

# Parabolas and their focus

Launch the lesson by asking how we might use parabolas to create heat from the sun.

**Supplies-** Protractor, graphing calculator, patty paper, handouts, and current text for reference.

## Objectives:

Explore the focus of a parabola

Write equations of parabolas

Model real-life problems

## Common Core Mathematical Practices:

Mathematically proficient students apply the properties they know about parabolas to solve a real-life problem involving a solar reflector.

If time allows, have each group present a design plan.

Rubric:

Skill	Possible points	Score
<b>Completion</b>	4 points	
<b>Accuracy</b>	4 points	
<b>Applying properties to situation</b>	4 points	
<b>Precise sketches</b>	4 points	
<b>Group Norms</b>	4 points	
<b>Total</b>	20 points	

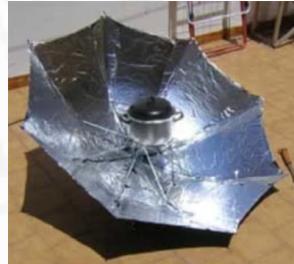
\* Allowing students to self-evaluate is a great option here.

After the fact:

Give/show this Study done by a grant funded by the National Science Foundation

[http://www.geometryexpressions.com/downloads/Investigating Parabolic Cookers.pdf](http://www.geometryexpressions.com/downloads/Investigating%20Parabolic%20Cookers.pdf)

Show some examples of other design ideas:



Assignment created by  
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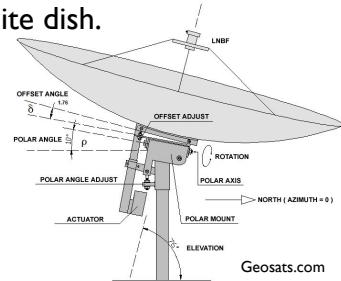
## DESIGN A CIRCULAR PARABOLOID SOLAR COOKER

The company you work for wants your team to design a parabolic cook stove. The product will be used for outdoor cooking by those who desire a way to heat without the necessity of fuel. You will use your knowledge of parabolas to create a design for your boss.

Consider important features of product design- aesthetics, cost, space needed, portability, and special components.

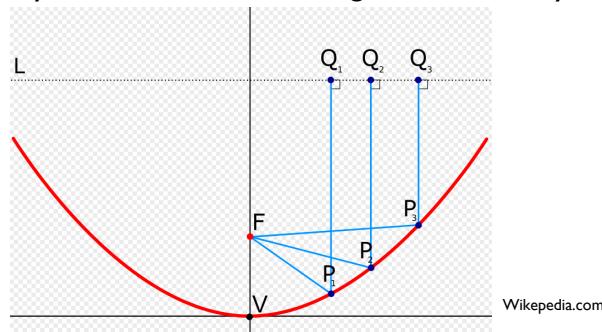
This is a side view of a satellite dish.

- 1) Label the focus and the vertex.



- 2) How does a satellite dish relate to designing a functional solar cooking device?

Fact: Vertical rays reflect at the same angle at which they entered



- 3) Draw, using color coding, the angles referred to in the Fact. Describe the angle.

- 4) What process did you do to draw the angles accurately?

- 5) What was the most difficult part and why?

This is a graph of a typical parabolic reflector



6) Write a function that models this satellite reflector

7) Describe the process you used to come up with function.

8) Draw the focus. How did you find the focus?

9) Draw a design of your parabolic solar cooker, including the sun in the image.  
(Incorporate accurate dimensions)

We learned that the standard form of a parabola with vertex at  $(h, k)$  and  $p$ , the distance from the vertex to the focus, is  $y = \frac{1}{4p}(x - h)^2 + k$ .

- 10) Explain what  $(h, k)$  and  $p$  are in the previous parabola.
- 11) Describe what these values represent in your solar cooker. Draw a diagram.
- 12) Write a model of your solar cooker in the standard form of a parabola. (Show your work)
- 13) What type of materials are you using? Why did you choose this type of materials?
- 14) Estimate the cost of the materials.
- 15) What are some of the concerns you have with your design?
- 16) What are some of the highlights of your design?
- 17) How can this concept of parabolas be used in other aspects of our lives?