Example- Solution Writing

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November 2020

Problem

The startup cost for a restaurant is \$120,000 and each meal costs \$10 for the restaurant to make. If each meal is sold for \$15, after how many meals does the restaurant break even?

Solution

Part 1: Building the solution

This problem is asking for the break even point, which is the solution of the system made up by the cost function and the revenue function. So, we being by building the system to describe the situation.

The **cost function** is a linear function with the price of the item (in this case, meals) as slope and the $y-$intercept, $b = 0$. Because each meal is sold for \$15, the function will be

$$C(x) = 15x,$$

where x represents the number of meals produced.

The **revenue function** is a linear function with the variable cost as the slope and the fixed cost as the $y-$intercept. The variable cost is how much it costs to make each meal, in this case it's \$10. The fixed cost is the startup cost, in this case it's \$120,000. So, the function is given by

$$R(x) = 10x + 120,000,$$

where x is the amount of meals sold.

To build the system, we switch $R(x)$ and $C(x)$ for the variable y:

$$y = 15x \tag{1}$$
$$y = 10x + 120,000 \tag{2}$$

Part 2: Solving the Equation

Now that we have a system of linear equations in two variables that describes the situation, we will solve the system by substitution. Equation 1 is already solved for the variable y, so we will plug in that expression in Equation 2 and solve for x:

$$y = 10x + 120,000,$$
$$15x = 10x + 120,000,$$
$$15x - 10x = 120,000,$$
$$5x = 120,000,$$
$$x = 24,000$$

Now that we have a value for x, we will plug it into Equation 1 and solve for y:

$$y = 15x$$
$$y = 15(24,000)$$
$$y = 360,000$$

So, the solution of the system (and the break even point) is $(24,000, 360,000)$. This means that the restaurant will break even only after it sells 24,000 meals.