$\qquad$ Date $\qquad$

## Coffee Shop

Maximizing Income


After a month of mediocre sales, the snack shop invests their profits in research and development to determine if profit could be further increased. A study was conducted and the results are shown in the table below.

| Price for a <br> cup of <br> coffee (x) | $\$ 1$ | $\$ 1.50$ | $\$ 2.00$ | $\$ 3.00$ | $\$ 3.50$ | $\$ 4.00$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of <br> cups sold (y) | 20 | 17 | 15 | 8 | 3 | 2 |
|  |  |  |  |  |  |  |

As the store manager you are in charge of pricing the coffee to maximize gross income. Consequently you must price your coffee so that the coffee shop brings in the most money possible.

1. Define the term gross income.
2. How can we use the data given in the chart to calculate the gross income at each price point?
3. In the chart above, title the third row "Gross Income" and determine the gross income at each price point. Do you notice any patterns? What happens to the gross income as the price increases?
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4. According to your calculation, what price yields the greatest gross income?
5. Is it possible that by slightly increasing or decreasing the price that gross income could increase? Can you only charge the price indicated in the chart? Explain.
6. The process described in the steps that follow show how to calculate the exact price that yields the greatest profit. Enter the data given in the chart into an excel spreadsheet. Create an $x-y$ scatterplot and determine the equation of the line of best fit. Since the price for a cup of coffee is the independent variable, it should be located on the $x$-axis, and since the number of cups sold is the dependent variable, it should be located on the $y$-axis.
7. Record the equation of the line of best fit.
8. The equation of the line of best fit relates the price charged to the number of cups sold. In addition, the profit equation relates the price charged to the number of cups sold. Record the two equations below. Use substitution to write one equation for profit. Record this equation below.
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9. Use your graphing calculator and input the equation for profit into the $y=$ screen. Describe the graph that you see.
10. Does the graph reach a maximum point? What are the coordinates of the maximum point on the graph?
11. What does this $x$ value represent? What does the $y$ value represent?
12. How many cups do you expect to sell at this price?
13. Use the data below to determine the price that customers should pay for muffins which maximizes gross income.

| Price for a <br> muffin $(x)$ | $\$ 1$ | $\$ 1.75$ | $\$ 2.00$ | $\$ 3.00$ | $\$ 3.50$ | $\$ 4.00$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of <br> muffins sold <br> $(y)$ | 30 | 22 | 18 | 12 | 8 | 3 |

