

10/4 In Class—Universal Gravitation and More Circular Motion

1. A child of mass 25kg rides on a merry-go-round. The child is 0.5 meters from the center of the merry-go-round, and it goes at a constant angular speed of 5rpm. What is the centripetal acceleration? (rpm means revolutions per minute. Can you figure out how to convert it to radians per second? And then how to get speed from that? or you can go in one step from rpm to speed using distance over time.)
2. What is the gravitational force between the earth and the sun? (Look up the masses and distance you need.)
3. A satellite of mass 5000kg orbits the earth at a distance of 0.5 earth radius above the surface of the earth. What is the speed required to keep the satellite in uniform circular motion around the earth? (You will need to look up the mass and radius of the earth.)
4. Three masses are arranged as follows: $m_1 = 4\text{kg}$ is located on the y-axis at $y = 4\text{m}$, (or $(0, 4\text{m})$), $m_2 = 5\text{kg}$ and is located at $(4\text{m}, 4\text{m})$, and $m_3 = 2\text{kg}$ is located at the origin, Find the force on m_3 (the 2kg mass) due to only the other two masses. Hint: find the force on m_3 due to m_1 , then the force on m_3 due to m_2 and add. Remember all the forces are vectors!
5. Look up the mass and radius of the moon. Calculate \vec{g} for the moon. Is it about 1/6 that of earth?
6. Tetherball:
A tetherball of mass 0.4kg is attached to a rope of length 1.5m. The ball is hit so that it moves at constant speed in a circle around the pole. The rope makes an angle of 20° with respect to the pole. (Assume the rope is free to move and does NOT wrap around the pole.)
 - (a) Draw a free body diagram for the tetherball.
 - (b) What is the tension in the rope?
 - (c) What is the speed of the tetherball?

