Names: _____

Unit 9 Assignment: Parabolas and Solar Cookers /40

OVERVIEW:

PART 1: Building a Parabolic Dish Model (Friday)
PART 2: The Use and Design of Solar Cookers (homework due Tuesday May 12)
PART 3: Building a Solar Cooker (Tuesday)
PART 4: Testing our Solar Cookers! (Tuesday)

PART 1: BUILDING A PARABOLIC DISH MODEL (/10)

1. Using the given pattern:
- **a.** Cut out the circle.
- **b.** Cut along each radius, stopping about 2 mm from the center, making sure that all sections are still attached together.
- **c.** Bend up each section one at a time (starting from the center), and tape it to the section beside it to form a "cone". Overlap the sections by approximately ¼ the width of one section.
- **d.** Measure the diameter and height of your "cone" in centimeters to one decimal place. (Your shape is not a true cone as the vertex is not a sharp point – we want this slightly rounded vertex as it models a parabola – this 3-Dimensional shape will be called a **parabolic dish**.)

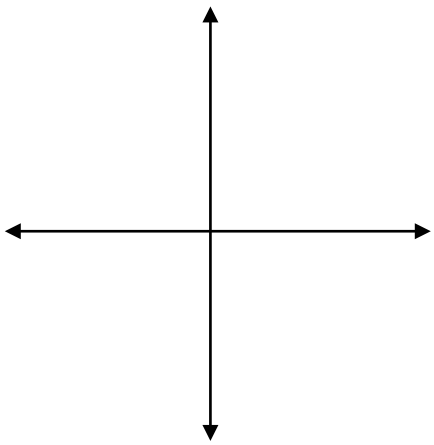
Diameter: _____ **Height**: _____ *(1 mark)*

Recall that a conic is a curve obtained by intersecting a cone with a plane (taking a 2-Dimensional shape from a 3-Dimensional cone). The shape of the conic (circle, parabola, ellipse or hyperbola) that is "sliced" out of the cone is dependent on the angle of the plane.

We are going to intersect our parabolic dish with a vertical plane that "slices" directly through the vertex, thereby cutting it into 2 symmetrical halves. The resulting conic will be a **PARABOLA**. By finding the focus point of this one parabola, we are finding the focus point of the parabolic dish.

PARABOLIC DISH

2. On the axes below, **sketch a parabola at the origin**. This parabola is to represent the vertical slice taken from your parabolic dish.



Labeled sketch (1 mark)

- **a.** Using the values you measured for the diameter and the height of your parabolic curve, label the endpoints of your parabola with *(x,y)* coordinates.
- **b.** Draw a point as an estimate as to where the focus point could be on your graph. Then draw an appropriate directrix based on the placement of your estimated focus.
- **c.** Label the *(x,y)* coordinates of the vertex and the focus, and the equation of the directrix in terms of only 0 or c.
- **d.** Using one of your endpoints, and the definition of a parabola, find the value of c to 3 decimal places. Show your work below. *(1 mark)*

c = _____

3. Fill in the following information about your parabola (to 3 decimal places): *(2 marks)*

Vertex: _____

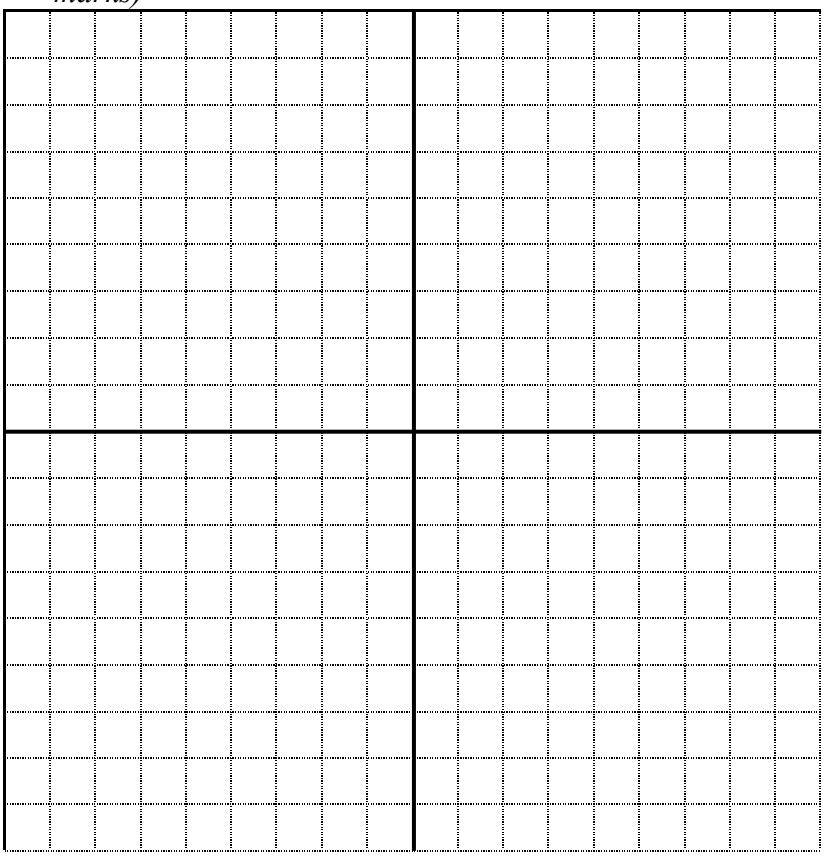
c: _____

Focus: _____

2 Additional Points: _____
(in line with the focus) _____

4. Write the equation of your parabola (to 3 decimal places): *(1 mark)*

5. Accurately graph your parabola. Include the points listed above, the directrix and the **endpoints**. *(2 marks)*



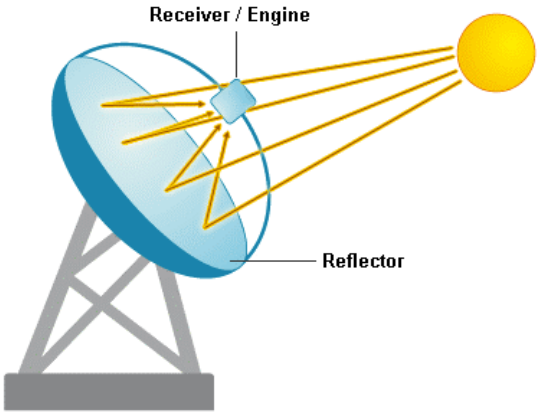
**** Group work for Friday:** #1–5 should be finished by the end of Friday. Bring this booklet to your teacher before the end of class to assign your group a mark out of 2 for completion.

_____ (*2 marks)*

**** Due to the nature of this project, late work (on a daily basis) will be given a grade of zero ****

PART 2: THE USE OF SOLAR COOKERS (/10)

HOMEWORK – DUE START OF CLASS TUESDAY!



Solar cookers (also called solar ovens or parabolic ovens) are becoming more and more common. There are many Internet sites that provide instructions on how to make them, as well as many companies that sell them. Using the Internet, research answers to the following questions. Respond the each question in a Google Drive document and share with your teacher. Point form answers are acceptable. **Keep track of your sources,** as you will need to cite them at the end.

6. What is a solar cooker and how does it work? *(2 marks)*

7. Solar cookers are usually parabolic in shape, but they can also be rectangular. Explain why a parabolic solar cooker would be better. In your answer, describe the purpose of the focus and include a **diagram** that shows the reflection of light that hits the parabolic cooker. *(2 marks)*

8. Parabolic solar cookers can vary in shape. See if you can find any research that supports one shape over another. From what you can tell, is one design more common than another (small or large diameter, shallow or deep)? *(2 marks)*

9. List the sources you used. Proper format is not important, just list the website addresses. *(1 mark)*

10. Your task for the remainder of this project is to build a solar cooker. You can build it similar to the paper model we did in class (although you should use a material that is sturdier than paper), or you can research another method and use this instead. Brainstorm how you would like to build it and record your idea. Write down your list of materials and who in your group is in charge of bringing each material in for Tuesday's class. *(1 marks)*

** **Homework completion:** #6–11 should be finished and shared with the teacher by the start of Tuesday's class. You also need to bring your **materials** for Tuesday! Bring this booklet to your teacher at the start of class to assign your group a mark out of 2 for completion. _____ (*2 marks)*

**** Due to the nature of this project, late work (on a daily basis) will be given a grade of zero ****

PART 3: BUILDING A SOLAR COOKER (/20)

Task Specifications:

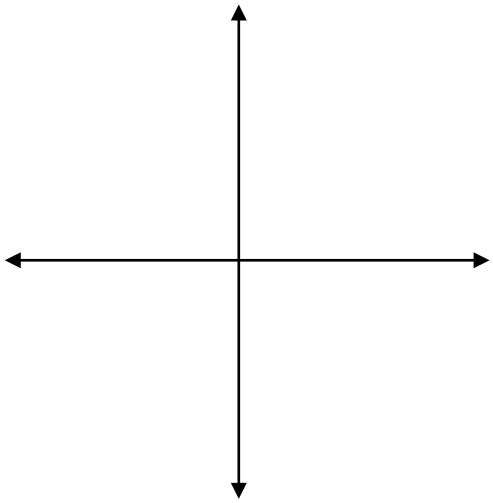
- It must be parabolic in shape *(2 marks)*
- The diameter of your parabolic dish must be at least 30 cm, but must NOT exceed 1 meter
- You can choose the depth for your dish (deep – more like a cone; or shallow – more like a dish)
- You many NOT spend more than 200 pesos on the materials
- It must have a reflective surface *(2 marks)*
- It must have a way of attaching or securing a small paper cup (provided for you) that will be half full with water so it must be able to support its weight as well *(2 marks)*
- It must have a way of standing on its own and can be turned to be angled towards the sun *(2 marks)*
- ***Bonus marks will be given to the groups that can raise the temperature of their cup of water the most (+3 first place, +2 second place, +1 third place)***

11. Complete the following for your solar cooker using the same format as you did when you made the paper models.

Diameter: _____ **Height**: _____ *(1 mark)*

Find c – show your work (3 decimal places) *(1 mark)*

c = _____



Labeled sketch (1 mark)

Information: (2 marks)

Vertex: _____

c: _____

Focus: _____

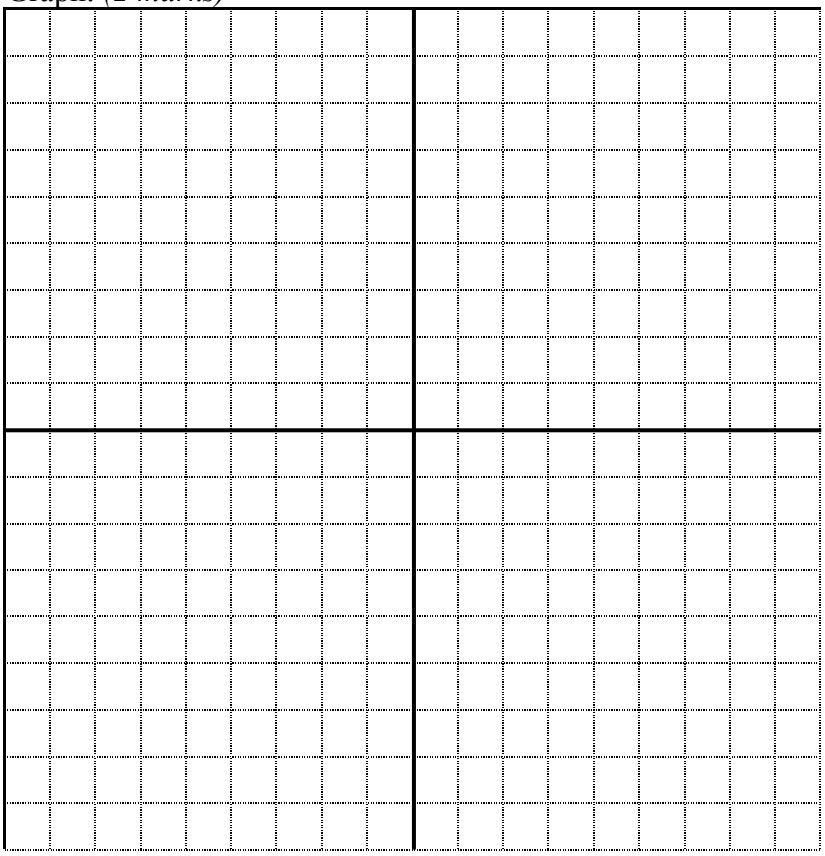
2 Additional Points: _____

(in line with the focus) _____

Write the Equation of your Parabola: *(1 mark)*

**** Due to the nature of this project, late work (on a daily basis) will be given a grade of zero ****

Graph: *(2 marks)*



12. Why did you choose to design your solar cooker the way that you did? List at least 2 points. *(2 marks)*

**** Group work for Tuesday:** You will have all of Tuesday's class to build your solar cooker. Bring this booklet to your teacher before the end of class to assign your group a mark out of 2 for work. _____ (*2 marks)*

Your solar cooker will stay in the class on Tuesday after school, so be ready to finish it in class time.

We will test our solar cookers on Wednesday's class. You will have 5 minutes to touch up your cooker, and then we will take them outside to heat up some water!

**** Due to the nature of this project, late work (on a daily basis) will be given a grade of zero ****