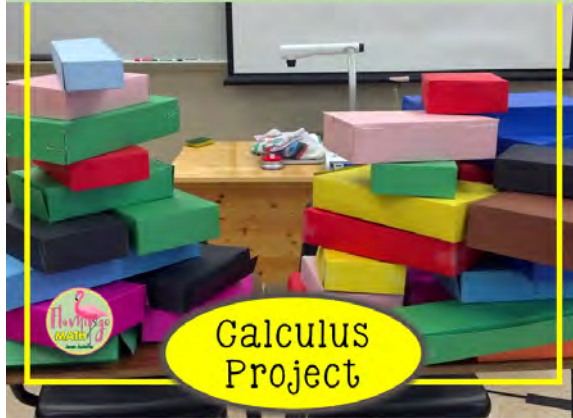


Maximize-a-Box Optimization



Maximize-a-Box Optimization Calculus Project

Your AP Calculus students will have creating a box of maximum volume given a random size of poster board.

This activity is designed to challenge your **AP Calculus** students by engaging them in conversations related to Optimization problems in the real-world and exploring methods to problem-solve given a specific task related to maximizing volume and modeling.



College Board® Topics:

Topic 5.11: Solving Optimization Problems

About the Project:

This resource is a Calculus Project for students to have a real-world application of optimization in the **Applications of Differentiation Unit**. Students are given a sheet of poster board of a specific size and are asked to create a box (with a fold-down lid) of maximum volume. Directions and a student recording sheet are provided.

Students will practice the following skills:

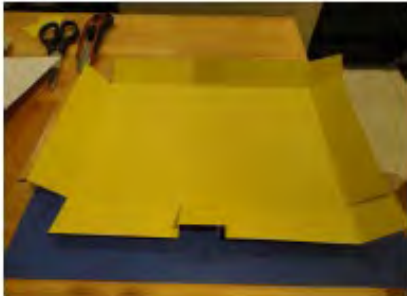
- ☒ Assign students a designated poster size, which they will use to create a box of maximum volume.
- ☒ Students should calculate the volume for two different boxes based on the orientation of the poster, either Length X Width or Width X Length. Each orientation will create a different shaped box, with different volumes.
- ☒ You can decide to have them choose only the maximum volume to create, or whether to allow them to choose the shape based on their particular need.
- ☒ This project can be used as a class celebration, if desired. Students can place a gift inside, wrap the box in some holiday paper (Christmas, Hanukkah, etc.)

Activity

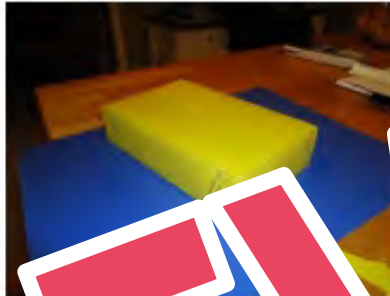
BUILDING THE TWO BOXES

Here are two models that maximize the 12" by 16" cardboard. (1-2) Glue, then tape or paperclip to hold shape until glue dries. (3) Trim the flap corners so that the box will tuck together neatly. (4-6) Show both sizes of maximized boxes.

(1)



(2)



(3)



(5)



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(4)



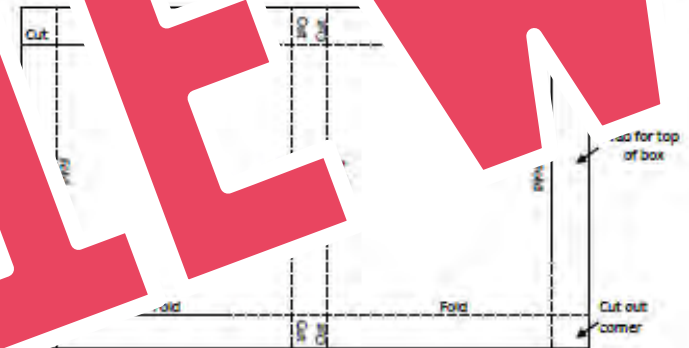
Jean Adams

MAXIMIZE BOX WITH TOP

This is an optimization problem. You are to build a box from a specified piece of poster board. You must maximize the volume of the box considering the size of the piece you have.

1. Draw a number of boxes that will fit on a piece of poster board that is 6" x 20" #4: 18" x 22"

Use the guide to help you. You must glue the tabs to the box. You must solve the optimization problem to know the possible boxes that can be made.



Your completed project should include:

1. A clearly labeled drawing.
2. A Volume equation, in terms of x .
3. Your calculations, neatly done.
4. Dimensions of both boxes that produce a maximum volume.
5. The maximum volume.
6. The completed box.

We will have a gift exchange using these boxes on _____. If you are participating in the gift exchange, please purchase an appropriate item to put inside your box and wrap the box in holiday paper. Maximum dollar value \$ _____. Instructions for the gift exchange will be given on that day. If you do not want to participate in the exchange, simply do not wrap your box, and do not take a gift.

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Practice

MAXIMIZE BOX WITH TOP

PREPARATION:

1. Cut poster board in the four sizes, one piece for each student.
#1: 12" x 16" #2: 14" x 18" #3: 16" x 20" #4: 18" x 22"
2. Cut out number cards: #1 through #4.
3. Make a proto-type box in any size.

TEACHER NOTES:

1. Explain that each box can be created with orientation on either the long side or the short side. Students should calculate both box dimensions for the project. Then determine which size they want to make for the physical model.
2. It may be helpful to discuss decimal approximations and conversion to fractions for measuring the poster board when creating the physical box. Students should determine the closest conversion factor for their decimal values.

$\frac{1}{16} = 0.0625$	$\frac{5}{16} = 0.3125$	$\frac{1}{8} = 0.125$	$\frac{3}{8} = 0.375$	$\frac{7}{8} = 0.875$	$\frac{15}{16} = 0.9375$
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1. How tall is the box? How wide is the box? How deep is the box? How many boxes can you make with the three poster boards? Split for each box.
2. How many boxes can you make with the three poster boards? Split for each box.
3. How many boxes can you make with the three poster boards? Split for each box.
4. How many boxes can you make with the three poster boards? Split for each box.

Maximizing a Box Project

Name _____

My Poster Board size in inches: _____

Box #1:

Volume Formula: _____

Height: _____

Max. Volume: _____

Box #2:

Volume: _____

Derivative: _____

x ≈ _____

Length: _____

Width: _____

Height: _____

Max. Volume: _____

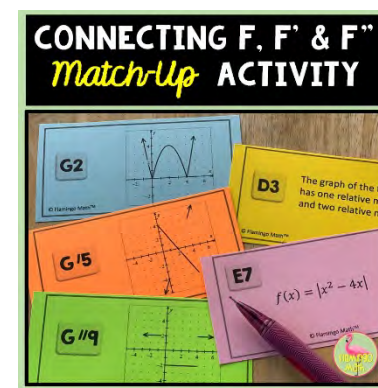
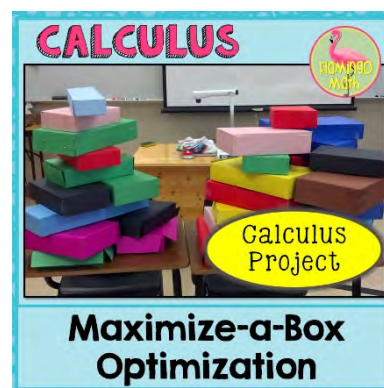
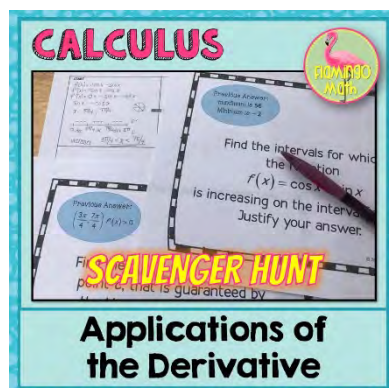
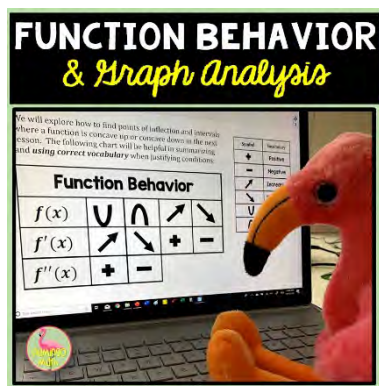
The Maximum Volume for the poster board size of _____ is Box # _____ with Volume _____



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