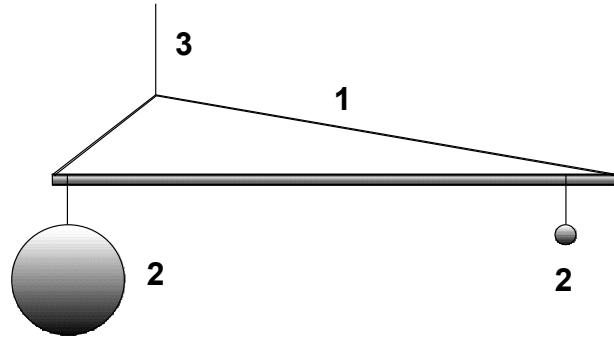




## The Mathematics of Rotating Objects (Extra-Solar Planets)

### Materials

- Tube (from clothes hanger)
- String or thread
- Baseball or grapefruit
- Super ball or Styrofoam ball (about 1 inch)
- 4 Paper clips
- Camcorder with cables to VCR
- VCR with tape

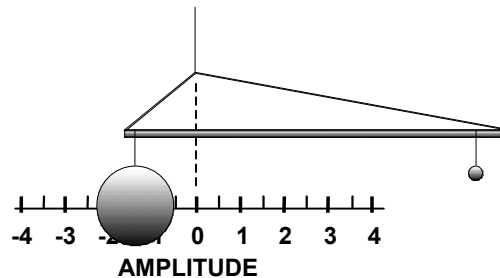


### Constructing the apparatus

1. Thread string through the tube by straightening a paper clip, tape the string to it, and dropping it through -- the clip will pull the thread through the tube. Tie off the string into a loop as shown above.
2. Attach both weights near each end -- one very small to represent a planet; the other very large one (baseball) represents the star. Eyehooks using paper clips make this easier.
3. Make a smaller loop through the first -- this helps locate the center of mass on the first string -- which is the axis around which both masses rotate. NOTE: don't tie off tightly; the second loop must slid freely.
4. Hang the second loop.

### Procedure

1. Find the center of mass --so the tube hangs horizontally -- by sliding along the first loop, and slowly rotate the apparatus on the axis of the vertical line.
2. Affix the amplitude scale on a whiteboard behind the apparatus and videotape the rotation on a camcorder.
3. Transfer the camcorder video onto a VHS tape.
4. Play as follows:
  - a. Frame-by-frame (some VCR's can do this); OR
  - b. One student observes the playback counter while another observes the amplitude and reads the measure out loud. A third student records these data.
5. Transfer the data onto a data sheet (reverse side) and connect the points to get a graph; OR
6. Record the data points onto a spreadsheet program that can draw the graph. NOTE: observe only one edge of the ball (L or R) for all observations.



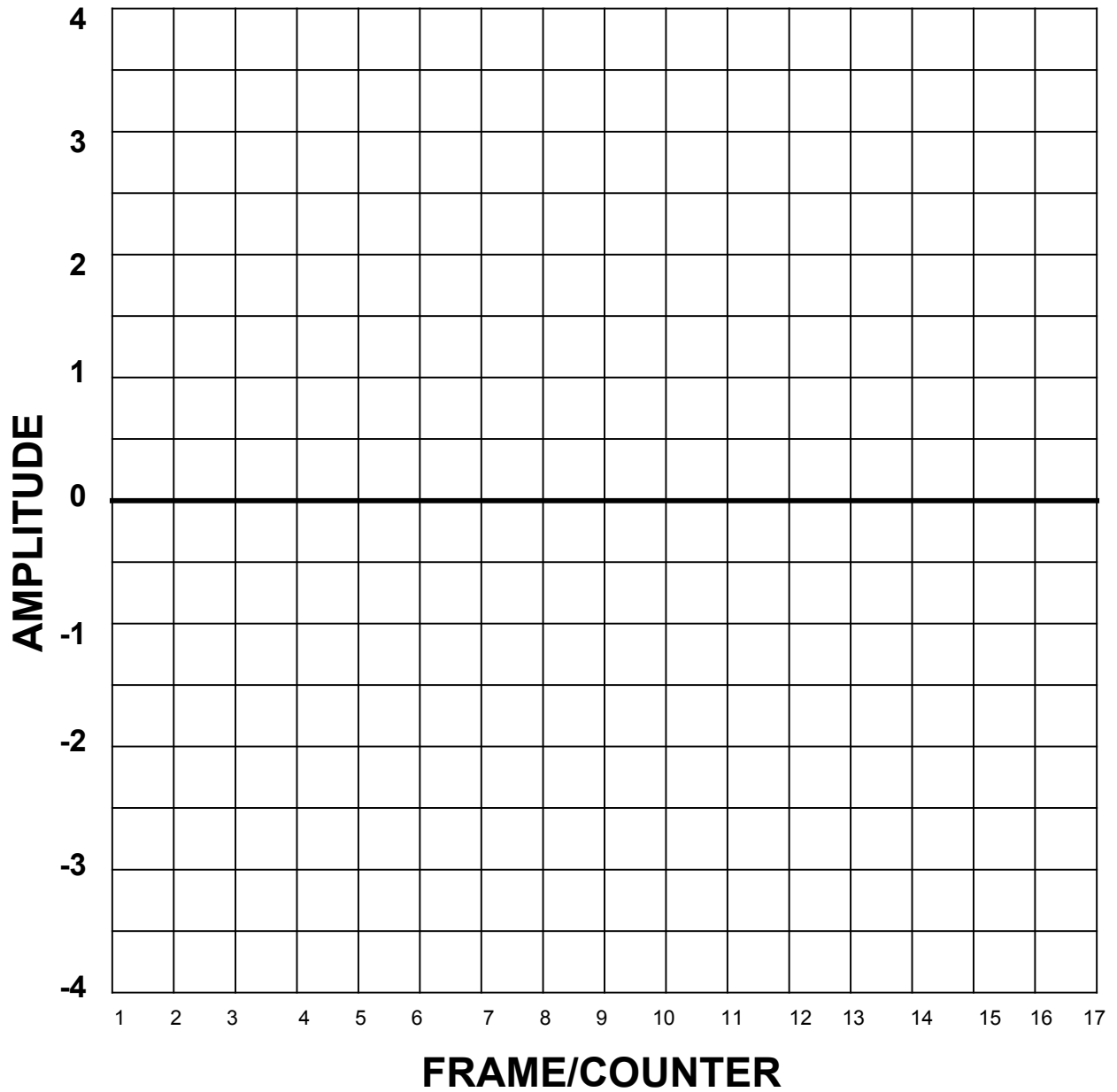
The graph should be a sinusoidal (sine) wave, something that occurs frequently in nature.

### NCTM Standards (Content)

- Collecting, Representing, and Interpreting Data Using Spreadsheets and Graphing Software (Grades 3 – 5)
- Using Graphs, Equations, and Tables (Grades 9 - 12)

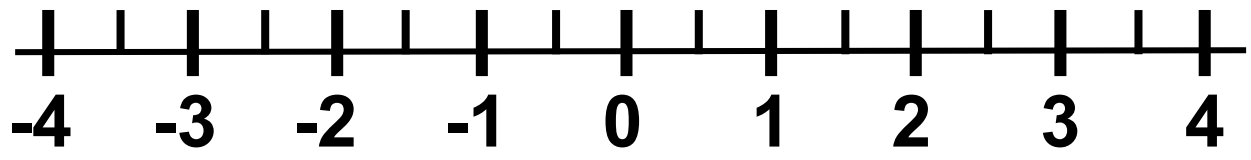
### NCTM Standards (Thematic)

Strategies for eliciting student understanding of mathematical concepts that encourage the use of multiple modalities, learning methods and assessment tools. Objects that can be moved and rearranged and that require the processing and analysis of three-dimensional quantitative information are advised.



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**AMPLITUDE**