Prices and Revenue

Lab Preparation

In a small, simple economy it is reasonable to assume that if the price of an item is increased, then there will be a drop in sales. In this lab, you will investigate the changes in revenue that could accompany changes in selling price.

To prepare for the investigation you should do the following exercises.

1. Market research reveals that when the price of a carton of ice cream is $4.50, 8,500 cartons are sold. If the price drops to $3.80, the number of cartons sold increases to 9,900.

   a.) Complete the following table that shows the number of cartons sold $N(x)$ for selected prices $x$, assuming linear growth:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$N(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.50$</td>
<td></td>
</tr>
<tr>
<td>$3.80$</td>
<td>9900</td>
</tr>
<tr>
<td>$4.00$</td>
<td></td>
</tr>
<tr>
<td>$4.50$</td>
<td>8500</td>
</tr>
<tr>
<td>$4.80$</td>
<td></td>
</tr>
<tr>
<td>$5.00$</td>
<td></td>
</tr>
</tbody>
</table>

   b.) Write a formula for the linear function $N(x)$ that gives the number of cartons sold when the price per carton is $x$ dollars. How many cartons will be sold if the price is changed to $5.00$? Sketch the graph of $N(x)$. What is a reasonable domain for $N(x)$?

2. To compute the revenue generated for a company by the sales of its ice cream, one must multiply the number of cartons sold by the price of each carton. If 8,500 cartons are sold at $4.50 per carton, compute the revenue generated by the sale. How much revenue is generated by the sale of 9,900 cartons at $3.80 each? How much revenue is generated when the price is $5.00? Find $R(x)$ that gives the revenue generated when the price is $x$ dollars.

Lab: Prices and Revenue

1. Research has shown that for a company’s toy truck every increase of $0.10 in the price will result in 200 fewer sales. At one point, when the price was $2.35, the company sold 18,500 trucks. A reasonable employee of the company wondered aloud what price would maximize the revenue generated by the sale of the trucks for the company.

   a.) Determine the formula of the function $N(x)$ that gives the number of trucks sold when the price is $x$ dollars. Draw a graph of the function $N(x)$. 

b.) Determine the formula for the function \( R(x) \) that gives the revenue generated when the price is \( x \) dollars. Graph \( y=R(x) \).

c.) Determine algebraically the price that yields the maximum revenue. How much revenue is generated? How many trucks are sold at this price?

d.) Let’s say that the company wants to sell 20,000 trucks. How much should they charge and how much revenue is generated?

e.) What is the average rate of change in revenue from \( x=2.50 \) to \( x=2.85 \)? What is the average rate of change from \( x=3.00 \) to \( 3.25 \)? What units are associated with the average rate of change? Interpret each average rate of change in the context of the given situation. What do these average rates of change tell you about the shape of the graph of \( R(x) \)?

2. The number sold function \( N(x) \) of gourmet cookies has the following graph. The baker wants to know how to price the cookies so that the revenue generated by the sale of the cookies is as large as possible.

One explanation for the rise in the middle is the phenomenon that consumers sometimes believe that a higher-priced item is of better quality and hence a better buy and therefore will be more likely to purchase the higher-priced item.

a.) Determine the formula of the piecewise function \( N(x) \) that gives the number of cookies sold when the price is \( x \) dollars.

b.) Determine the formula for the piecewise function \( R(x) \) that gives the revenue generated when the price is \( x \) dollars. Graph \( y=R(x) \).
c.) Determine algebraically the price that yields the maximum revenue. How much revenue is generated? How many cookies are sold at this price?

d.) How do your answers to parts a, b and c change if 3,000 cookies are sold when the price is $1.00? Assume that the other “pivotal” points stay the same. Include a graph of the new revenue function $R(x)$.

**Lab Report**

Describe and interpret the graphs of the functions $N(x)$ and $R(x)$ for each problem in the lab. Include in your discussion a description of a reasonable domain and range, and be sure to include all relevant tables, graphs and formulas.

Explain how, in general, to find the maximum value of the revenue function.

For the cookie problem, describe how the change (in part 2d) in $N(x)$ is related to the change in $R(x)$ and the change in the maximum value of the revenue.