

## Pirate Ship Swing Ride Physics

Names:

Using the Pirate Ship simulation program

Tasks:

1. On some rides, which seat you get can affect your ride. Is there any variation in the g-forces experienced by our three riders? Is this difference significant? Are there other aspects of this ride which vary based upon your seat selection?

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2. When swinging freely, when does the ship have the greatest speed? When does it have the least speed?

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3. When the ship is swinging freely, when do the riders have the greatest centripetal acceleration due to their circular motion? When would they be likely to experience the greatest g-forces?

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- Restart the ride and have it do small swings. Determine the period of oscillations ; it may be helpful to examine the g-force graph and determine the time between cycles of maximum g-force (clicking on the graph displays the "time location" of the cursor). Does this result agree with the theoretical value for the physical pendulum?

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- How does the size of the swings (i.e. the amplitude) affect the period of the swings? Try going from small swings to swings that nearly carry the ship all the way around. (Try making a table of period vs Amplitude)

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6. Try to estimate the torque produced by the drive by using the Work energy theroem. The work done by a constant torque is  $W=\tau\Delta\theta$ . Note the angular width of the entire ship is about  $60^\circ$  which is about 1 radian. The ship's mass in the simulation is 5000 kg. Hint: try figuring out how many "pushes" it takes to get the ship to swing up  $90^\circ$  so that its height from its lowest position is 14 m (the work will be equal to  $mgh$  where  $h$  is the length of the pendulum).

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