Circular Motion: The Carousel

Getting started

- Chrome- Google "Walter Fendt"
- Select "Java Applets on Physics (Java 1.4)"
- Under the list of mechanics simulations, select "Carousel (centripetal force)"

The graphics are crude, but there are valuable observations to be made from them.

Run the simulation

1. Think about the variables we have been using in circular motion calculations over the last week. What variable (i.e. what letter) do you associate with
    a. period
    b. distance between suspensions an axis of rotation

2. Using the simulation's default settings, calculate
    a. the frequency of the ride

    b. the linear speed of the swings

    c. the centripetal acceleration of the swings

    d. the centripetal force acting on the swings

Be sure to show all of your work.

3. Sketch a free body diagram for one of the swings. Label the magnitudes of the forces you know as well as what causes the forces.

4. The ropes suspending the swings serve two purposes force-wise. What are they? [Hint: the tension has an x-component and a y-component to it. What functions do these forces provide?]

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5. Vary the period from 2s to 10s.
    a. What is the relationship between period and linear speed – direct, inverse, or none? Why does this make sense?

    b. What is the relationship between period and the angle at which the swings hang from the carousel – direct, inverse, or none?

6. As you decrease the period of the motion, what happens to the centripetal force? Explain why.

7. What affect does the above change in centripetal force have on the free body diagram? Sketch a new one to represent this situation. How is this different from what you drew in #3?

8. Think about the free body diagram you just drew.
    a. Is the swing in equilibrium in the vertical direction? Explain.
    b. Is the swing in equilibrium in the horizontal direction? Explain.
    c. How can you use these ideas to determine the tension *(both magnitude and angle)* of the rope suspending the swing?