# Section 4.5

Business and Economics Applications

# Reminder

- Profit = Revenue – Cost $P(x) = R(x) - C(x)$

Revenue = (demand)(units) $\mathrm{R}(x) = p * x$

Cost = (cost per unit)(units) + fixed cost $C(x) = cx + k$

Average cost = Cost / units $\bar{C}(x) = \frac{C(x)}{x}$

# Example 1:

- A company determined that it's total revenue (in dollars) for a product can be modeled by $R = 33x^2 - 0.02x^3$ where x is the number of units produced and sold.

What production level will yield a maximum revenue?

# Example 2:

A company estimates that the cost in dollars of producing x units of a product can be modeled by $C = 800 + .04x + .0002x^2$. Find the production level that minimizes the average cost per unit.

# Example 3:

- A commodity has a demand function, p, and a total cost function modeled by C, where x is the number of units. $p(x) = 100 - 0.5x \quad and \quad C(x) = 50x + 37.5$

a) What price yields a maximum profit?

a) When the profit is maximized, what is the average cost per unit?

# Example

- Supppose the demand for a product is \$14 and the total costs are $C(x) = 0.2x^2 + 6.4x + 2$. What is the maximum value of the profit?

# Additional Problems:

- Inventory Cost Function:

$$x = \text{lot size;}$$

$$\frac{x}{2} = \text{average number of items in the inventory;}$$

$$\frac{\text{total ordered}}{x} = \text{number of orders per year; and}$$

$$C(x) = (\text{storage cost per item}) \cdot \left(\frac{x}{2}\right) + (\text{cost per order}) \cdot \left(\frac{\text{total ordered}}{x}\right)$$

$$\left(\begin{array}{c}\text{inventory}\\ \text{costs}\end{array}\right) = \left(\begin{array}{c}\text{storage}\\ \text{costs}\end{array}\right) + \left(\begin{array}{c}\text{ordering}\\ \text{costs}\end{array}\right)$$

# Example 4: Inventory Cost

- A furniture dealer sells $500$ desks per year. The desks take up floor space and warehouse space, and the dealer estimates his storage costs at $\$6$ per desk. The distributor charges the dealer a $\$60$ fee for each order. How many times per year and in what lot size should the dealer order to minimize inventory costs?

# Inventory Example

A jewelry store expects to sell 120 diamond bracelets during the next year. It costs $2.40 to store one diamond bracelet for one year. To reorder, there is a fixed cost of $16, plus $2.60 for each diamond bracelet ordered. In what lot size and how many times per year should an order be placed to minimize inventory costs?

# Example 5:

When a wholesaler sold a product at $40 per unit, sales were 300 units per week. After a price increase of 5, however, the average number of units sold dropped to 275 per week.

a) Find the demand function D(x), assuming it is linear.

b) Find the Revenue function.

c) What price per unit will maximize the revenue?

# Example

A sporting goods store sells 100 tennis rackets per month at $90 each. The owners estimate that for each $5 increase in price, they will sell 5 fewer tennis rackets per month. Find the price per tennis racket that will maximize revenue.

# Example 6:

- The profit P (in thousands of dollars) for a company spending an amount s (in thousands of dollars) on advertising is given by the following equation:

$$P = -\frac{1}{10}s^3 + 15s^2 + 500$$

a) Find the amount of money that will yield a maximum profit.
b) Find the point of diminishing returns.