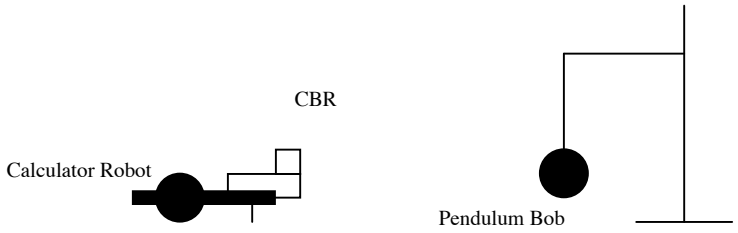
The Robot meets the CBR

In this activity we will combine the calculator robots, CBRs, and pendulum motion to model a sinusoidal wave with a bit of an added feature.

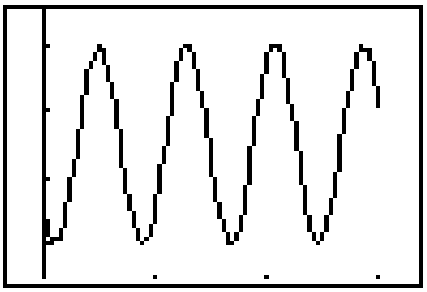


For this activity you need:

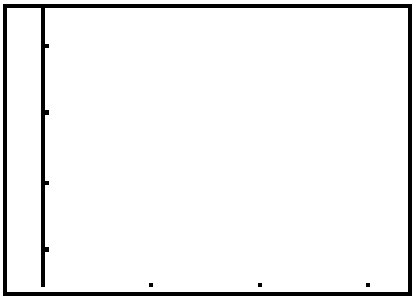
1 Calculator Robot	**1 CBR**
1 TI Calc w/ link cable	**1 Pendulum set-up**
CBL/CBR APP	**Robot Program**

Overview:

If you were to set the pendulum in motion and set the ranger down to collect position vs. time data, the graph should look something like this.



What if we were to set the pendulum in motion, have the robot move away from the pendulum at a constant rate, and put the Ranger on top of the robot to collect the same data as it moved away?? What should the position vs. time graph look like?



Procedure:

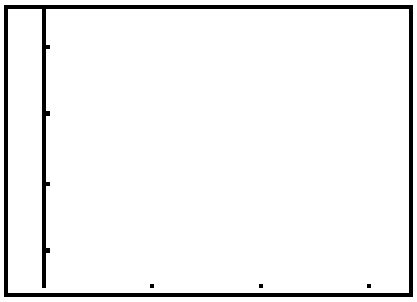
1. CBR SET-UP. Set the Ranger to collect data for 5 seconds and to use the TRIGGER to begin data collection. Get to the screen that directs you to detach the Ranger and do so.

2. ROBOT SET-UP. Create a Robot control program that causes both wheels to move forward for at least 5 seconds. The specific duration value will depend on your robot, so test it out.

3. Place your robot (facing away) .5 meters from the pendulum *when it will swing to its closest point.* Run the program to test the direction and duration and make adjustments as necessary.

> *****There are many variables that could affect the quality of your data. You will need to adjust for time, direction, height of pendulum, length of pendulum swing, angle of CBR sensor. These will all depend on your individual set-up so be prepared to experiment until you get a decent data set.**

4. Draw a sketch of your data in the space provided and compare it to your original sketch.



Analysis:

If you think of "normal" sinusoids as being wrapped around, or centered-on the x-axis, this graph is wrapped around a diagonal line.

1. Use trial and error to draw this line and record your equation in the space below:

> **Equation of wrapping line:_____**

2. If we use the model y = a cos (b(x-c)) + d to model this data, what is the value of d?

3. Calculate the values of a, b, and c

a= **b=** **c=**

4. Enter your equation, along with the values of a, b,c, and d into your y= menu and graph your fit.

Teacher Check:_____

Questions

1. If you could slow down or speed up the ROBOT, how would that change the graph?? Justify your answer.

2. If you made the string on the pendulum longer, or shorter, explain the changes that you would observe in the data and justify your explanation.

3. If you have time, look at the ROBOT fact sheet and slow down the forward speed of your robot, lengthen the data collection time on your CBR, and collect another set of data. *Don't forget to save your original data first!!