

**Circular motion:**

18. A 2 kg box is placed on the floor at the edge of a merry-go-round of radius 6 m. The coefficient of static friction between the box and the floor is 0.3. The merry-go-round accelerates from rest and eventually the box slides off the edge. Determine the speed at which this occurs.
19. Tarzan (mass = 80 kg) tries to cross a river by swinging from a 9-m long vine. His speed at the bottom of the swing (as he just clears the water) is 7 m/s. Tarzan doesn't know that the vine has a breaking strength of 1000 N. Does he make it safely across the river? Be sure to justify your answer.
20. A cup of water is being swung in a vertical circle of radius 1.2m. At what minimum speed must the cup of water be traveling when upside down at the top of the circle if the water is not to fall out?
21. A 40-kg child takes a ride on a Ferris wheel that rotates four times each minute and has a radius of 9 m.
- What is the magnitude of the centripetal acceleration of the child?
  - What force (magnitude and direction) does the seat exert on the child at the lowest point of the ride?  
Draw an arrow to show the direction.
  - What force (magnitude and direction) does the seat exert on the child at the highest point of the ride?
22.  $m = 0.1$  kg,  $M = 0.4$  kg. Mass "m" revolves in a circle of radius 1 meter on a frictionless horizontal table. The suspended mass "M" remains in equilibrium while the mass "m" on the tabletop revolves.
- What is the tension in the string?
  - What is the centripetal force required to keep the mass "m" in this circular motion?
  - What is the speed of the mass "m"?

