Rotation Homework Problems:
p. 91: #1, 3, 4, 5, 6, 16

Problems taken from the school's old textbook:

Giancoli, D. (1980). *Physics*, 2nd Ed. Englewood Cliffs, NJ: Prentice Hall.

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1. A child moves with a speed of 1.80 m/s when 12.4 m from the center of a merry-go-round. Calculate
   a) The centripetal acceleration of the child.
   b) The net force exerted on the child (child's mass = 25.0 kg).

3. Calculate the centripetal acceleration of the earth in its orbit around the sun and the net force exerted on it. What exerts this force on the earth? Assume that the earth's orbit is a circle of radius 1.50×10^{11} meters, and that the earth's mass is 5.98×10^{24} kg.

4. A horizontal force of 26.0 N is applied to a 0.60-kg stone to keep it rotating in a horizontal circle of radius 0.40 m. Calculate its speed.

5. What is the maximum speed with which a 1300-kg car can round a turn of radius 95 m on a flat road if the coefficient of friction between tires and road is 0.55? Is this result independent of the mass of the car?

6. How large must the coefficient of friction be between the tires and the road if a car is to round a level curve of radius 62 m at a speed of 55 km/h?

16. What must a curve with a radius of 60.0 m be banked at (i.e. what is the banking angle) for a car traveling at 60 km/h? Remember, banked curves are designed so that for a given speed, NO fricition would be require to safely get around the corner. (Although not required, a more interesting, and difficult problem, would be to determine what the coefficient of static friction needs to be for a car not to skid when traveling at 90 km/h around this same curve, banked at the angle you determine in solving this problem).

ANSWERS:

1a. 0.26 m/s^2 inward toward the center of the merry-go-round
1b. 6.53 N inward toward the center of the merry-go-round
3. 5.95×10^{-3} m/s^2 towards the sun; 3.56×10^{22} N towards the sun; the force of gravity between the earth and the sun provides the force acting on the earth.
4. 4.16 m/s
5. 22.6 m/s; yes, the result is independent of the mass of the car since mass cancels out in the solution. This implies that all objects, no matter their mass, are limited to the same speed when rounding the corner.
6. .384
16. 25.3^o; if you accepted the challenge of the second part of this problem, μ_{static} = .393