Integrated Geometry   Name_____

The businesses that are most likely to succeed are those that pay close attention to details and trends. 50% of all small businesses FAIL in the first year (Source: U.S. Small Business Administration). A business owner owned two "Bruce & Stirs" ice cream shops. Both business are in very similar locations and sell approximately the same amount of products. The owner was experimenting with different numbers of employees for each location and collected the following data for a few different summer months:

Number of Employees, *(x)*	4	3	0.5	1	2.5
Gross Profit *(y)* *(in Thousands of Dollars)*	2	8.5	5.2	8.6	8.9

1) What do you think is meant by 0.5 employees?

2) How many total hours of work would have been worked by 0.5 employees?

3) Plot the data on the graph at the right.
   a. Describe the shape or pattern the data makes.

   b. Can you make a hypothesis as to why such a pattern might occur?
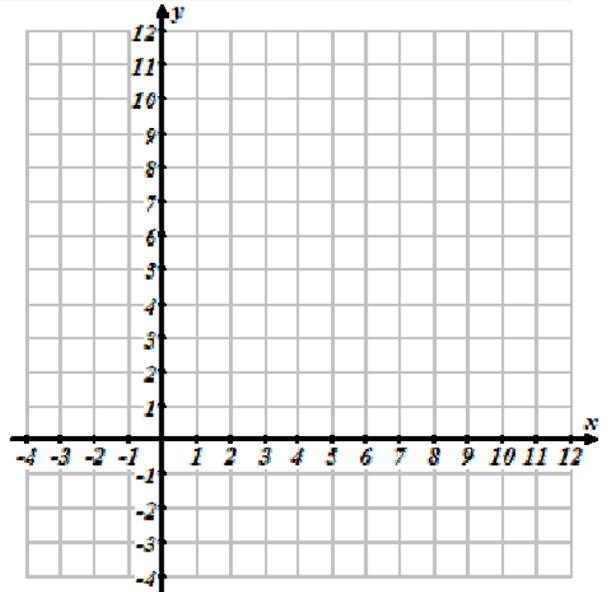
4) Using the data to find a quadratic model that represents the data using a quadratic regression.
   The following are the directions for the TI-83/84:

   A) Under the Stat menu, press [STAT] [5] [ENTER] .
      (This just resets the list menus)

   B) Next, press [STAT] [ENTER]

   C) If there is OLD data already in the lists that needs to be cleared press the up arrow,
      [^] , to highlight **L1** and then press [CLEAR] [ENTER] to clear out the old data. Do the same for L2 if it has OLD data that needs to be cleared.

   To clear out **OLD** data, first highlight **L1** and press [CLEAR] [ENTER].

   D) Next, enter the **Number of Employees** in **L1** and the **Gross Profit** in **L2**.

   E) Return to the home screen by pressing [2nd] [MODE] and then to calculate the quadratic regression press [STAT] [>] [5] [ENTER] .

   Fill in the blanks to complete the QUADRATIC REGRESSION equation.
   (round to the nearest tenth)

$$\mathbf{y} = \underset{a}{\underline{\hspace{1.5cm}}} \cdot \mathbf{x}^2 + \underset{b}{\underline{\hspace{1.5cm}}} \cdot \mathbf{x} + \underset{c}{\underline{\hspace{1.5cm}}}$$

You are trying to decide how many employees to hire. Let **x** represent the number of **employees** you hire; let **y** represent your profit in thousands of **dollars**. Use the equation you determined from the previous page.

$$y = \underline{\hspace{1cm}}_{a} \cdot x^2 + \underline{\hspace{1cm}}_{b} \cdot x + \underline{\hspace{1cm}}_{c}$$

5) Describe the shape and characteristic(s) of the graph of the function above based on the leading coefficient (a).

6) You need to graph this function in order to identify how many employees you need to hire that would maximize your profit. Describe how you would do this without using your calculator.

7) Draw a sketch of the graph. **Label** the vertex, axis of symmetry, y-intercept, zeros, and axes (x-axis represents employees and y-axis represents thousands of dollars).
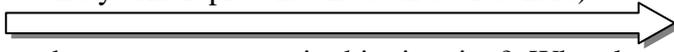
8) What does the vertex represent in this situation? What does the x-value represent? What does the y-value represent?

9) Based on your function, how much **_gross profit_** should be made with **_zero employees_**? How might this be possible?

10) Describe what the zeros represent? Are these possible or do you think the domain should be restricted for this problem?
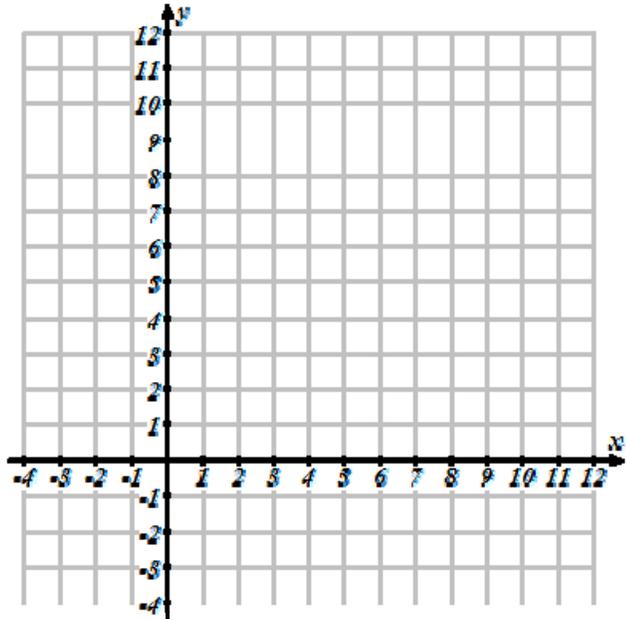
11) Make a table to show the relationship between employees and profit.
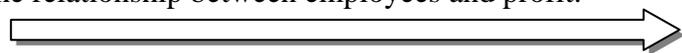
12) What type of numbers most accurately describes the numbers you used for in the first column of your table? (Natural, Whole, Integers, Rational, Irrational, Real)

13) Should the input of the function be Continuous? Explain.

14) How many employees should you hire? Explain.

Number of Employees	Gross Profit

15) What can you say about the axis of symmetry?

16) If the owner is content with making $8000 in profit but would like to help her local economy by hiring as many employees as she can, how many employees should she hire?

17) Make a list of other quantitative (numeric) variables you think a business owner should monitor for trends?

18) Provide two variables between which you think there should be a **linear** relationship. Explain your reasoning.

19) Provide two variables between which you think there should be a **quadratic** relationship (other than the number of employees and gross profit). Explain your reasoning.

The Scoop on Selling Ice Cream - Interesting facts about the Ice Cream Business
- Each American consumes a yearly average of 23.2 quarts of ice cream, ice milk, sherbet, ices and other commercially produced frozen dairy products. How many gallons is this?

- The top three cites that purchase the most ice cream on a per capita basis are: Portland, Oregon; St. Louis, Missouri; and Seattle, Washington.

- Children of the ages two through 12, and adults age 45 plus, eat the most ice cream per person.

- 98 percent of all households purchase ice cream. (Source for the previous four statistics: MakeIceCream.com)