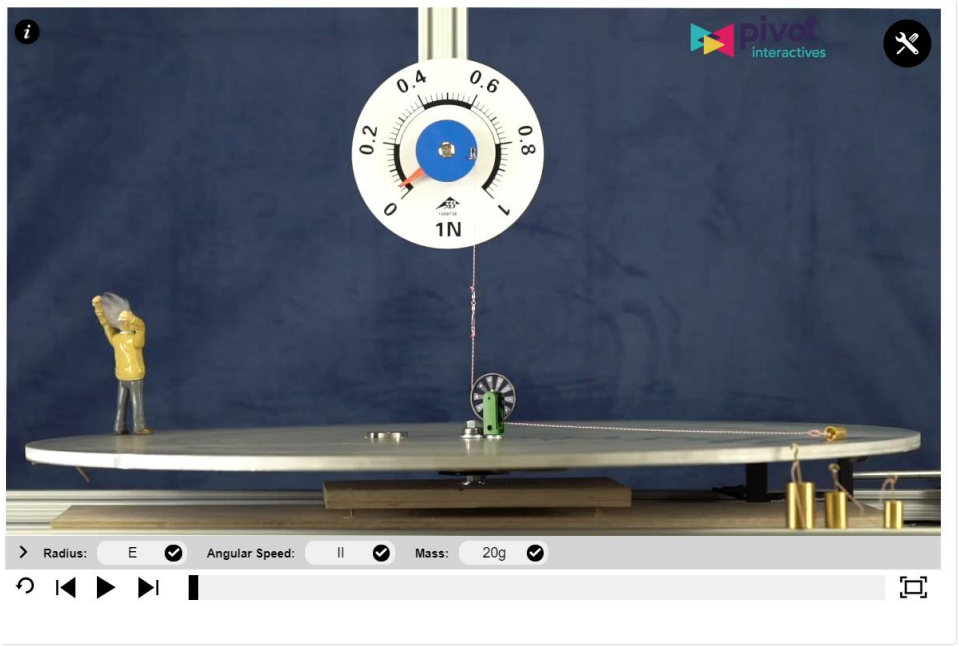
Pivot Interactives Exploring Forces in Circular Motion

Purpose: To determine the dependence of the force necessary to keep an object in circular motion on mass, angular velocity and radius.

Access the Pivot Interactives lab "Exploring Forces in Circular Motion I". For this lesson we will be using the video and measurement tools, but we will be using an Excel spreadsheet for the analysis.

Scroll down to "Part I: Videos and Tools" and then expand that section. You will see this:



Expand the bar on the bottom of the video window in which settings for radius, angular speed and mass are available. By running the video for different settings of radius and angular speed and using the ruler and the stopwatch in the toolbox (located in the upper right hand part of the video), determine what radius and angular speed settings are available.

Choose a radius that is near the middle of the available settings, and an angular speed that is also near the middle of the available settings. Then read the forces required to keep each of the available masses in circular motion by reading them from the spring scale in the video. Open a spreadsheet in which you have columns for mass (in kg) and force. Make a plot of your data points and fit with a polynomial trendline. Is your plot linear? Or does it require a higher power polynomial. Print the equation of the trendline on your plot. The copy the plot into a Microsoft Word document and answer the above questions underneath that plot.

For the next part, keep the angular speed at the value you used in the previous part and choose either a 0.10 kg or 0.20 kg mass. Now vary the radius over all the available values. Plot the

force against the radius using the spreadsheet, and fit a polynomial trendline. Is this plot linear, or does it require a higher power polynomial? Print your trendline equation in the plot. Then copy the plot into your Word document and answer the questions in this paragraph underneath it.

Finally, keep the mass you used in the previous part and select a radius near the middle of the range. Now vary the angular speed over the entire available range. Plot the force against the angular velocity using the spreadsheet, and fit a polynomial trendline. Is this plot linear, or does it require a higher power polynomial? Print your trendline equation in the plot. The copy the plot into your Word document and answer the questions in this paragraph underneath the plot.

You have now determined whether the force required to keep an object moving in a circular path (that is, the centripetal force) is linearly dependent on the mass, the angular velocity and the radius, or whether there is a higher order polynomial dependence on one or more of those quantities. Once you decide, write an expression for the centripetal force by multiplying each of the quantities you have measured with the appropriate power. Once you've done so, check your equation against what is in your text (or you can even google it).

Write down your equation in your Word document and submit it via Canvas.