



North Carolina
School of Science
and Mathematics

Swinging into Parametric Equations

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The NC School of Science and Mathematics

NCTM Regional Conference

Minneapolis, MN

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School of Science
and Mathematics



About North Carolina School of Science and Mathematics

NCSSM is the nation's first public residential high school focused on science, technology, engineering and math. Through a residential campus, extensive online offerings, and summer STEM enrichment programs, we challenge and inspire talented students from across the state.



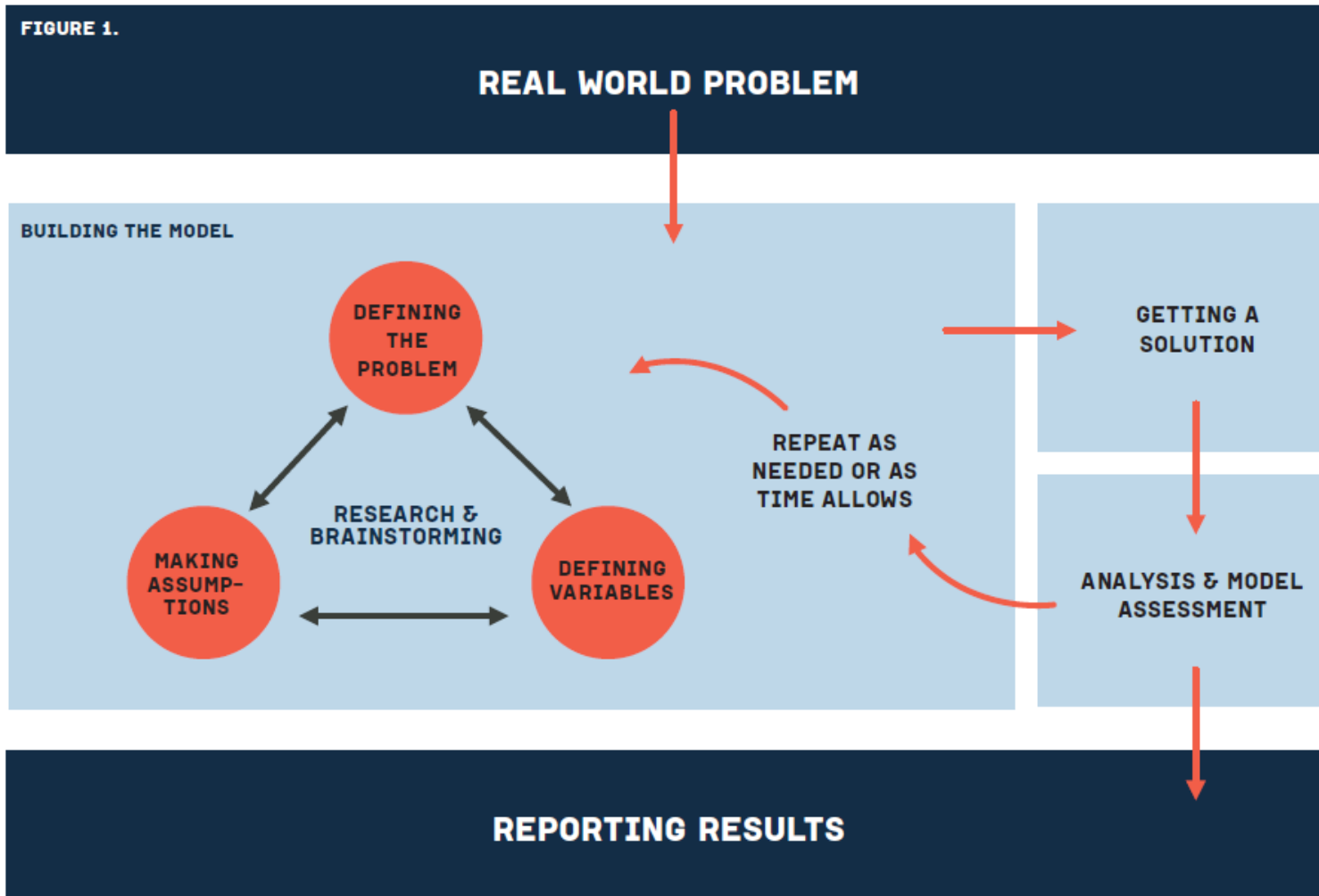
Goals for the Session

- Introduce the modeling project and parametric equations
- Demo data collection via LoggerPro
- Create models for the collected data
- Analyze and assess the models
- Share resources for other projects



Modeling Cycle

From *SIAM Modeling Guidebook: Getting Started, Getting Solutions* Fowler, Bliss, Galluzzo





Watch the Swing Video

What questions do you have as you watch the video?





LoggerPro Demo

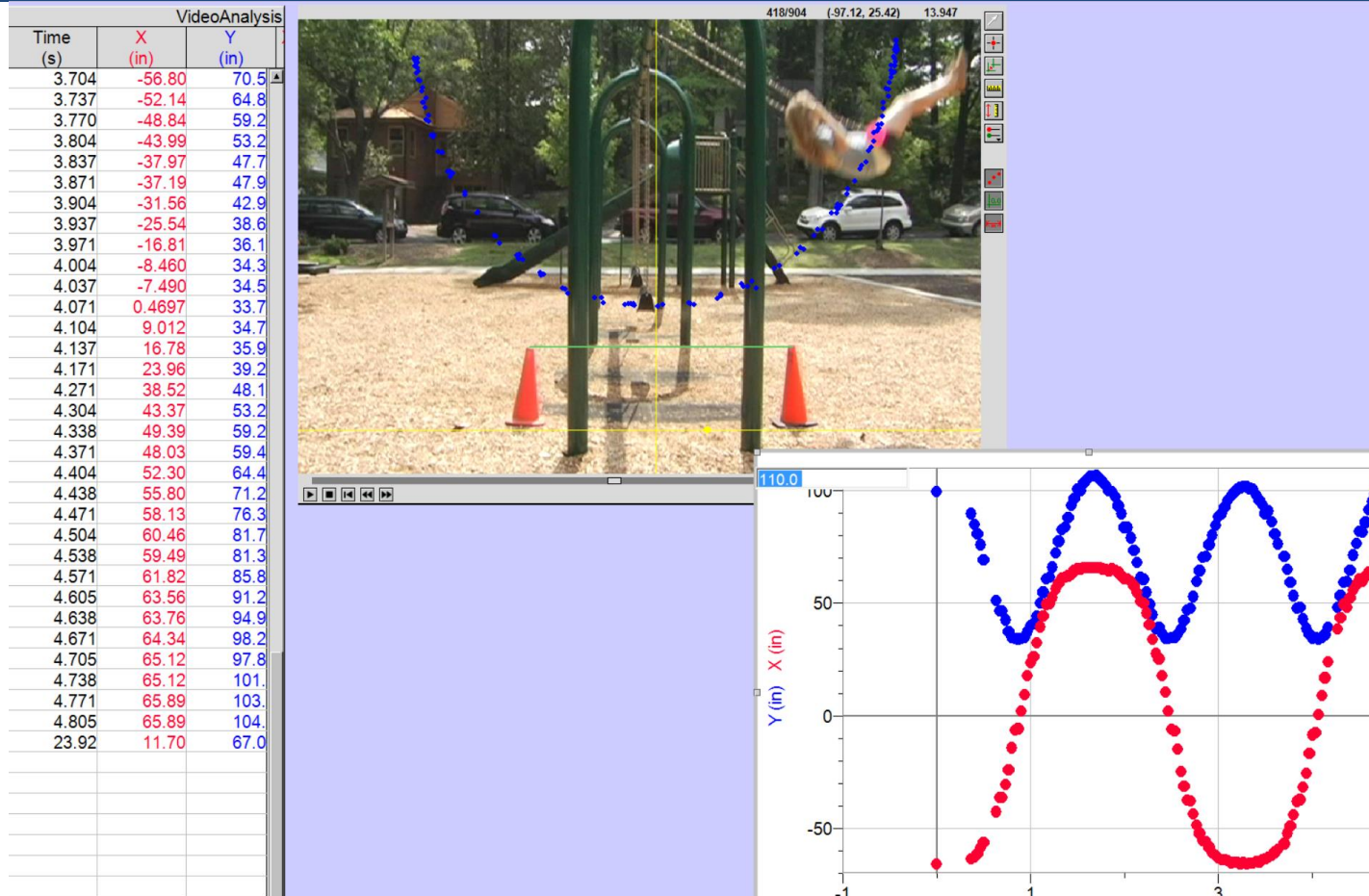
Logger Pro is a tool used to capture data from a video (or probes).

My data will be shared in other forms for your use.

Let's see how to capture the data...



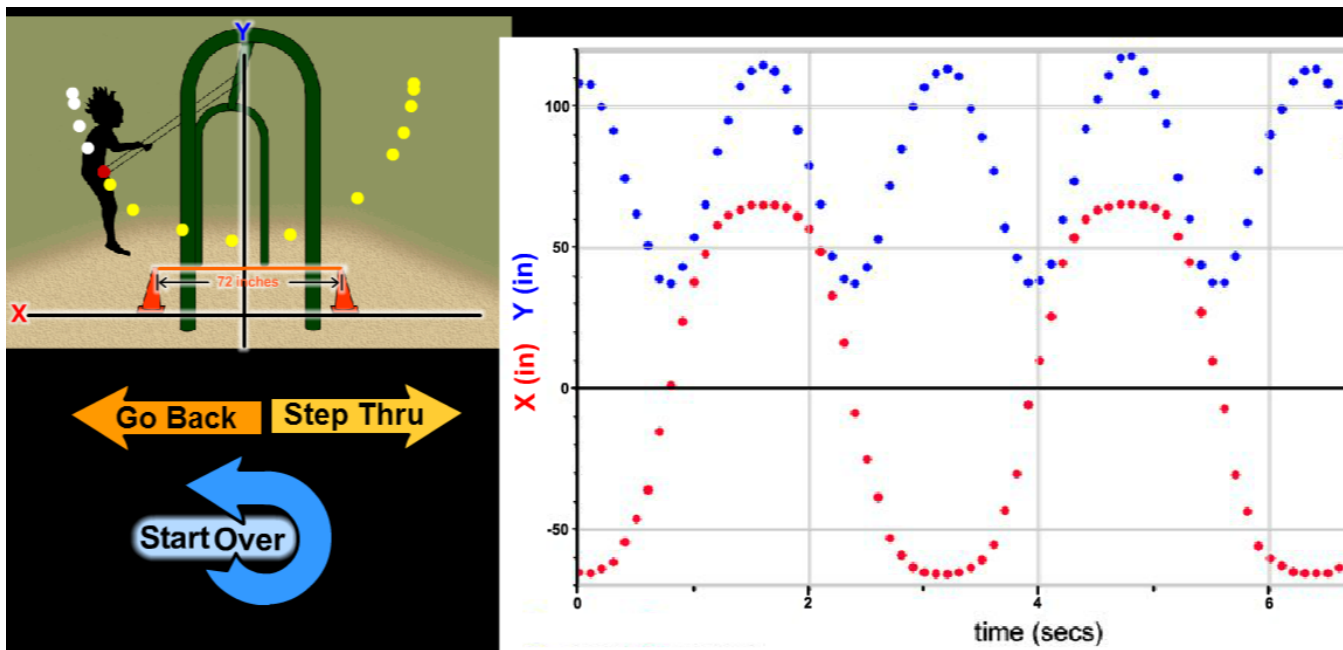
Multiple Representations!





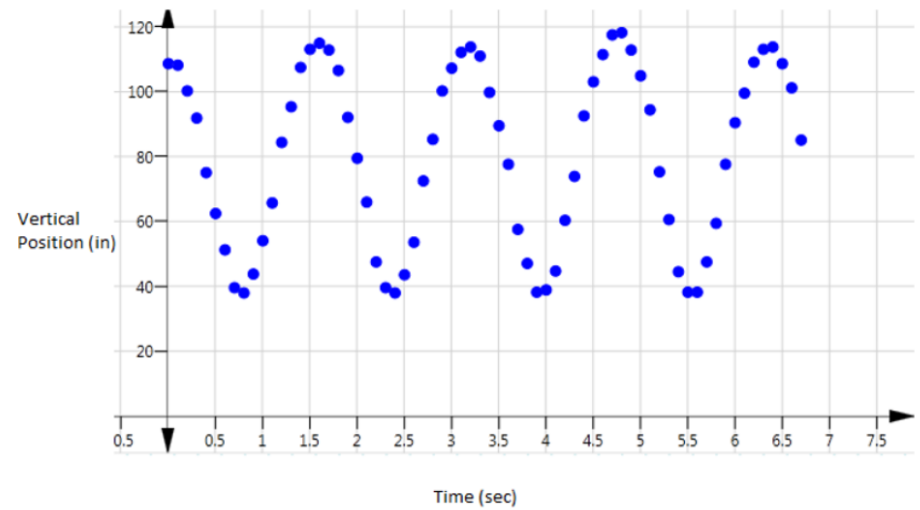
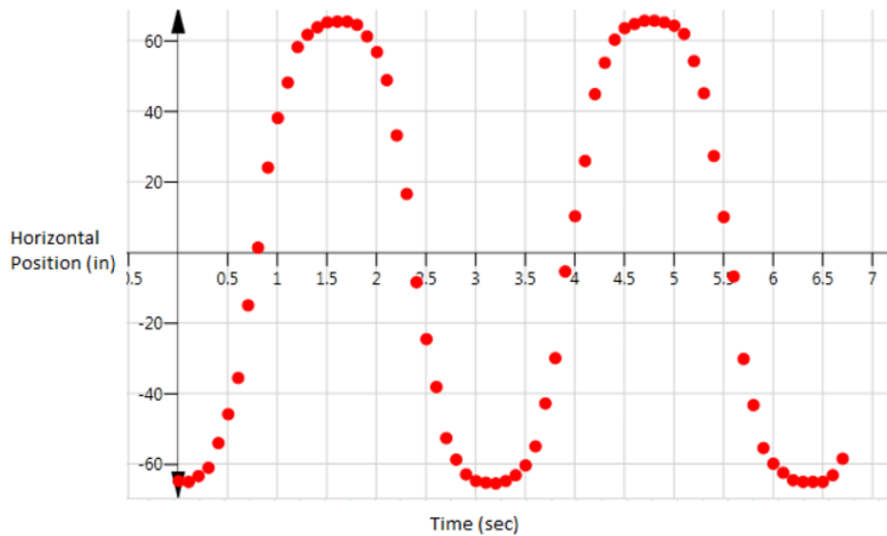
Explore the motion via an animation

<http://www.dlt.ncssm.edu/AFM/lessons/sldox/SwingAnim.html>





Graphs of the Data





Creating Models

We will use our knowledge of trigonometric functions and transformations of functions to find models.

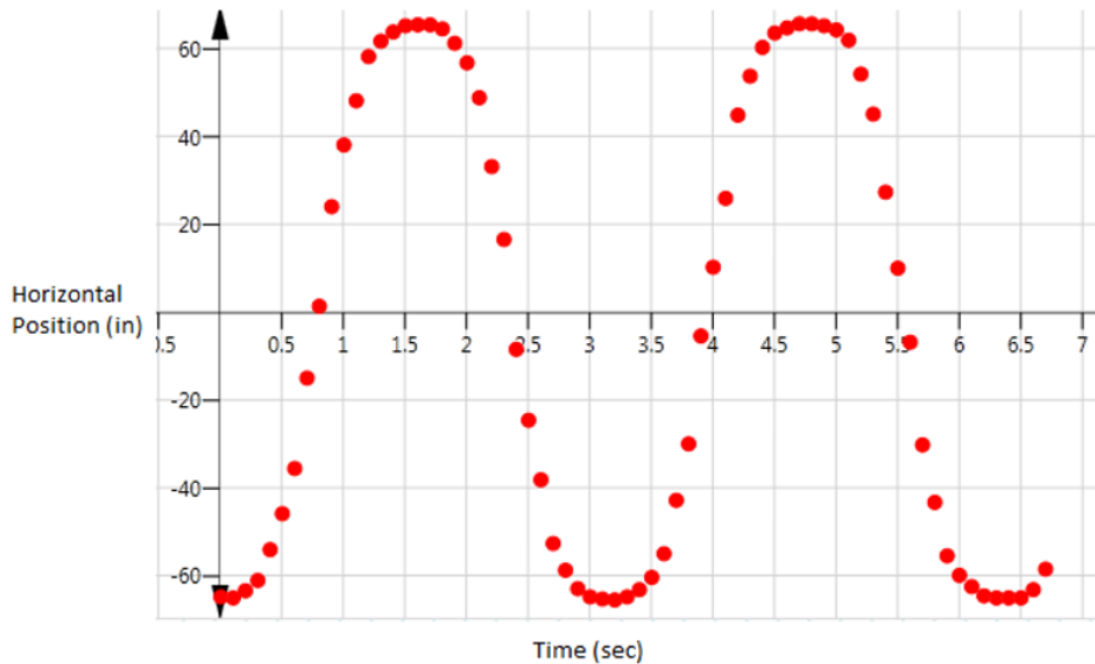
Let's do it together...





Horizontal Model

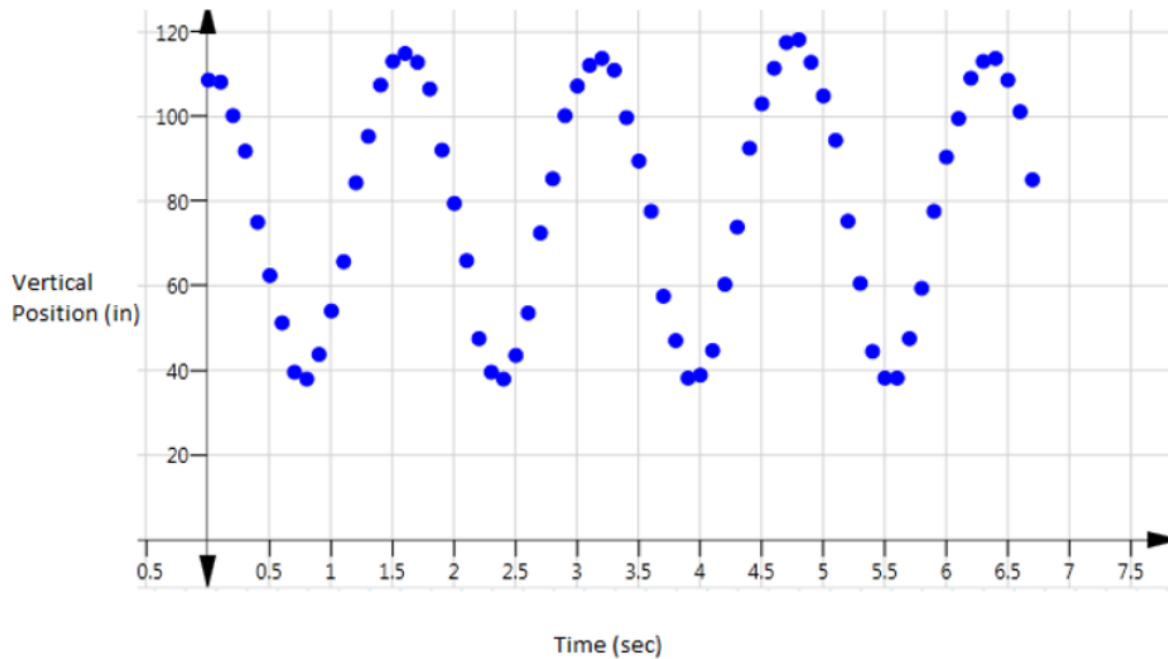
Finding a model for the horizontal position of the swinger





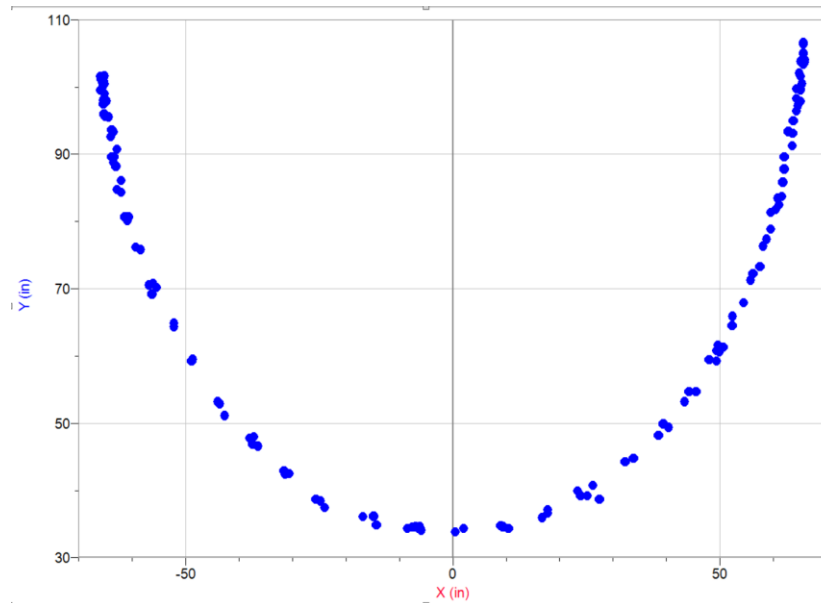
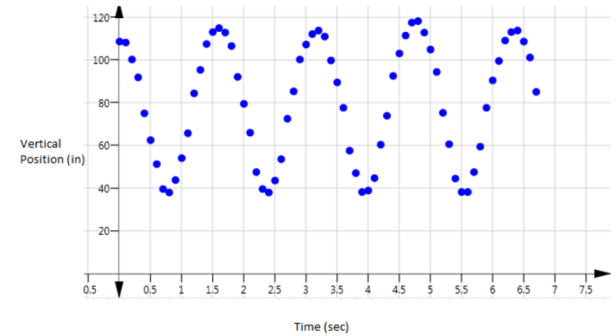
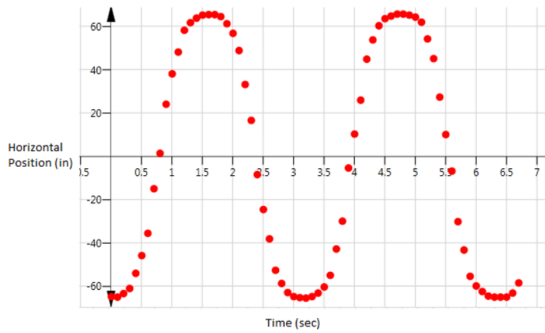
Vertical Model

Finding a model for the vertical position of the swinger



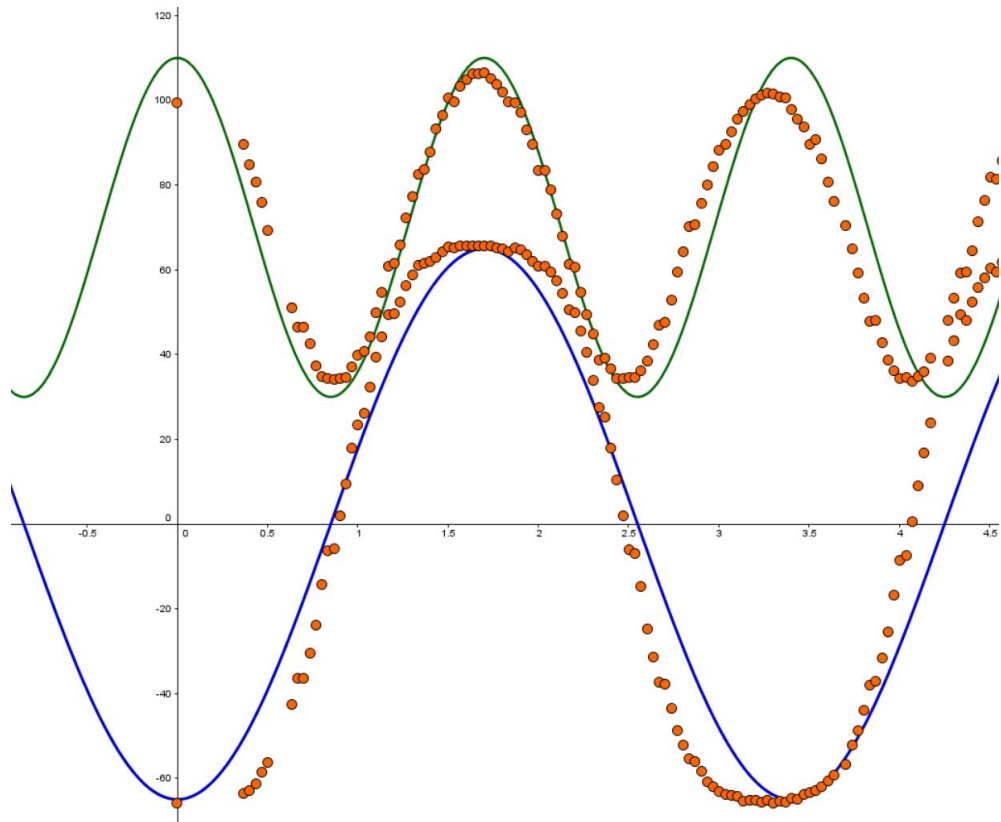
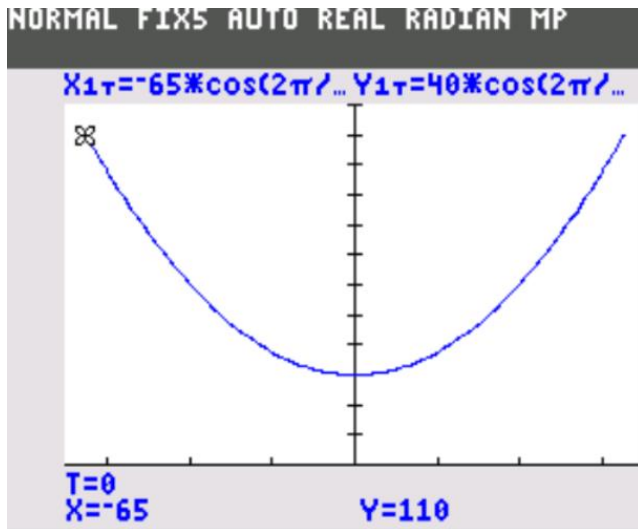


Creating a Parametric Model





Evaluate the Model





Other Data Analysis Explorations & Collaboration

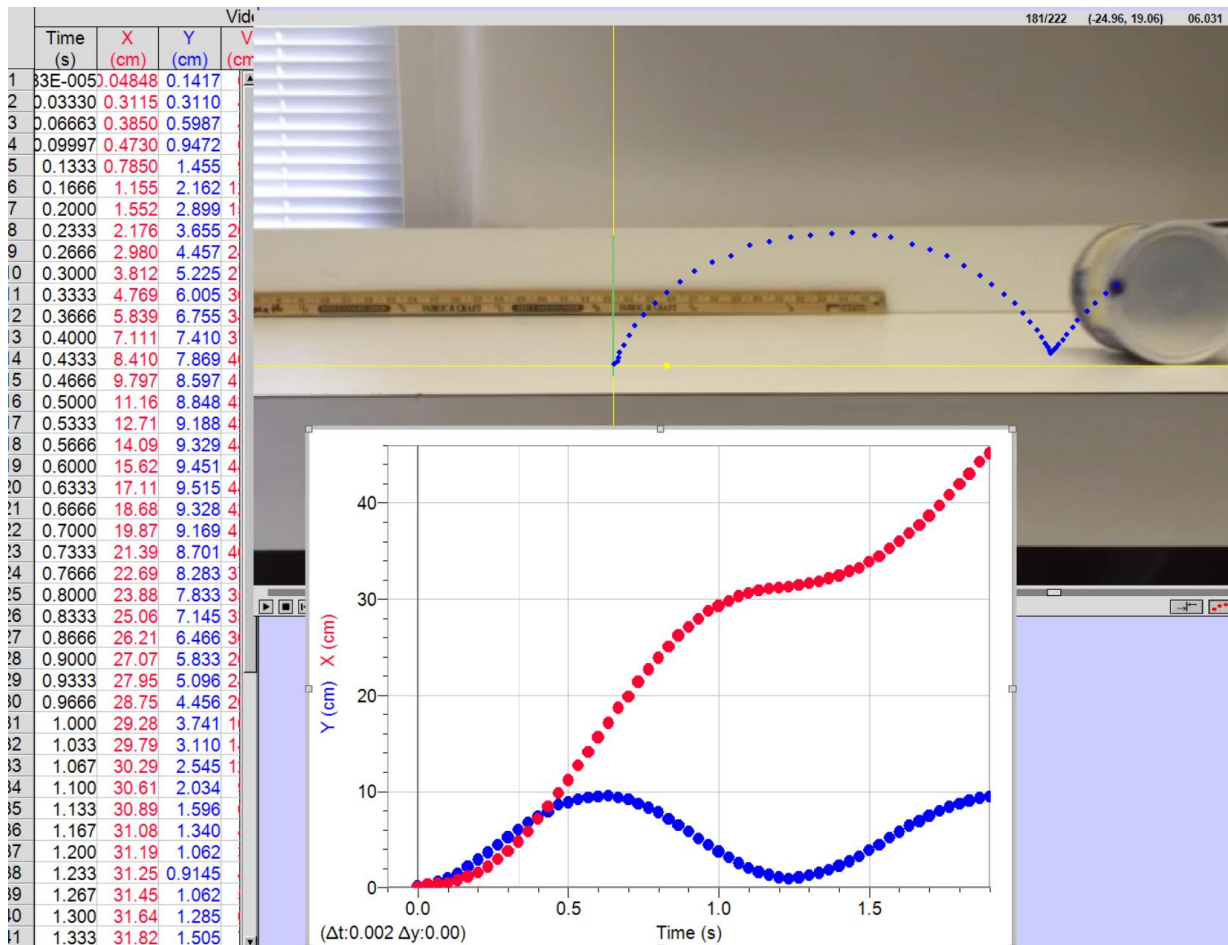
A diagram illustrating a cycloid. A black circle is shown rolling along a horizontal line. A red curve, the cycloid, is traced by a point on the circle's circumference. A red dot marks the point of contact between the circle and the line. A blue dot marks the center of the circle. The text "The Cycloid: From Geometry to Calculus" is overlaid on the diagram.

The Cycloid: From Geometry to Calculus

NCTM National Conference, April 2015

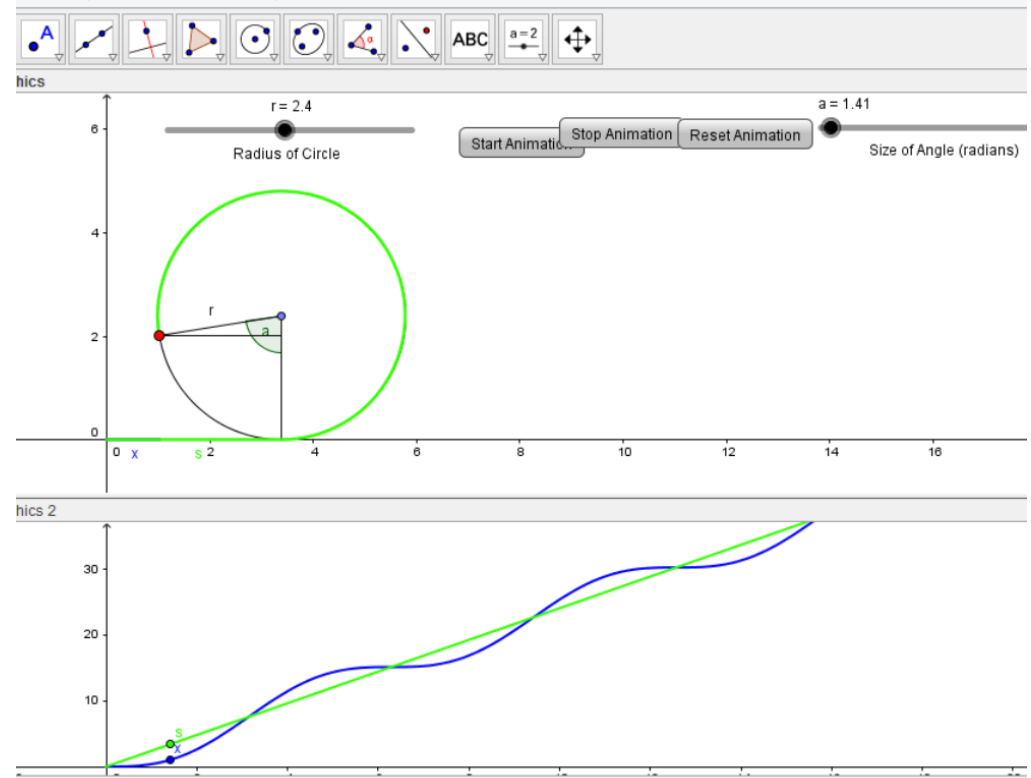
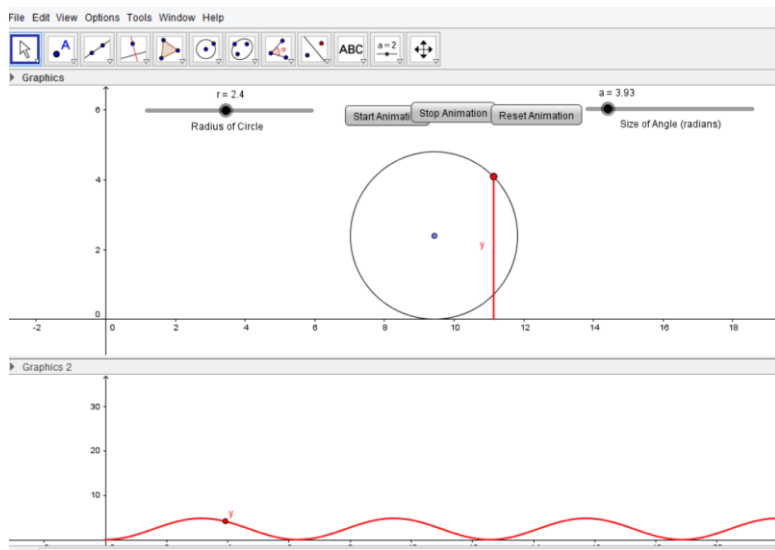


Cycloid Data from Video





Dynamic Animation GeoGebra



Can find materials at

http://www.ncssm.edu/courses/math/TCM/TCM2014/talks/hernandez_g/



Benefits of Collecting Your Own Data w/Videos

Collecting real world data using videos and probes can be powerful for students and can help them see math in the world around them!

Student Reflections:

“By embedding the video in Excel, my partner and I were able collect data points and form a model to model the swinger’s position over time. I found this project very interesting, and would enjoy completing a similar project.”

“One example of particular enjoyment would be the use of LoggerPro and Excel in the water jug problem. It provided the opportunity to use the skills learned before and apply them, such as collaborating, collecting data, linearizing data, and many more.”



Modeling Activities Resources

NCSSM Advanced Functions and Modeling/Algebra 2

Recursion and Swing

- <http://www.dlt.ncssm.edu/AFM/topic.htm>
- <http://www.dlt.ncssm.edu/stem/content/lesson-1-introduction-recursion>
- <http://www.dlt.ncssm.edu/stem/content/swing-lab-documents>
- NCSSM Math I Project <http://betterlesson.com/unit/144785/math>
- NCSSM Post AP Projects
<http://www.ncssm.edu/courses/math/apcalcprojects/>

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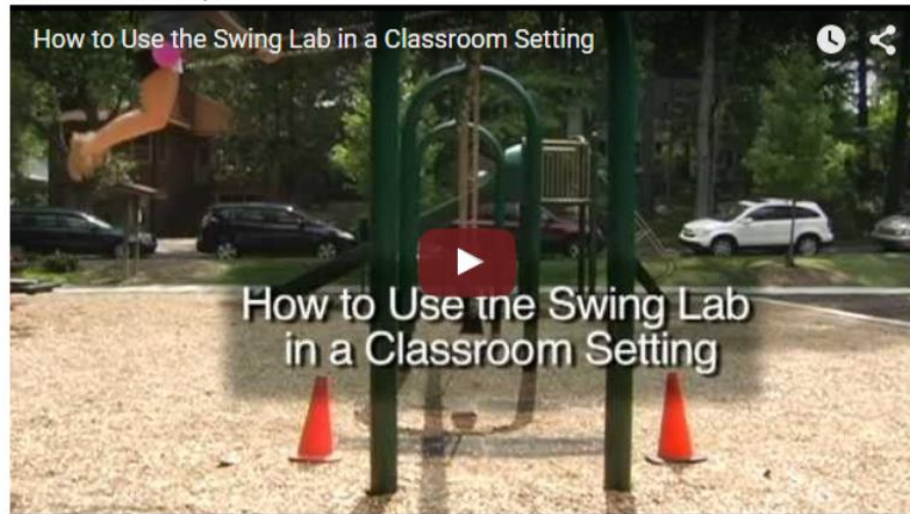
Swing Lab Documents

This video provides teachers with an overview on **How To Use the Swing Lab Materials** in a Classroom Setting. The Swing Lab gives students an opportunity to create trigonometric functions to model a real-world problem. This lab activity will help your students explore the motion of a swinger by modeling the horizontal and vertical positions of the swinger over time.

Subject: Mathematics

Grade Level for Mathematics: Secondary

Media Format: lesson plan



Link to teacher's instructional video on **How To Use the Swing Lab Materials** in a Classroom Setting:

<http://youtu.be/BafExNcuXjA>



Resources for Swing Activity

- Data is provided in Excel spreadsheet and LoggerPro file
- Handout to be used with calculator or other devices

Information about Tools for Data Collection:

- LoggerPro <http://www.vernier.com/support/updates/logger-pro/>
- Easy Link <http://www.vernier.com/products/interfaces/ez-link/>
- Video Physics <http://www.vernier.com/products/software/video-physics/>
- Graphical Analysis for iPad <http://www.vernier.com/>



North Carolina
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Conferences



The NC School of Science and Mathematics

Durham, NC, January 29 – 30, 2016

<http://www.ncssm.edu/courses/math/tcm/TCM2015/>

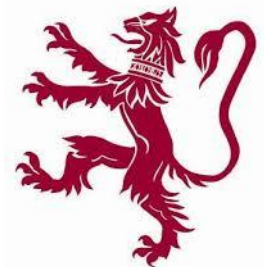


TEACHING CONTEMPORARY
MATHEMATICS CONFERENCE

Anja Greer Math, Science and Technology Conference

Phillips Exeter Academy, June 26 – July 1, 2016

Weeklong Mini-Courses





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Questions, Comments, Discussion

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