1) The earth (5.98×10^{24} kg) takes 1 year to orbit the sun (1.99×10^{30} kg) in a nearly perfect circle of radius 1.50×10^{11} m. Scientists propose that there is a planet that orbits the sun in a nearly perfect circle with a radius 3 times that of the earth's orbit. How long does it take this planet to complete one orbit around the sun?

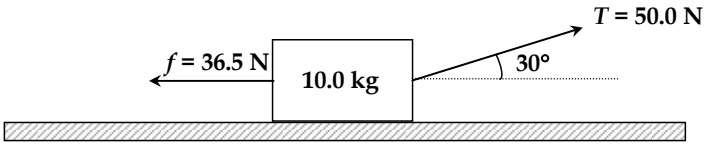
2) A 50 kg person stands in an elevator that is moving down and slowing down at 1 m/s^2.

a) Draw a ***qualitatively accurate*** labeled free body diagram for the forces acting on the person. *Qualitatively accurate* means that the force vectors clearly point in the correct direction and clearly demonstrate which forces are larger, smaller, or if have the same magnitude.

b) To the side of the free body diagram, draw an arrow which clearly indicates the direction of the person's acceleration.

c) Determine the magnitude of each of the forces acting on the person.

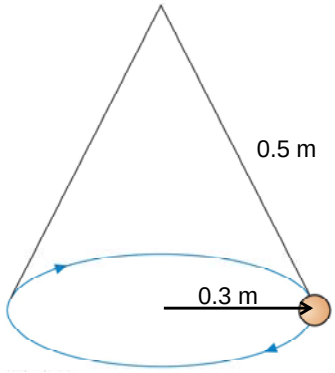
3) A 10.0 kg block is pulled to the right along a rough, flat surface, by a rope. As shown in the figure, the tension T in the rope is 50.0 N and the force of friction f is 36.5 N.



a) Determine the magnitude of the acceleration of the block.

b) Determine the magnitude of the normal force of the floor on the block.

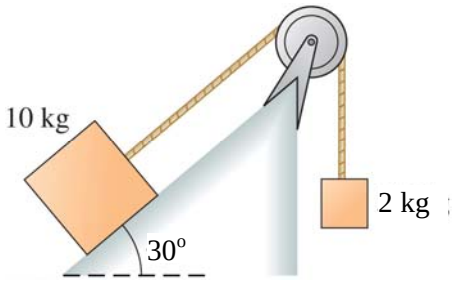
4) A conical pendulum (mass 0.2 kg) attached to a string that is 0.5 m long makes a horizontal circle of radius 0.3 m. The string makes an angle 53.13° with respect to the horizontal.



a) Determine the tension in the string.

b) Determine the speed the mass is moving.

5) The 10 kg block is attached by a light rope over an ideal pulley to the 2 kg mass. The 10 kg block slides down the ramp, which is inclined at 30° with respect to horizontal. Choose **one** of the following to answer; ii) is more challenging than i).



Determine the acceleration of the 10 kg block:
i) if the ramp is frictionless; or
ii) if the coefficient of kinetic friction between the ramp and the block is 0.2.

(bonus challenge question, answer on separate sheet if you choose to try this problem)
A three-star system is given by two stars, each of mass m, both orbiting a fixed central star, also of mass m. The two orbiting stars move in a circle of radius r about the central star, and are located at opposite sides of the orbit, as shown. Determine the period of the orbiting stars, in terms of m, r, and constants.