Physics 12
Assignment #12
Centripetal Force and Acceleration
Due Thursday, June 9th, 2016

1. Bert is coming home from visiting Ernie when he comes to a bend in the road. The radius of the curve is 130m and he is travelling at 120km/h. a) What is the coefficient of friction between the tires and the road if he is just on the edge of losing control? (Mass is 1500kg)   b) If it is raining and the coefficient of friction is 0.25 what is the maximum speed he can go?

2. The ISS (International Space Station) orbits the Earth at an altitude of approximately 410km. It has a mass of 450 000kg. a) Determine the average speed of the ISS required to keep it in orbit. b) Determine the period of its orbit. (You may have to use some knowledge from way back at the start of the semester)

3. Explain why centrifugal force is fictious.

Practice Problems
4. Helicopter blades are spun at rapid rates and experience large centripetal accelerations. a) Calculate the centripetal acceleration at the tip of a 4.0m long helicopter blade that rotates at 300rpm. b) What is the speed of the blade at its tip? **(3947.84m/s² , 125.66m/s)**
5. A truck tire with 0.42m radius tires travels at 32m/s. At how many radians per second are the tires rotating? What is the rpm? **(80 rad/s, 763.94 rpm)**
6. a) A jet fighter flying at 300m/s makes a turn of 1.85km. What is the centripetal acceleration in gs (related to acceleration of gravity)? b) Suppose the pilot makes an emergency turn to avoid a missile, subjecting himself to a centripetal acceleration of 10gs, while flying at 450m/s. What is the radius of the turn? c) How large is the force exerted on the pilot if he has a mass of 80kg? What type of force is it – besides centripetal force? (Note: Severe damage to the jet would occur at extended exposure to accelerations above 10gs. Also humans will black out at accelerations above 10gs) **(48.64m/s², 2.07km, 0.165MN)**
7. A physics instructor swings a 2kg pail of water in a vertical circle 0.8 m in radius. a) What is the minimum velocity required to keep the water in the pail? b) What is the force of tension at the bottom of the swing at the velocity in part a)? c) What is the maximum time per revolution if the water is not to spill? d) How fast would the pail be rotating if the force of tension at the top of the swing was 40N? **(2.8m/s, 39.2N, 1.79s, 4.88m/s)**
8. A stone attached to a string 1.20 m long is whirled in a horizontal circle. At what speed must the stone move for its centripetal acceleration to be equal to the acceleration of gravity (g)? **(3.43m/s)**
9. An off ramp on a highway is banked at 15°. The radius of curvature is 70m. The road is covered in ice. How fast can a 1400kg go around the curve without losing control? **(13.56m/s)**