

**Wickenburg Unified School District
Wickenburg High School
CTE Academic Integration**

**Solar Hot Dog Cooker
Algebra II with Engineering II**

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Grade Level Participation: 10-12

Standards Meet:

Engineering Standard

6.0 Apply Engineering Technology and Tools

Math

Strand 3: Patterns, Algebra, and Functions PO8: Find major and minor axes, intercepts, and asymptotes of conic sections

Strand 4: Geometry and Measurement PO3: Graph equations of conic sections

Lesson:

Algebra II: Students were introduced to conic sections, including formulas and graphing. Within the conic section unit, students studied formulas for parabolas and the concept of the focus. To put theory into practice, students working in groups of 2 were instructed to design a parabola to fit in a shoe box that would be used as a hot dog cooker. The focus would be the point where the center of the hot dog would be placed. From this activity, students were required to provide a written summary which included:

- Formula for the parabola
- Location of the focus
- All sizes for the shoe box.
- Full graph of the parabola

This information was given to Engineering II to build the parabola assembly. Once the assembly was completed, students finished the assembly by adding foil over the parabola and decorating the shoe box. Students then evaluated the parabola by cooking a hot dog outside. The temperature of each hot dog was measured to determine the effectiveness of the parabola design.

Engineering II: All of the engineering students are either in or have completed Algebra II. They were each given 2 parabolas each.

Students were required to do the following:

- Evaluated the parabola formula for reasonableness based on the shoe box dimensions given.
- Design the components using Pro/Engineer Computer Aided Design (CAD) software.
- Create drawings for all parts.
- Create Computer Numerical Control (CNC) tool paths to cut the parabolas.
- Use scroll, table, and miter saws to make all simple parts.
- Use CNC router to machine parabolas.

The assemblies were returned to the Algebra II students for final assembly.

Assessment:

Algebra II: Students were graded on:

- The completeness of their parabola design.
- Quality of the finished product
- Correct design of parabola and focus

Engineering II:

- Evaluation of student parabolas
- Completeness of the design
 - 3-D models
 - Drawings
- Accuracy of finished product
- Proper use of tools and technology

Assessment Results:

Student understanding of the relationship between the focus and parabola was greatly enhanced by this activity. The concepts were reinforced in Engineering II while strengthening their ability to use technology to make tangible objects. Algebra II students apply the theory of parabolas into tangible objects and see the results of their design. They were able to see how the completeness of their work impacts others.