

Exercise 331

For the following problems, consider a restaurant owner who wants to sell T-shirts advertising his brand. He recalls that there is a fixed cost and variable cost, although he does not remember the values. He does know that the T-shirt printing company charges \$440 for 20 shirts and \$1000 for 100 shirts.

- Find the equation $C = f(x)$ that describes the total cost as a function of number of shirts and
- determine how many shirts he must sell to break even if he sells the shirts for \$10 each.

Solution

The cost function is linear.

$$C(x) = mx + b$$

x is the number of shirts sold, and m and b are constants to be determined. Use the given information to determine m , the slope.

$$m = \frac{1000 - 440}{100 - 20} = 7$$

The cost function is then

$$C(x) = 7x + b.$$

Use the fact that 20 shirts costs \$440 to determine b .

$$440 = 7(20) + b$$

Solve for b .

$$b = 440 - 140 = 300$$

Therefore, the cost function is

$$C(x) = 7x + 300.$$

The owner's profit is the revenue minus the cost.

$$P(x) = R(x) - C(x)$$

The owner sells the shirts for \$10 each, so the revenue function is $R(x) = 10x$.

$$\begin{aligned} P(x) &= 10x - (7x + 300) \\ &= 3x - 300 \end{aligned}$$

If the owner breaks even, then the profit is zero.

$$0 = 3x - 300$$

Solve for x .

$$3x = 300$$

$$x = 100$$

Selling the shirts for \$10 each, the owner would have to sell 100 of them to break even.