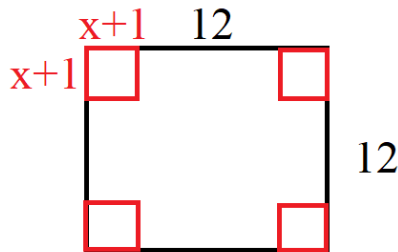## Exercise 77

For the following exercises, write the polynomial function that models the given situation.

A square has sides of 12 units. Squares $x + 1$ by $x + 1$ units are cut out of each corner, and then the sides are folded up to create an open box. Express the volume of the box as a function in terms of x.

Solution

Draw a schematic of the cut-out box.

The area of the box's base is the new length times the new width.

$$A = [12 - 2(x + 1)][12 - 2(x + 1)]$$

$$= (12 - 2x - 2)(12 - 2x - 2)$$

$$= (10 - 2x)(10 - 2x)$$

$$= 100 - 40x + 4x^2$$

Multiply it by the box's height to get the volume.

$$V = Ah = (100 - 40x + 4x^2)(x + 1)$$

$$= (100 - 40x + 4x^2)x + (100 - 40x + 4x^2)(1)$$

$$= 100x - 40x^2 + 4x^3 + 100 - 40x + 4x^2$$

$$= 4x^3 - 36x^2 + 60x + 100$$