Answer the following questions. Be sure to show all work. Once you have finished answering the questions, submit your responses to the dropbox.

1. A trained monkey swings a porcupine around by its tail in a horizontal circle. If the speed that he swings the porcupine is doubled (v2 = 2v1), what happens to the tension in the porcupine’s tail?

Compared to the original, the new tension is (circle one):

½ ¼ the same 2x 4x

1. A child swings on a swing as shown to the right.
   1. On the picture, draw vectors representing each force acting on the child at the position shown.
   2. At what point of the path of the swing is the tension in the ropes the greatest? (mark an ‘x’ on the drawing)
2. An astronaut on the space shuttle takes a 3.2 kg stone, attaches it to a 0.6 m rope and swings it in a circle. The stone has a constant speed of 2.3 m/s.
   1. What is the acceleration of the stone? (ignore the acceleration of gravity)
   2. What is the tension in the rope?
3. A space station is designed to simulate gravity by spinning at a constant speed. The plan is for the thing to simulate half of the earth’s gravity (a = g/2 = 4.9 m/s2 ) by spinning around its axis. If the station has a radius of 35 m, with what speed must it rotate to create a centripetal acceleration of 4.9 m/s2?
4. A 1,250 kg car is traveling at a constant speed on a flat surface and makes a right turn with a radius of 45.0 m. Its speed is 15.0 m/s.
   1. What is the magnitude of the force necessary to move the car in a circular path?
   2. Draw a free body diagram of the car (hint: draw the car driving towards you) and clearly label each force.
   3. What, actually, is providing the center-directed force?
   4. Find the minimum coefficient of friction needed to keep the car traveling along the path.
5. A 1.5 kg rock is swung in a ***vertical*** circle of radius 0.75 m.
   1. What is the minimum speed that the rock can have at the top of the circle before it falls from its circular path?
   2. What is the tension in the string if the 1.5 kg rock was moving at 6.12 m/s at the bottom of the circular path?

