WvEB Mathematics: College Level, Web-Enhanced Algebra and Trigonometry Courses for High School Students in West Virginia

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WvEB Mathematics: College Level, Web Enhanced Algebra and Trigonometry Courses for High School Seniors in West Virginia

Description:
The goal is to provide students a smooth transition into college level mathematics. High school participants outperform on-campus counterparts on monitored tests. Course design and a study using the math portion of the ACT test will be discussed. This project is funded in part by the NSF, CCLI project number 0339117.

Detailed Description:

The West Virginia Higher Education Policy Commission (HEPC) invited mathematicians and mathematics educators to participate in the design of a mathematics course to be offered to high school students for early college credit. A primary goal of the HEPC was to increase the college going-rate in West Virginia. Through this project, the HEPC collaborates with the West Virginia Department of Education in efforts to increase student understanding and doing of mathematics as evidenced *in part* by increasing ACT scores. The main goal of the project is to allow students a smooth transition into college level mathematics with the hope of encouraging them into fields of science, technology, engineering or mathematics. High school mathematics teachers facilitate at each site and work with a university instructor of record to offer a sequence of algebra and trigonometry courses. Students registered at high school sites consistently maintain less than an 8% drop/fail/withdraw rate as compared to a 30-40% rate on campus. In addition, as a group, they outperform on-campus students when using the same proctored on-line exams. During the 2004-2005 academic year, a study using an alternate version of the math ACT test was implemented. The session will give an overview of the project development and structure, a brief description of course components, and a description of the study findings. Course components include *WEBCT* quizzes and tests, JAVA applets and CD lectures. This project is funded in part by the NSF, CCLI project number 0339117.

The Box Problem

Names:____

(4 communication points)

About this Laboratory

You will build a box from a sheet of paper with dimensions 8.5 inches x 11 inches by cutting squares from each corner of the paper and folding up the sides. In this laboratory, you will explore the changes of the shape and volume of the box with respect to the size of the square which is cut out of each corner. You will determine a function that relates the volume of the box to the size of the square. You will also explore relationships among the length, width, and height of the box.

CP 1
Construct an open top box from an 8.5 inch by 11 inch sheet of paper. Do this by cutting or tearing congruent squares out of each corner as shown in Figure 1. (Discard the squares.) We will fill the box with rice (optional) and want to maximize the volume of the box. ***You will turn in your box model with this laboratory, so put your names on it (4 points)***. You will examine the volume of boxes that *could* be constructed.

Find the equation for the volume of the open box in terms of x, the length of the edge of the square (4 points).

V(x): = ________________________

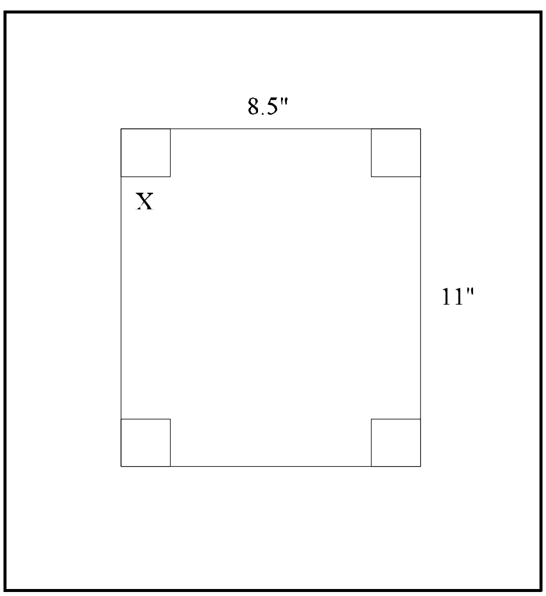


Figure 1

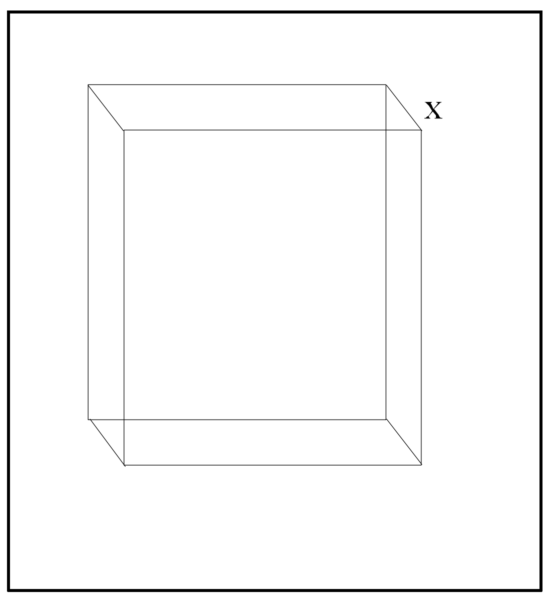


Figure 2

The Box Problem

Fill in the white rectangles at the bottom right of the applet so that the length is 11, and the width is 8.5. Select **Set**.

Point the arrow to the 2-dimensional paper model and drag until you have heights (cut sizes) that are approximately equal to the values listed in the table below. Record the volume values by filling in the table below. Adjust the cut size as needed (2 points).

cut size (in.)	Volume (in.^{3})
0	
.5	
1	
2	
3	
4	

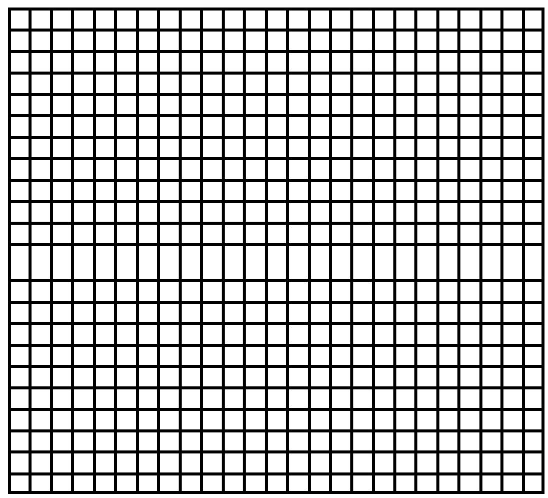
What happens to the volume as the cut size increases (2 points)? (BE CAREFUL)

CP 2

Enter the volume <u>expression</u> from the previous page into the equation box. Select **Graph**. You might want to zoom out and then drag a zoom box to get a "nice" view of the graph. You want to sketch a "complete graph" showing such things as intercepts and turning points.

The Box Problem

Sketch a picture of the "complete graph" (4 points).
(Label the axes with the names of the units on the sketch.)



What does the x variable represent in this example (4 points)? ________________________

What does the V(x), value represent in this example (4 points)? ______________________

What is the domain of the **function** (4 points)? ____________________________________
(Without respect to the problem.)

What is the range of the **function** (4 points)? _____________________________________
(Without respect to the problem.)

What x values **make sense** for the **problem** we are solving (4 points)? ________________
These values make up the *restricted domain*. Hint: Some values for x and y do not make sense for the box problem. Make a guess and come back to check this answer later.

What y values **make sense** for the **problem** we are solving (4 points)? ________________
These values make up the *restricted range*. Hint: Some values for x and y do not make sense for the box problem. Make a guess and come back to check this answer later.

Find each x-intercept to within **.**1 by **.**1 (4 points per intercept). (Use the techniques from your first lab.)

Notice that if you move the cursor into the graph region and click the left mouse button, the right and left arrow keys on the keyboard allow you to trace along a graph and up and down arrow keys allow you to move the tracer between functions. The coordinates of the tracer show at the top of the graph.

x-intercept: (_______________, 0)

x-intercept: (_______________, 0)

x-intercept: (_______________, 0)

Describe the real life meaning or insight to the problem that the x-intercepts provide; that is, how do the coordinates relate to the numbers found in your box model and the restricted domain (8 points)?

Now move the cursor to the local maximum on your screen. (If you zoomed in, you will need to zoom back out.)

The coordinates of the local maximum to within **.**1 by **.**1 are (8 points): (_____,_____).

Describe the real life meaning of the local maximum coordinates (8 points).
(What is so important about these coordinates as related to the problem and the restricted domain?)

Is there an absolute or largest value for V(x) of the equation for the function (4 points)? **Explain**.

Do we need to find the largest value of the equation of the function in order to find the maximum volume (4 points)? **Explain**.

The Box Problem

Answer the following to within ± .1.

What should the length of the side of the cut out square be to maximize the volume (4 points)?
___________ (Be sure to use appropriate units in your answer.)

What should the dimensions of the open box be to maximize the volume (4 points)?
___________________ (Be sure to use appropriate units in your answer.)

What is the maximum volume (4 points)? _______________
(Be sure to use the appropriate units in your answer.)