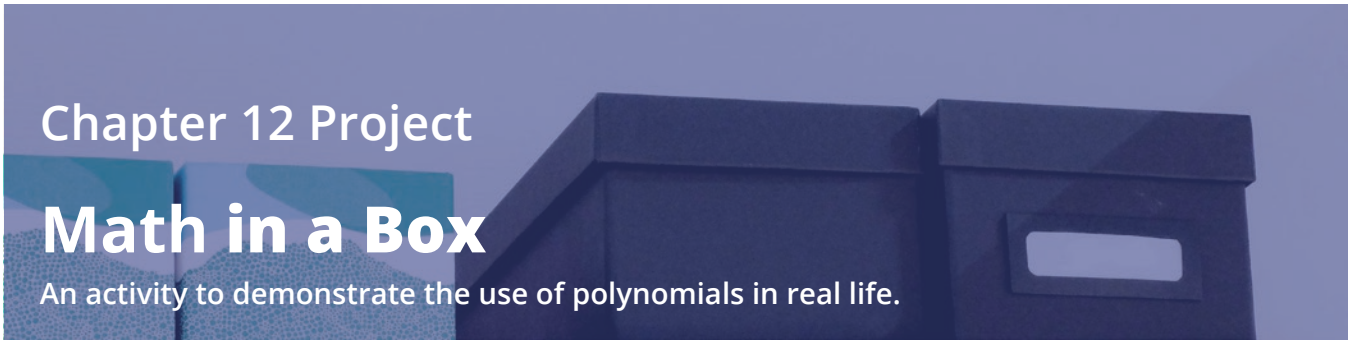
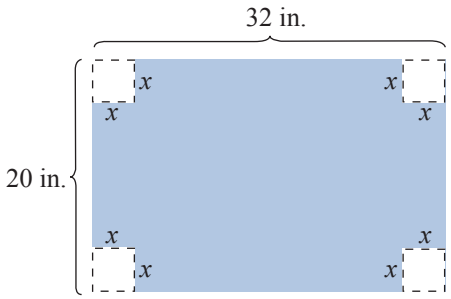


Chapter 12 Project

Math in a Box

An activity to demonstrate the use of polynomials in real life.

Suppose you have a piece of cardboard with length 32 inches and width 20 inches and you want to use it to create a box. You would need to cut a square out of each corner of the cardboard so that you can fold the edges up. But what size square should you cut? Cutting a small square will make a shorter box. Cutting a large square will make a taller box. Look at the diagram below.



1. Since we haven't determined the size of the square to cut from each corner, let the side length of the square be represented by the variable x. Write a simplified polynomial expression in x and note the degree of the polynomial for each of the following geometric concepts:

- **a.** The length of the base of the box once the corners are cut out.
- **b.** The width of the base of the box once the corners are cut out.
- **c.** The height of the box.
- **d.** The perimeter of the base of the box.
- **e.** The area of the base of the box.
- **f.** The volume of the box.

2. Evaluate the volume expression for the following values of x. (Be sure to include the units of measurement.)

- **a.** $x = 1$ in.
- **b.** $x = 2$ in.
- **c.** $x = 3$ in.
- **d.** $x = 3.5$ in.
- **e.** $x = 6$ in.
- **f.** $x = 7$ in.

3. Based on your volume calculations for the different values of x in Problem 2, if you were trying to maximize the volume of the box, between what two values of x do you think the maximum will be?

4. Using trial and error, see if you can determine the side length x of the square that maximizes the volume of the box. (**Hint:** It will be a value in the interval from problem 3.)

5. Using the value you found for x in Problem 4, determine the dimensions of the box that maximize its volume.

6. Calculate the volume of the box in Problem 5.