

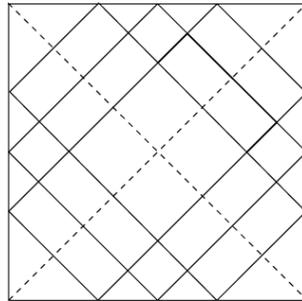
The Optimal Origami Box – Class Handout

Gathering data and making predictions

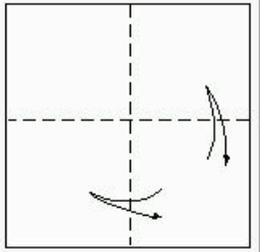
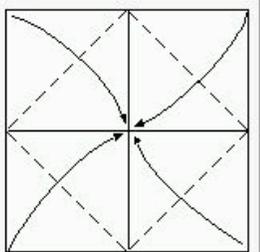
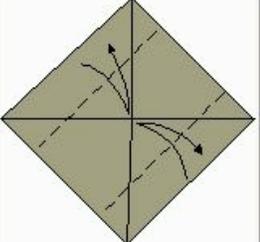
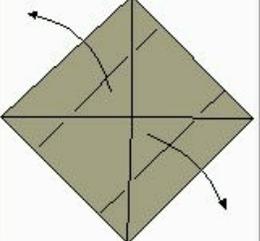
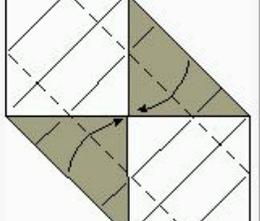
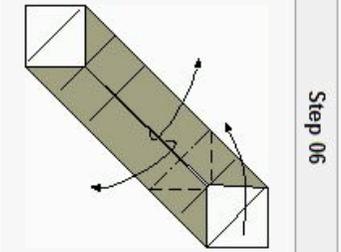
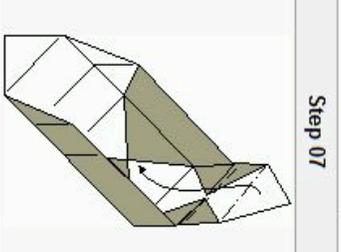
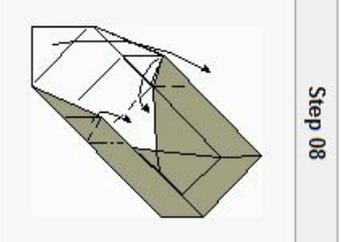
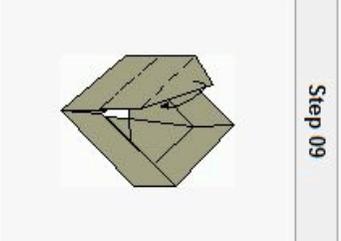
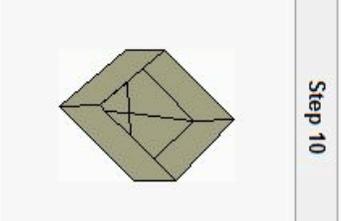
1. Using your $12'' \times 12''$ square sheet of paper, fold a box following the instructions given. Note that since our paper is square and our folding process is symmetric, the base of the box is also square. Measure the dimensions of your box, and calculate its volume. Include units on your answers.
2. In your group, fold boxes of different heights by adjusting the height of the sides you fold in Steps 3 and 6. Measure and calculate the volume of each box, and create a table of your data.
3. Create a scatterplot of your data and draw a smooth curve to connect the points. Predict the height of the box that will have the maximum possible volume. Based on your prediction, what is the maximum possible volume for your origami box?

Creating a theoretical model

4. What is the formula for the volume of a box with a square base?
5. Unfold one of the boxes that you made so that you can see the creases. They should look similar to the diagram below. Trace the creases that outline the base of your box and the creases that outline the sides. What is the length of the dashed diagonal lines that have been added?



6. Identify segments of the diagonal lines on the crease diagram that can be used to measure the length and height of the box. Use these segments to find an equation that relates the length of the diagonal, D , to the height, H , and length, L , of the box. How can we use this equation to eliminate L from the volume formula, so that the volume is a function of the height of the box?
7. What mathematical approach do you suggest for determining the optimal height and maximum volume of an origami box?
8. Use the volume function you created to determine the maximum possible volume for your origami box. How does this result compare to your prediction in Problem 3?

Step 01		Step 02		Step 03		Step 04		Step 05	
Crease and Return	Step 06	Step 07	Step 08	Step 09	Step 10	Complete			
									
Lift both sides and one end of the model so it becomes 3D	Fold flap to centre	raise end	Fold flap to centre	Complete					

Japanese masu box folding instructions from the website tenoclocktoastime.wordpress.com.