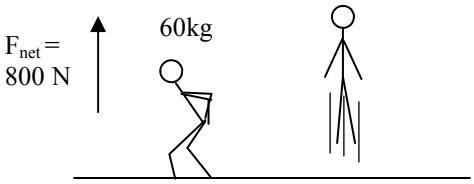
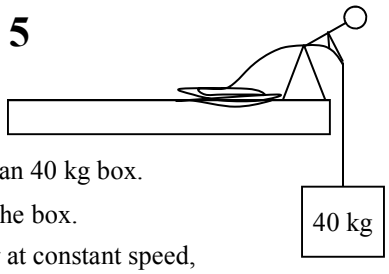
B-Day: Due Wed., Nov 3
A-Day: Due Thurs., Nov 4

2010-11 PreAP Forces 5

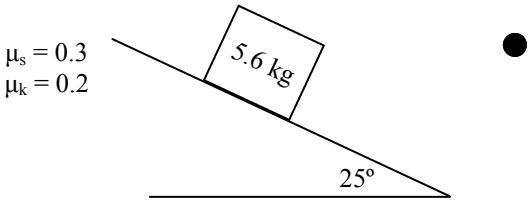


1. * In jubilation, Slim Jim jumps straight up into the air. His net force is 800 N.
   A. What is his weight?

   B. What is his acceleration?

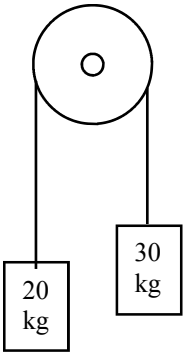


2. Slim Jim has a rope attached to an 40 kg box.
   A. Draw a force diagram for the box.
   B. If the box is not moving or at constant speed,
      i. What is it's acceleration?
      ii. What would be the tension in the rope?
   C. Which is bigger: Jim pulling on the rope or the rope pulling on Jim?
   D. If Slim Jim pulls the object up with an acceleration of 2.5 m/s^2, find the tension in the rope.

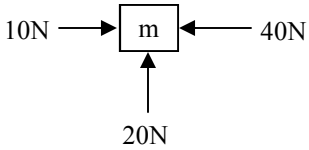


Use the "Connected Objects and Ramps" notes:

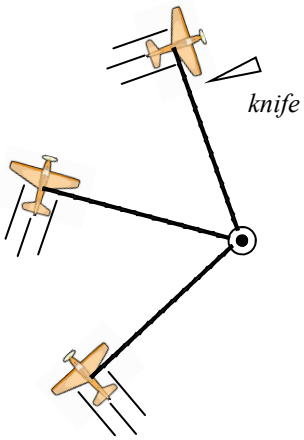
3. A. On the dot, draw a force diagram for the mass.
   B. As the ramp tilts higher, does the normal force increase or decrease?
   C. Decide whether or not the object on the ramp will slide or not. If it will slide, find the acceleration. If it doesn't slide, what additional force is necessary to make it move.



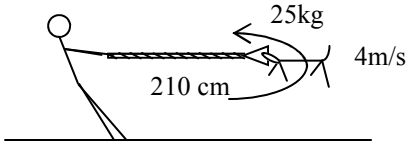
4. Two masses are suspended from a frictionless, massless pulley. Following the "Connected Object and Ramps" notes exactly, calculate the * acceleration and tension in the rope.



5. The diagram shows three forces are acting on an object. We are looking down on it.
   A. Draw and label the direction of the net force.
   B. Draw and label the direction of the acceleration.
   C. Which way is the object moving?

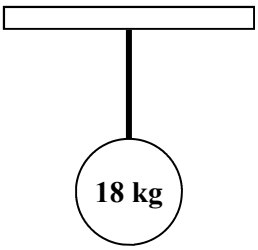


6. A toy plane attached to a rope is flying in a circle around a pole.
   A. What force is holding onto the plane?
   B. For each position draw and label the direction of the plane's velocity and acceleration.
   C. What kind of acceleration is this?
   D. At one point a knife cuts the rope. Draw the path that the plane will follow after the rope is cut.

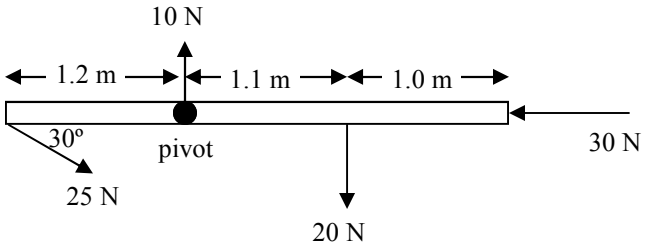


7. Slim Jim's dog Bim has an amazing bite force. While biting onto a rope, Jim twirls him around in a circle.
   A. * Calculate the Bim's acceleration.

   B. Calculate the force keeping Bim in the circle.



8. An 18 kg object is suspended by a rope.
   A. What is the acceleration of the object?
   B. What is the tension in the rope?

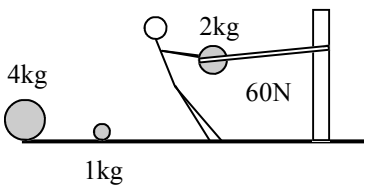


9. Calculate the net force on the lever above.

10. Let's learn how mass and distance affect the gravitational force. In the following table calculate the gravitational force for each of the situations. Leave "G" in your answer. This is for comparison, so you don't need to fully calculate your answer.

Situation	m_1 =	m_2 =	r =	F_g = (keep G in the equation)
1. control	1	1	1	$F_g = G\frac{m_1 m_2}{r^2} = G\frac{1(1)}{1^2} = G\frac{1}{1} = 1G$
2. double the mass	2	1	1	
3. half the mass	1	0.5	1	
4. double the distance	1	1	2	
5. half the distance	1	1	.5	

11. Use the information you just collected to answer the following.
   A. If the distance between two masses doubles, by how much does the force change?
   B. If the mass doubles, by how much does the force change?
   C. If the distance between two masses is halved, by how much does the force change?
   Now, continue the logic:
   D. If one of the masses is tripled, by how much does the force change?
   E. If the distance is tripled, by how much does the force change?
   F. If the distance is 1/3 the original, by how much does the force change?



12. Slim Jim makes a giant slingshot that can provide 60N of force. He launches three objects: 1 kg; 2 kg; 4 kg.
   A. Which mass has the greatest acceleration?
   B. Why?

   C. In the F = ma equation, solve for a.

   D. So the acceleration is proportional to the _____ and inversely proportional to the _____.

Action Reaction: Newton's 3rd Law.

13. What is the reaction force for the following:
    A. Horse pushing on the ground.

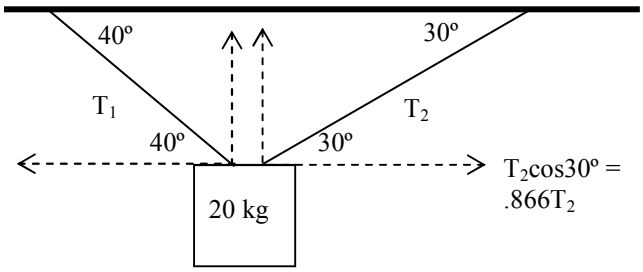
    B. Horse pulling on the harness.

    C. Harness pulling on the cart.

    D. Cart's force on the ground.

Let me see if I can walk you thru this. Have FAITH in the process.

14. A 20 kg object is suspended by two ropes. Calculate the tension in each rope.



A. Since it is suspended, its acceleration must equal what?

I already helped by showing what angles are the same, drawing the x and y components of the tensions, and giving one of the components.

B. On the diagram, follow my example and write the x and y components for each rope.

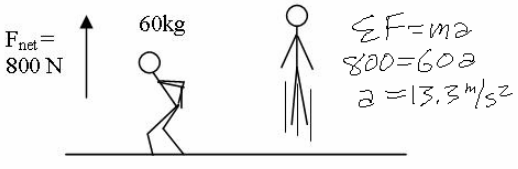
C. Don't forget the force pulling down on the mass.

D. Since it is suspended, the left forces must equal the right forces and the ____ forces must equal the _____ forces.

E. Write horizontal ∑F = ma below.
You will have variables (T_1 and T_2).

F. * Write vertical ∑F = ma below.
You will have variables (T_1 and T_2).

G. You should have 2 equations and 2 unknowns. Solve for both tensions.



$\Sigma F = ma$
$800 = 60a$
$a = 13.3\ m/s^2$

1. * In jubilation, Slim Jim jumps straight up into the air. His net force is 800 N.
   A. What is his weight? 600 N

   B. What is his acceleration? never add to Fnet $F_{net} = \Sigma F$

4 a = 2 m/s²

7A * Calculate the Bim's acceleration.

$a_c = \frac{v_t^2}{r} = \frac{4^2}{2.1} = 7.6\ m/s^2$

14 F. Write vertical ∑F = ma below.
You will have variables (T_1 and T_2).

$T_1 \sin 40^\circ + T_2 \sin 30^\circ = mg$
$.643T_1 + .5T_2 = 200$