

## Summarize

Ask students:

- Compare the equations for profit and area.
- Does it matter that in the area equation the variables are  $A$  and  $\ell$  and in the profit equation the variables are  $D$  and  $n$ ?
- How can you use the information about maximum area in Question A to find the maximum profit in Question B?
- Compare the methods for combining equations or expressions to write one equation in this investigation.

### Check for Understanding

- Write an equation for profit in terms of  $p$ .
- How is this different from the equation you found in Question B, part (2)?

### Materials

- Student notebooks

## ACE Assignment Guide for Problem 2.3



Core 12, 27–29, 39

Other Applications 10, 11; Connections 13, 30–37; and unassigned choices from previous problems

**Adapted** For suggestions about adapting ACE exercises, see the CMP *Special Needs Handbook*.

**Connecting to Prior Units** 13: *Say It With Symbols*, Investigation 1; 27–29: *Frogs, Fleas and Painted Cubes*; 30–35: *Growing, Growing, Growing*; 36: *Bits and Pieces III*; 37: *Filling and Wrapping*

## Answers to Problem 2.3

- A. 1.  $A = \ell(44 - \ell)$  or  $A = 44\ell - \ell^2$ ; Since  $88 = 2(\ell + w)$ , then dividing both sides of the equation by 2 gives the equation  $44 = \ell + w$  so  $w = 44 - \ell$ . Thus  $A = \ell(44 - \ell)$ . Students may multiply through and obtain the equation  $A = 44\ell - \ell^2$ .
2. The maximum area is  $484 \text{ ft}^2$  which occurs when the floor plan is a  $22 \text{ ft}$  by  $22 \text{ ft}$  square.
- B. 1. Yes; Equation 1 means that for each \$1 increase in the price to rent, the number of rentals decreases by 1. The starting value is 54 rentals for a price of \$0. Equation 2 means that the daily income equals the number of tube rentals times the price of a rental.

2.  $I = n(54 - n)$ ; First solve  $n = 54 - p$  for  $p$  obtaining  $p = 54 - n$ .

Then substitute the expression for  $p$  into the income equation in order to get:

$$I = n(54 - n)$$

3.  $D = n(54 - n) - 10n$  or  $D = 44n - n^2$ ; Since  $D = \text{income} - \text{expenses}$  and  $\text{Expenses} = 10n$  we have that  $D = n(54 - n) - 10n$  or  $D = 54n - n^2 - 10n = 44n - n^2$ , which is the daily profit.
4. The equations in Questions B, part (3) and A, part (1) represent the same quadratic relationship. The only difference is that they use different variables.
5. 22 rentals will produce a maximum profit of \$484; The maximum value can be found by graphing the equation or looking at the table of the equation  $D = 44n - n^2$ . Students should also realize that the maximum profit is the same as the maximum area that they found in Question A, part (2).  
A price of \$32 produces the maximum daily profit; Since the maximum profit occurs at 22 rentals we need to find  $p$  when  $n = 22$  in the equation  $n = 54 - p$ . Students may use a graph or table to get the answer or they may solve the equation  $22 = 54 - p$  for  $p$  using a symbolic method.