(1) A pear plantation contains 90 trees per acre. The average yield is 300 pears per tree. The farmer wishes to plant more trees to maximize the yield per acre. From past evidence the farmer has determined that for each additional tree planted per acre, the yield per tree is reduced by 3 pears. Find the number of trees per acre that will maximize the yield per acre.

(2) A Tire Company has 20 stores on the island of Montreal, each of which has an average income of \$7000 per week. After study, the company notices that for each new store opened, the average weekly income drops by \$70. How many new stores should be opened to maximize income?

(3) The average cost in dollars/unit to manufacture a product is $\overline{C} = \frac{1}{3}x^2 + 30x - 1600 + \frac{50\,000}{x}$. How many units should be made in order to minimize the cost and what is the minimum cost?

(4) The selling price in dollars/unit of a product is $p = -\frac{1}{3}x^2 - \frac{3}{2}x + 810$. How many units should be made in order to maximize the revenue and what is the maximum revenue?

(5) A company manufactures and sells x units of a product per week. The weekly average cost in dollars per unit is $\overline{C} = 8x + 331 + \frac{5000}{x}$ and the selling price in dollars per unit is $p = -\frac{1}{3}x^2 - 6x + 2160$. Find the weekly maximum profit, the production level that will realize the maximum profit and the price that the company should charge for each unit.

(6) If the average manufacturing cost (in dollars per unit) of a product is given by $\overline{C} = x^2 + 35x + 82 + \frac{11500}{x}$, where x is the number of units manufactured, and the selling price in dollars per unit is $p = -x^2 - 31x + 5500$, what production level will maximize the profit? What is the maximum profit?

(7) A rancher wants to build a fence around 4500 square feet of his land, and subdivide it into 2 equal rectangular fields. The inner fence costs \$20 per linear foot and the outer fence costs \$40 per linear foot. Find the minimum cost of the fence.

(8) A company wants to enclose a storage area with a fence, next to a wall of a building. The storage area will be 6400 square meters. The fence opposite the wall of the building costs \$10 per linear meter and the fence of the other two sides costs \$20 per linear meter. Find the dimensions of the storage area to minimize the cost of the fence.

(9) A cherry plantation contains 70 trees per acre. The average yield is 600 cherries per tree. The farmer wishes to plant more trees to maximize the yield per acre. From past evidence the farmer has determined that for each additional tree planted per acre, the yield per tree is reduced by 3 cherries. Find the number of trees per acre that will maximize the yield per acre.

(10) A Heating Company has 20 stores on the South Shore of Montreal, each of which has an average income of \$24 000 per week. After study, the company notices that for each new store opened, the average weekly income drops by \$800 for each store. How many new stores should be opened to maximize income?

(11) The average cost in dollars/unit to manufacture a product is $\overline{C} = \frac{1}{3}x^2 + 18x - 1440 + \frac{20\,000}{x}$. How many units should be made in order to minimize the cost and what is the minimum cost?

(12) The selling price in dollars/unit of a product is $p = -\frac{1}{3}x^2 + 2x + 96$. How many units should be made in order to maximize the revenue and what is the maximum revenue?

(13) A company manufactures and sells x units of a product per week. The weekly average cost in dollars per unit is $\overline{C} = \frac{1}{3}x^2 + 9x + 17 + \frac{1552}{x}$ and the selling price in dollars per unit is $p = -\frac{1}{3}x^2 - 12x + 7370$. Find the weekly maximum profit, the production level that will realize the maximum profit and the price that the company should charge for each unit.

(14) If the average manufacturing cost (in dollars per unit) of a product is given by $\overline{C} = 2x^2 + 7x + 42 + \frac{1597}{x}$, where x is the number of units manufactured, and the selling price in dollars per unit is $p = -x^2 - 11x + 4200$, what is the production level that will maximize the profit? What is the maximum profit?

(15) An area of 4200 square meters is to be enclosed by a fence, and separated into 2 equal rectangular fields. The inner fence costs \$10 per linear meter and the outer fence costs \$30 per linear meter. Find the minimum cost of the fence.

(16) A farmer has \$3600 to fence a land next to a river. She wants to enclose a rectangular field, and the fence opposite to the river costs \$15 per linear meter while the fence of the other two sides costs \$25 per linear meter. Find the maximum area of the land she can enclose.

(17) A company manufactures and sells x units of a product per day. If the daily cost in dollars is $C = 3x^2 + 44x + 13\,417$ and the revenue in dollars is $R = -\frac{1}{3}x^3 - x^2 + 4517x$, find the maximum profit.

(18) The demand function for a product is given by $p = \frac{-0.1x + 80}{0.01x + 2}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$10 decreases by 3%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(19) The demand function for a product is given by $p = \sqrt{600 - x}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$17 decreases by 2%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(20) The demand function for a product is given by $p = -x^2 - 39x + 8241$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$6551 increases by 3%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(21) The demand function for a product is given by $p = 57 - \sqrt{x}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$18 increases by 5%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(22) The demand function for a product is given by $p = \dfrac{-0.05x + 120}{0.01x + 4}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$3.75 decreases by 4%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(23) The demand function for a product is given by $p = \sqrt{300 - x}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$15 increases by 1%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(24) The demand function for a product is given by $p = -x^2 - 21x + 12\,528$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$9986 decreases by 4%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(25) The demand function for a product is given by $p = 450 - 2.5\sqrt{x}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$175 decreases by 3%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

(26) The demand function for a product is given by $p = \sqrt{100 - \sqrt{x}}$ where p is the price per unit when x units are demanded.

(a) Determine the intervals on which the demand is elastic or inelastic.

(b) If the price of the product at \$6 increases by 2%, what is the approximate percentage change in demand?

(c) If the change in **(b)** happens, will the total revenue increase or decrease?

(d) What price will generate maximum revenue?

ANSWERS

(1) 95 trees per acre (2) 40 new stores (3) 20 units, Cost is \$32 666.67

(4) 27 units, Revenue is \$14 215.50 (5) Max. Profit = \$37 924.67; 31 units; \$1653.67 per unit

(6) 21 units, Profit is \$54 650 (7) \$12 000 (8) 40m by 60m (9) 135 trees per acre

(10) 5 new stores (11) 24 units, Cost is \$416 (12) 12 units, Revenue is \$864

(13) Max. Profit = \$196 291; 43 units; \$5621.33 per unit (14) 21 units, Profit is \$50 000

(15) \$8400 (16) 4320 square meters (17) \$169 157

(18) (a) $[0, 247[$: E; $]247, 800]$: I (b) Inc 2.5% (c) Dec (d) \$12.37

(19) (a) $[0, 400[$: E; $]400, 600]$: I (b) Inc 3.72% (c) Inc (d) \$14.14

(20) (a) $[0, 41[$: E; $]41, 73]$: I (b) Dec 8.31% (c) Dec (d) \$4961

(21) (a) $[0, 16\,044[$: E; $]16\,044, 36\,100]$: I (b) Dec 4.62% (c) Inc (d) \$19

(22) (a) $[0, 658[$: E; $]658, 2400]$: I (b) Inc 2.29% (c) Dec (d) \$8.23

(23) (a) $[0, 200[$: E; $]200, 300]$: I (b) Dec 6% (c) Dec (d) \$10

(24) (a) $[0, 58[$: E; $]58, 101]$: I (b) Inc 9.46% (c) Inc (d) \$7946

(25) (a) $[0, 14\,400[$: E; $]14\,400, 32\,400]$: I (b) Inc 3.82% (c) Inc (d) \$150

(26) (a) $[0, 6400[$: E; $]6400, 10\,000]$: I (b) Dec 4.5% (c) Dec (d) \$4.47