Force Problems

1. Draw the free-body diagram of a ball falling without air resistance.

2. Draw the free-body diagram of a ball falling with air resistance.

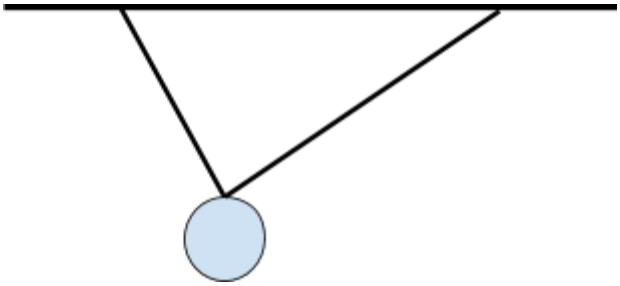
3. Draw the free-body diagram of a mass hanging from a rope.

4. Draw the free-body diagram of a box sitting on an incline plane without friction.

5. Draw the free-body diagram of a box sitting on an incline plane with friction.

6. A box is being suspended in the air by chains attached to each corner. The four chains meet at a single point and continue as one chain above the center of the box. Draw the free body diagram of the point where all of the chains meet.

7. A ball with a mass of 65 kg is suspended by two ropes.The ball is not moving. The shorter rope makes an angle of 60^o with the horizontal support. The longer rope makes an angle of 45^o with the horizontal support. Find the tension in both of the ropes.



8. A block with a mass of 50 kg is being pushed and is moving at a constant velocity. The coefficient of kinetic friction between the block and the ground is .45. What is the magnitude of the force pushing the block?

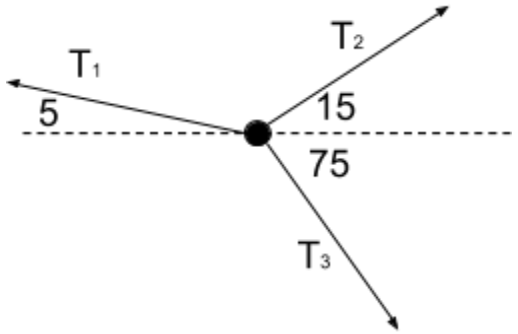
9. A spaceship has a mass of 4000 kg with engines firing in the x and y direction. The x engine exerts a 200 N force and the y engine exerts a 150 N force.
    a. Find the magnitude and direction of the forces from the engine.
    b. Find the acceleration of the spaceship.

10. A ball with a mass of .15 kg is falling through the air with an acceleration of 7 m/s^2, what is the force due to air resistance?

11. A box has a mass of 10 kg and is being dragged across a horizontal floor by a rope with a force of 20 N at an angle of 40^o. If the box has an acceleration of .5 m/s^2, what is the coefficient of kinetic friction between the box and the floor?

12. A crate of toys from Santa's workshop sits on a ramp waiting to be loaded into Santa's magical sleigh. The crate of toys has a mass of 87 kg and the ramp makes an angle of 15° with the horizontal. What is the magnitude of the static friction force that holds the crate in place?

13. A piece of abstract art, as shown below, is hanging on display. If the artwork weighs 545 N and the force along T_1 is 1890 N, what is the magnitude of T_3?



14. A block is sitting still on an inclined plane. The plane is at an angle of 20°. The force of static friction acting on the block is 500 N. What is the mass of the block?
15. A block with a mass of 60 kg is sitting still on an incline plane on a distant planet. The plane is at an angle of 10°. The force of static friction acting on the block is 800 N. What is the gravitational acceleration on this planet?
16. A spaceship lifts off with a force of $22.7 * 10^6$ N. If the spaceship is traveling at a constant velocity and the ship has a mass of 5000 kg, what is the force due to air resistance?