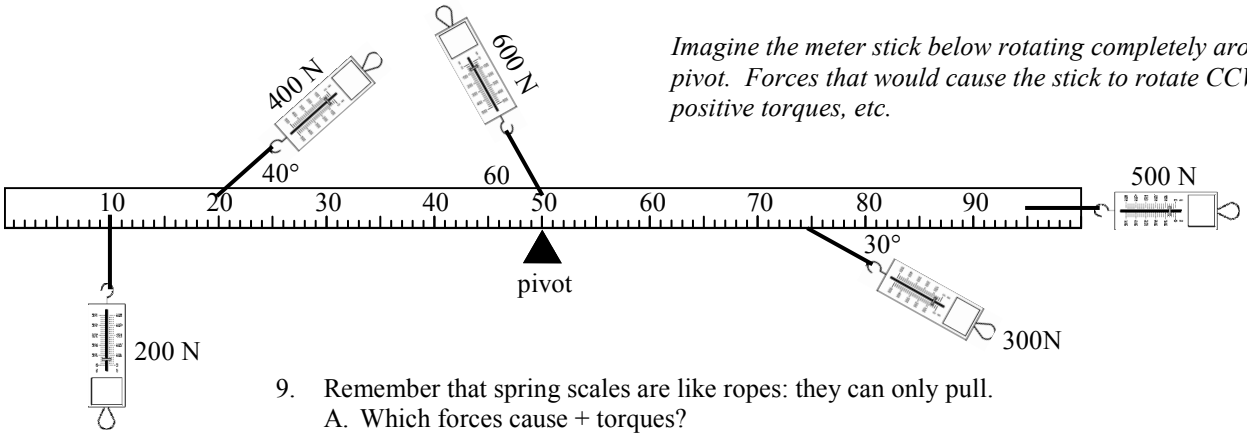
x-equation y-equation

7. A. *Using the dots as the objects, draw and label all forces acting on the objects.
   B. *Write the x and y equations for each object. (Write $\sum F_x = ma_x$ and $\sum F_x = ma_y$ for each object, putting in the horizontal forces into the x-equation and the vertical forces into the y-eqution.)

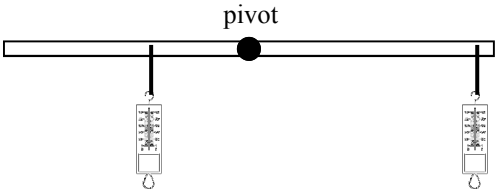


8. * Slim Jim and Bim are playing on a merry-go-round. Jim applies a force to the left. Pretend that your right hand is wrapped around the center post of the merry-go-round. Make sure your fingers are curled the way the merry-go-round is rotating (CW).
   A. Is your thumb pointing up or down?
   B. Is this force causing a positive or negative torque?

Imagine the meter stick below rotating completely around the pivot. Forces that would cause the stick to rotate CCW cause positive torques, etc.



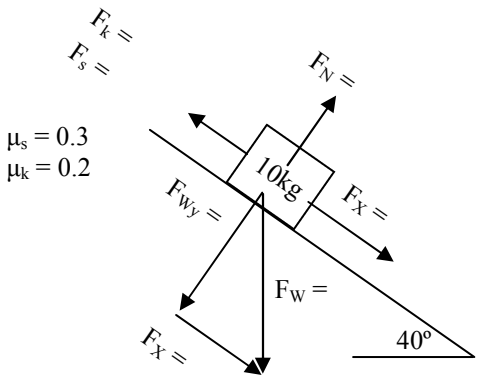
9. Remember that spring scales are like ropes: they can only pull.
   A. Which forces cause + torques?
   B. Which forces cause no torque?
   C. Calculate the net torque on the meter stick. (*Example on last page*.)

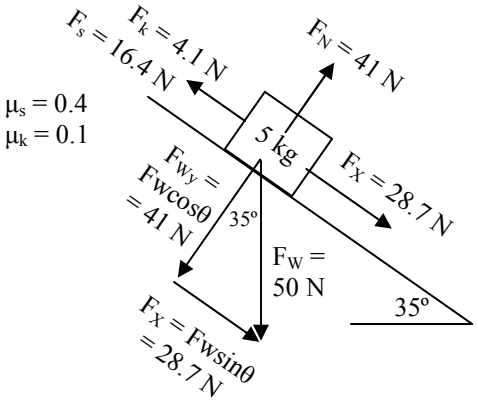


10. Two forces are being applied to the lever at the left. The lever is not moving when both forces are applied.
    A. Which spring scale gives more torque?
    B. Which spring scale shows more force?
    C. If the left scale is turned so that its angle is no longer 90º but the force remains constant, what would happen to the lever?

11. * A 1200 kg object is 1400 meters from a 300,000 kg object. Calculate the force of gravity between them. (*Use the "EE" key for ×10. Example, in your calculate G should look like: 6.673E−11*).

12. A 25 kg object is on the earth. The $m_{earth} = 5.97\times10^{24}$ kg and $r_{earth} = 6.378\times10^{6}$ m. Use the equation for gravitational force to calculate the force of gravity on the object.

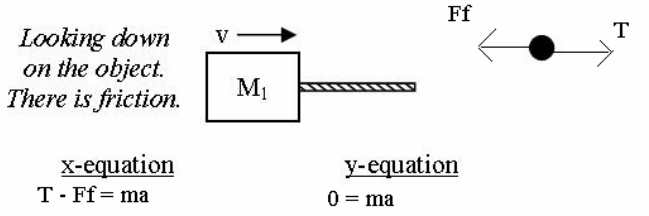




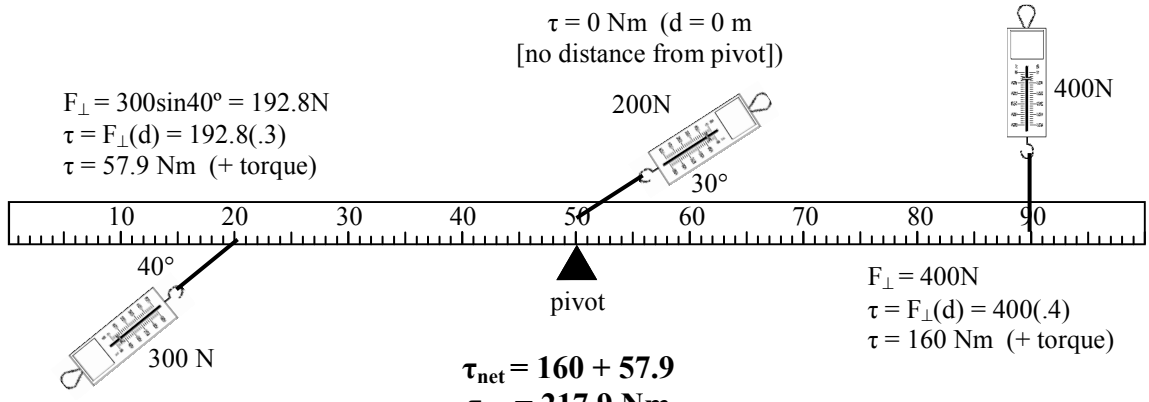
Cover up the diagram at the right and see if you can fill in the diagram without help.

13. After filling in the diagram above, answer the following questions.
    A. Does the object start to slide?
    B. If it doesn't slide, how much more force is necessary to move it?
    C. If it does slide, calculate its acceleration.

Q7



8A: Down; 8B: negative torque.
Q11: In calculator should look like:
$6.673E10^{-11}*1200*300{,}000/1400^2 = 1.23\times10^{-8}$ N
(Yup, a very small number)



$\tau_{net} = 160 + 57.9$
$\tau_{net} = 217.9$ Nm