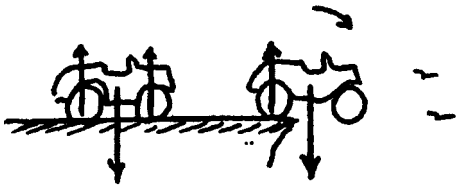
HW#07 Solutions
Physics 107, Gladden, Fall 2006

Solutions to Chapter 8 Exercises

10. Before leaving the cliff, front and back wheels provide the support base to support the car's weight. The car's center of mass is well within this support base. But when the car drives off the cliff, the front wheels are the first to leave the surface. This reduces the support base to the region between the rear wheels, so the car tips forward. In terms of torques, before driving off the cliff, the torques are balanced about the center of mass produced by the support forces at front and back wheels. But when the support force of the front wheels is absent, torque due to the support force of the rear wheels rotates the car forward about its center of mass making it nose forward as shown.



19. In the horizontal position the lever arm equals the length of the sprocket arm, but in the vertical position, the lever arm is zero because the line of action of forces passes right through the axis of rotation. (With cycling cleats, a cyclist pedals in a circle, which means they push their feet over the top of the spoke and pull around the bottom and even pull up on the recovery. This allows torque to be applied over a greater portion of the revolution.)

24. A rocking bus partially rotates about its center of mass, which is near its middle. The farther one sits from the center of mass, the greater is the up and down motion as on a seesaw. Likewise for motion of a ship in choppy water or an airplane in turbulent air.

26. The long drooping pole lowers the CG of the balanced system the tightrope walker and the pole. The rotational inertia of the pole contributes to the stability of the system also.

46. In accord with Newton's first law, at every moment her tendency is to move in a straight-line path. But the floor intercepts this path and a pair of forces occur; the floor pressing against her feet and her feet pressing against the floor Newton's third law. The push by the floor on her feet provides the centripetal force that keeps her moving in a circle with the habitat. She sense this as an artificial gravity.

52. Soil that washed down the river is being deposited at a greater distance from the Earth's rotational axis. Just as the man on the turntable slows down when one of the masses is extended, the Earth slows down in its rotational motion, extending the length of the day. The amount of slowing, of course, is exceedingly small. (Interestingly, the construction of many dams in the Northern Hemisphere has the opposite effect; shortening our days!)

Chapter 8 Problem Solutions

2. The linear speed, more correctly, *tangential speed distance*/*time*, will be the circumference of the Ferris wheel divided by the time for one revolution, 30 s. From geometry, the circumference = $2\pi r$ = 2(3.14)(10 m) = 62.8 m. So the linear speed v = (62.8 m)/(30 s) = **2.1 m/s**.

5. The mass of the stick is 1 kg. (This is a "freebie," see Check Yourself question and answer in the chapter!)

6. (a) Torque = force × lever arm = (80 N)(0.25 m) = **20 N m**.
   (b) Force = 200 N. Then (200 N)(0.10 m) = **20 N m**.
   (c) Yes. These answers assume that you are pushing perpendicular to the wrench handle. Otherwise, you would need to exert more force to get the same torque.