

1. Shannise Cole makes and sells candy. She has found that the cost per box for making  $x$  boxes of candy is given by

$$C(x) = x^2 - 40x + 405.$$

- (a) How much does it cost per box to make 15 boxes? 18 boxes? 30 boxes?

$$C(15) = \$30$$

$$C(18) = \$9$$

$$C(30) = \$105$$

- (b) What point on the graph corresponds to the number of boxes that will make the cost per box as small as possible?

The vertex is the point that corresponds to the minimum cost per box.

- (c) How many boxes should she make in order to keep the cost per box at a minimum? What is the minimum cost per box?

She should make 20 boxes per day to minimize the cost. The minimum cost is \$5 per box.

2. A researcher in physiology has decided that a good mathematical model for the number of impulses fired after a nerve has been stimulated is given by  $y = -x^2 + 20x - 60$ , where  $y$  is the number of responses per millisecond and  $x$  is the number of milliseconds since the nerve was stimulated.

- (a) When will the maximum firing rate be reached?

The maximum firing rate is reached after 10 milliseconds.

- (b) What is the maximum firing rate?

The maximum firing rate is 40 responses per millisecond.

3. Farmer Linton wants to find the best time to take her hogs to market. The current price is 88 cents per pound and her hogs weigh an average of 90 pounds. The hogs gain 5 pounds per week and the market price for hogs is falling each week by 2 cents per pound. How many weeks should Ms. Linton wait before taking her hogs to market in order to receive as much money as possible? At that time, how much money will she get per hog?

$$R(x) = (90 + 5x)(.88 - .02x)$$

She should wait 13 weeks to take her hogs to market. At that time she will receive \$96.10 per hog.

4. A rectangular garden bounded on one side by a river is to be fenced on the other three sides. Fencing material for the side parallel to the river costs \$30 per foot and material for the other two sides costs \$10 per foot. What are the dimensions of the garden of the largest possible area, if \$1200 is to be spent for fencing material?

$$20x + 30y = 1200$$

$$A = xy$$

$$A = x\left(40 - \frac{2}{3}x\right)$$

The dimensions of the garden with the largest possible area are 30 x 20, with the sides parallel to the river having length 20 ft and the sides not parallel to the river having length 30 feet.

5. If the revenue function for a company is  $R(x) = 400x - 2x^2$  and  $C(x) = 220x + 2000$ , with  $0 \leq x \leq 100$ , find:

- (a) the break-even point

$$x \approx 77.01 \text{ or } x \approx 12.98$$

- (b) the number of items that need to be sold to maximize the profit

Profit is maximized when  $x = 45$

- (c) the maximum profit

The maximum profit is \$2050

- (d) the range of sales that will result in a loss?

Since the break-even points are 77.01 and 12.98, there will be a loss if  $x < 12.98$  or  $x > 77.01$

- (e) the range of sales that will result in a profit?

A profit will occur for  $12.98 < x < 77.01$