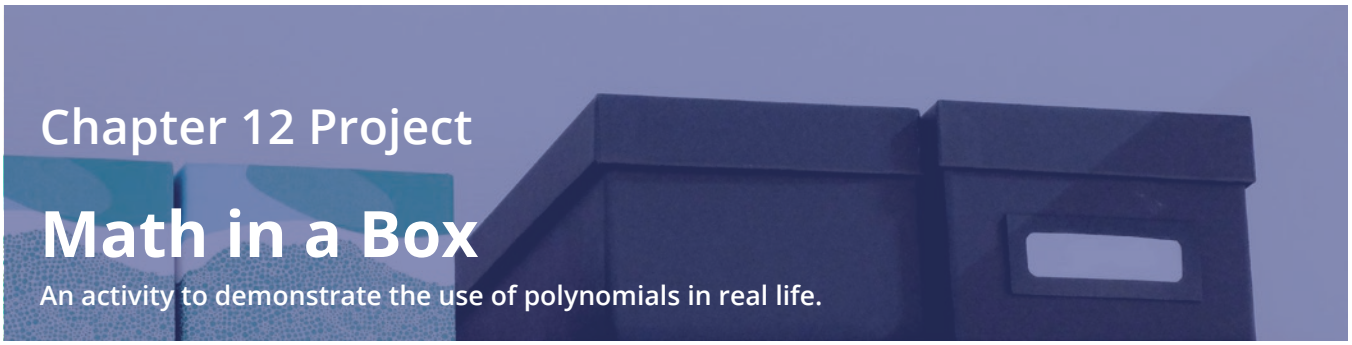
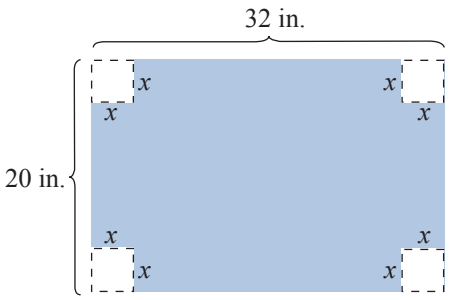


# Chapter 12 Project

# Math in a Box

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

Suppose you have a piece of cardboard with a length of 32 inches and a width of 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 squares should you cut? Cutting four small sqaures will make a shorter box. Cutting four large squares will make a taller box.




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.