Group Assignment #5

APPLICATION OF FUNCTIONS TO ECONOMICS

A bakery opens near campus that delivers fresh baked cookies 24 hours a day. Prior to opening for business, the owner of the bakery bought a recently renovated building to operate out of for $50,000 and an industrial-sized mixer and oven for $3,000. The cost of labor and ingredients depends on the amount of cookie orders the bakery receives. On average, this cost amounts to $4 per dozen cookies ordered.

1) What are the fixed costs, costs incurred even if nothing is produced, for the bakery?

$3,000 from purchase of building, mixer, and oven

2) What are the variable costs, which depends on how many units are produces for the bakery?

$4 per dozen cookies

4x, where x = dozen cookies

3) Use the values from questions #1 and #2 to construct a formula for the cost function, C(q). Note that the cost function is linear and can be written in slope-intercept form.

C(q) = 4q + 53000

4) Use the formula in question #3 to answer the following:
   a. How much will it cost the bakery to make 756 cookies?

C(756) = 4(756) + 53000 = 56224

b. How many dozens of cookies does the bakery have to make for costs to amount to $67,232?

67232 = 4q + 53000

\[
\frac{47}{4} = \frac{14232}{4}
\]

q = 3558 dozens of cookies
5) The bakery owner has decided to sell the cookies for $9 per dozen cookies. Construct a formula for the revenue function, \( R(q) \). Note that the revenue function is also linear and can be written in slope-intercept form.

\[
R(q) = 9q
\]

6) Use the formula in question #5 to answer the following:
   a. How much money will the bakery get for selling 942 cookies?

\[
R(942) = 9(942) = 8478
\]

   b. In order to get revenue of $78,300, how many dozens of cookies does the bakery need to sell?

\[
78300 = 9q \\
q = 8700 \text{ dozens of cookies}
\]

7) In the space below, graph both the cost function and the revenue function using an appropriate scale.

8) At what point do the two functions intersect?

Intersect when \( \text{cost} = \text{revenue} \)

\[
4x + 5300 = 9x \\
-4x \\
5300 = 5x \\
5 \\
\frac{5}{5}
\]

\[
x = 10,600
\]

\[
y = 9(10,600) = 4(10,600) + 5300 \\
= 95,400
\]

\[
\boxed{(10,600, 95,400)}
\]
9) Given that \( \text{Profit} = \text{Revenue} - \text{Costs} \), construct a formula for the profit function, \( P(q) \).

\[
P(q) = R(q) - C(q)
= 9q - (4q + 5300)
= 9q - 4q - 5300
= 5q - 5300
\]

10) In the space below, graph the profit function using an appropriate scale.

11) Use the formula in question #7 to answer the following:

a. How many dozens of cookies does the bakery need to sell in order to \textit{break even} (make a profit of $0)? \textit{This number should look familiar.}

\[
0 = 5x - 5300
\]

\[
-5x = -5300
\]

\[
x = 10,600 \quad \text{dozens}
\]

b. The bakery owner is contemplating raising his prices in order to make a profit of at least $10,000 by the end of the second year of business. If he anticipates selling 7,000 dozen cookies per year, will the bakery owner reach his goal with the current price of cookies? Would you recommend that he raise his prices in order to meet this goal?

In two years, predicted sales equal 14,000 dozens,

\[
\Rightarrow x = 14,000
\]

\[
10,000 \leq 5(14,000) - 5300
\]

\[
10,000 \leq 70,000 - 53,000
\]

\[
10,000 \leq 17,000
\]

Thus, the bakery will make $17,000 in 2 years. This is more than $10,000 \Rightarrow \text{Do not need to raise the price.}
12) Create a graph representing your demand for orders of a dozen cookies delivered to your home as a function of the price of one dozen cookies.

Answers will vary

13) Using the supply graph drawn on the board and your demand graph, find the equilibrium price (where the two graphs intersect). What do you think the equilibrium price represents?

Suggested Homework Problems

Sec. 1.4: 2, 4, 9, 10, 12, 14, 23, 24