Centripetal force ($F_c = ma_c = mv^2/r$) WS2

1. Identical triplets (m = 25 kg) are sitting on a merry-go-round. One is at the center, the second is 1 meter from the center and the third is sitting on the outside which is 2 meters from the center. If the merry-go-round takes 5 seconds to go around, how much is centripetal force on each child? A: 0 N or undefined
B: 39.8 N
C: 78 N

$V_T = \frac{2\pi r}{T}$

2. A car is going around a curve at 27 m/s. If the radius of the curve is 50 m and the car has a mass of 1000 kg, what is the force of friction needed to prevent the car from skidding?

F = 14,580 N

3. A stopper tied to the end of a string is swung in a horizontal circle. If the mass of the stopper is 13.0 g, and the string is 93.0 cm, and the stopper revolves at a constant speed 10 times in 11.8 s,
   a. what is the tensional force on the string? F = 3.4 N ($V_T = 4.95$ m/s), ($a = 26.4$ m/s^2)

   b. what would happen to the tension on the string if the mass was doubled and all other quantities stayed the same? doubled

   c. what would happen to the tension on the string if the period was doubled and all other quantities stayed the same? 1/4

proof: $V_T = \frac{2\pi r}{T}$ $F_c = \frac{mV_T^2}{r}$

$F_c = m\frac{(2\pi r)^2}{T} = \frac{m4\pi^2 r^2}{r \cdot T^2} = \frac{m4\pi^2 r}{T^2}$

F_c is proportional to V_T^2, so if you double T, F_c is 1/4 the original $(1/2)^2 = 1/4$

4. A rock of mass 400 g is tied to one end of a string that is 2.0 m in length and swung around in a circle whose plane is parallel to the ground. If the string can withstand a maximum tension of 4.5 N before breaking, at what speed is the rock traveling just as the string breaks? 4.7 m/s

Torque ($\tau = F \times r$ → Units are Nm)

1. A force of 15 N is applied to tangentially to a tire that has a radius of 0.5 m. What torque is applied? 7.6 Nm

2. If you can only apply 35 N of force, how long must a wrench be to remove a screw with 35 Nm of torque? 1 m

3. Why is it difficult to open a door if you try to push close to the hinge? Smaller r, so you need to exert more force