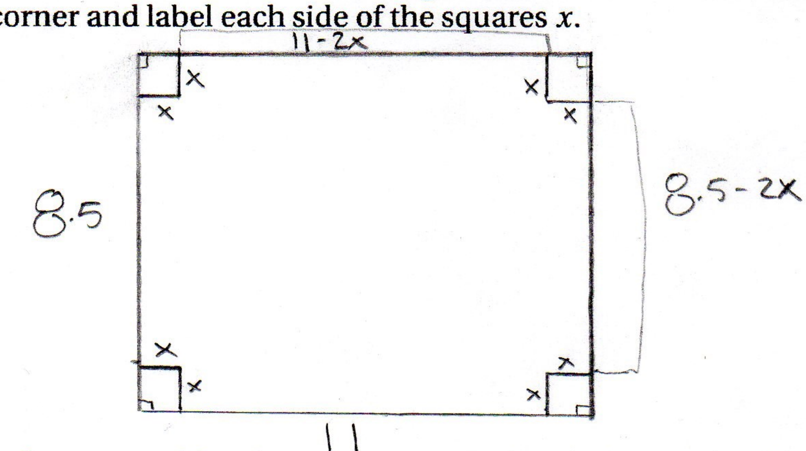
Name(s): Tyrel Mortensen

SLCC Math 1050 Project

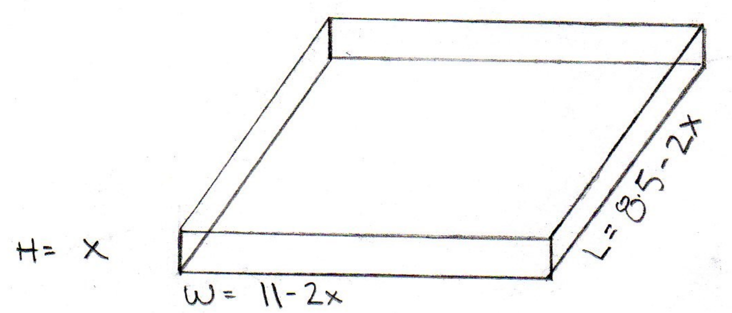
1. In your own words, write a paragraph to describe what this project is about.

This project is intended to show the skills required to find the maximum volume a cube can contain when given a rectangular 2D object and cutting a square at of each corner. The size of the square will change the vol

2. Draw a rectangle and label the length $8\frac{1}{2}$ inches and the width 11 inches. Put a square at each corner and label each side of the squares x.



3. Draw a 3-dimensional lunch container and label the length, width, and height in terms of x.



4. State the volume of the open box, $v(x)$, in terms of x, in descending order.

$V(x) = (11-2x)(8.5-2x)(x)$

$(93.5-22x-17x+4x^2)(x)$

$(93.5-39x+4x^2)(x)$

$4x^3-39x^2+93.5x$

$V(x) = 4x^3-39x^2+93.5x$

5. State the inequality if we want the volume of the open box to be at least $37\frac{1}{2}$ cubic inches.

$4x^3-39x^2+93.5x \geq 37.5$

Solve the inequality by following the next steps.

6. Make the right side of the inequality zero by adding or subtracting the same value on both sides.

$4x^3-39x^2+93.5x-37.5 \geq 0$

7. Multiply both sides of the inequality by the smallest positive number so that all the coefficient of the inequality are integers.

$\cdot 2$

$8x^3-78x^2+187x-75 \geq 0$

8. Let the left side of the inequality be $f(x)$.

$f(x) = 8x^3-78x^2+187x-75$

9. Use the Rational Zero Theorem to state all possible rational zeros for $f(x)$.

$p = \pm 1, \pm 3, \pm 5, \pm 15, \pm 25, \pm 75$

$q = \pm 1, \pm 2, \pm 4, \pm 8$

$\frac{p}{q} = \pm 1, \pm 3, \pm 5, \pm 15, \pm 25, \pm 75, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{5}{2}, \pm \frac{15}{2}, \pm \frac{25}{2}, \pm \frac{75}{2}, \pm \frac{1}{4}, \pm \frac{3}{4}, \pm \frac{5}{4},$

$\pm \frac{15}{4}, \pm \frac{25}{4}, \pm \frac{75}{4}, \pm \frac{1}{8}, \pm \frac{3}{8}, \pm \frac{5}{8}, \pm \frac{15}{8}, \pm \frac{25}{8}, \pm \frac{75}{8}$

Use synthetic division complete the following.

10. Find $f(x)$ with $x = 1$. 42

$f(1) = 8(1)^3 - 78(1)^2 + 187(1) - 75$

$= 8 - 78 + 187 - 75$

$= 42$

11. Find $f(x)$ with $x = \frac{1}{2}$. 0

$f(\frac{1}{2}) = 8(\frac{1}{2})^3 - 78(\frac{1}{2})^2 + 187(\frac{1}{2}) - 75$

$= 1 - 19.5 + 93.5 - 75$

$= 0$

$$\begin{array}{r|rrrr} \frac{1}{2} & 8 & -78 & 187 & -75 \\ & & 4 & -37 & 75 \\ \hline & 8 & -74 & 150 & 0 \end{array}$$

12. Call the depressed equation (see p. 379) $g(x)$.

$g(x) = 8x^2 - 74x + 150$

13. Find $g(x)$ with $x = 3$. 0

$g(3) = 8(3)^2 - 74(3) + 150$

$= 72 - 222 + 150$

$= 0$

$$\begin{array}{r|rrr} 3 & 8 & -74 & 150 \\ & & 24 & -150 \\ \hline & 8 & -50 & 0 \end{array}$$

14. Factor $f(x)$ completely. $(x - \frac{1}{2})(x - 3)(8x - 50)$

$2(8x - 25)$

$2(8x - 25)(x - \frac{1}{2})(x - 3)$

15. State the x values that one can use to design an open rectangular container with a $8\frac{1}{2}$ inches by 11 inches cardboard so that the volume is at least $37\frac{1}{2}$ cubic inches.

$[\frac{1}{2}, 3]$