



Part 1 – Warm-up

1. For $f(x) = \cos(x)$,
 - a. What is the range?

 - b. What is the amplitude? $A =$

 - c. What is the period? $T =$

2. For $y = A \cdot \cos(B \cdot x) + C$,
 - a. Describe the effect of increasing A .

 - b. Describe the effect of increasing C .

 - c. Describe the effect of increasing B .

3. What is the relationship between B and the period, T ? Explain how the graph on page 3.2 confirms this.

4. If a positive D shifts the graph to the right D units, what is the general sinusoidal equation for which this is true?

5. Explain what happens to the graph on page 3.4 when you move the slider to the right. Reconcile this with your answer on page 3.3.

6. To put this all together, move your cursor over $y = \cos(x)$ near the x -axis on page 3.5. When the vertical and horizontal arrows appear, grab and move the function. Describe the effects to the function as you move the function up and to the right. Click to release the graph. Now grab the graph near a peak and move it. How does this change the function?



Part 2 – Collect & Analyze Data

On page 4.1, read the instructions. Using the skills reviewed in the warm-up, write a cosine function that models the data collected. Estimate the amplitude and period and phase shift, D , to the nearest tenth. If a motion detector is not available, advance to page 5.1 and graph a function to model that data. To collect data, complete the following steps:

- Plug the motion detector into the mini USB. Auto Launch will occur.
- Select to open the data collection in a *Graphs & Geometry* page. If **(menu)** is pressed, there are new options. To toggle off of this press **(ctrl) + (tab)**. Use **(tab)** to navigate within the Data Collection Console. Repeatedly press **(tab)** until the play button is highlighted. If this application is closed, you can reopen it by pressing **(ctrl) + [D]**, or remove and reinsert the mini USB cord.
- Position the motion detector so that it is facing the pendulum, swing the pendulum, and press play.
- If your data doesn't look sinusoidal, press play again to repeat the trial. After selecting to discard the previous data, real-time data collection will begin again.
- When satisfied with your data, press **MENU > Experiment > Display Data In > New Lists & Spreadsheet**. Repeat this and choose **New Data & Statistics**.
- Model the data with a function. Derive the velocity and acceleration equations.

Record your position, velocity and acceleration equations for your experiment data here:

$y =$

$v =$

$a =$

Confirm your position and velocity equations by graphing them. To confirm your velocity equation using a *Graphs & Geometry* page, enter your equation in $f1(x)$, select **MENU > Graph Type > Scatter Plot**, and change the data for y to $dc01.vel1$. If you choose a *Data & Statistics* page, click the vertical axis, select $dc01.vel1$, and select **MENU > Analyze > Plot Function** to plot your velocity equation.

On page 5.2, you will see a distance-time graph for another set of data. Model the data with a function. Then, use calculus to derive the velocity and acceleration equations. Confirm your position and velocity graphs the same way you did for the experimental data.

$y =$

$v =$

$a =$