Optimization Problems & Marginal Analysis Practicing Exercises

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) Find the number of units that must be produced and sold in order to yield the maximum profit, given the following equations for revenue and cost:
   \[ R(x) = 60x - 0.5x^2 \]
   \[ C(x) = 4x + 7 \]
   A) 63 units  
   B) 57 units  
   C) 64 units  
   D) 56 units

2) Find the maximum profit given the following revenue and cost functions:
   \[ R(x) = 108x - x^2 \]
   \[ C(x) = \frac{1}{3}x^3 - 3x^2 + 96x + 36 \]
   where \( x \) is in thousands of units and \( R(x) \) and \( C(x) \) are in thousands of dollars.
   A) 108 thousand dollars  
   B) 36 thousand dollars  
   C) 72 thousand dollars  
   D) 18 thousand dollars

3) An appliance company determines that in order to sell \( x \) dishwashers, the price per dishwasher must be
   \[ p = 600 - 0.4x \]
   It also determines that the total cost of producing \( x \) dishwashers is given by
   \[ C(x) = 3000 + 0.2x^2 \] 
   What is the maximum profit?
   A) $153,000  
   B) $297,000  
   C) $147,000  
   D) $150,000

4) A hotel has 230 units. All rooms are occupied when the hotel charges $110 per day for a room. For every increase of \( x \) dollars in the daily room rate, there are \( x \) rooms vacant. Each occupied room costs $34 per day to service and maintain. What should the hotel charge per day in order to maximize daily profit?
   A) $177  
   B) $187  
   C) $170  
   D) $77

5) Find the number of units that must be produced and sold in order to yield the maximum profit, given the following equations for revenue and cost:
   \[ R(x) = 20x - 0.5x^2 \]
   \[ C(x) = 9x + 8 \]
   A) 19 units  
   B) 29 units  
   C) 12 units  
   D) 11 units

6) Find the maximum profit given the following revenue and cost functions:
   \[ R(x) = 136x - x^2 \]
   \[ C(x) = \frac{1}{3}x^3 - 9x^2 + 100x + 36 \]
   where \( x \) is in thousands of units and \( R(x) \) and \( C(x) \) are in thousands of dollars.
   A) 1260 thousand dollars  
   B) 774 thousand dollars  
   C) 1332 thousand dollars  
   D) 2232 thousand dollars

Professor Prieto-Valdes 1
7) An appliance company determines that in order to sell $x$ dishwashers, the price per dishwasher must be 
\[ p = 660 - 0.5x. \]
It also determines that the total cost of producing $x$ dishwashers is given by 
\[ C(x) = 6000 + 0.7x^2. \]
What is the maximum profit? 
A) $175,500  
B) $84,750  
C) $90,750  
D) $96,750

8) A hotel has 300 units. All rooms are occupied when the hotel charges $110 per day for a room. For every increase of $x$ dollars in the daily room rate, there are $x$ rooms vacant. Each occupied room costs $26 per day to service and maintain. What should the hotel charge per day in order to maximize daily profit? 
A) $205  
B) $218  
C) $228  
D) $108

9) If the price charged for a bolt is $p$ cents, then $x$ thousand bolts will be sold in a certain hardware store, where \[ p = 54 - \frac{x}{20}. \] How many bolts must be sold to maximize revenue?  
A) 540 bolts  
B) 1080 thousand bolts  
C) 540 thousand bolts  
D) 1080 bolts

10) A baseball team is trying to determine what price to charge for tickets. At a price of $10 per ticket, it averages 40,000 people per game. For every increase of $1, it loses 5,000 people. Every person at the game spends an average of $5 on concessions. What price per ticket should be charged in order to maximize revenue? 
A) $3.00  
B) $13.50  
C) $6.50  
D) $3.50

11) A bookstore has an annual demand for 38,000 copies of a best-selling book. It costs $0.60 to store one copy for one year, and it costs $55 to place an order. Find the optimum number of copies per order. 
A) 3024 copies  
B) 2639 copies  
C) 2375 copies  
D) 3408 copies

12) A local office supply store has an annual demand for 10,000 cases of photocopier paper per year. It costs $4 per year to store a case of photocopier paper, and it costs $60 to place an order. Find the optimum number of cases of photocopier paper per order. 
A) 173  
B) 387  
C) 548  
D) 300,000

13) A company estimates that the daily revenue (in dollars) from the sale of $x$ cookies is given by 
\[ R(x) = 885 + 0.02x + 0.0003x^2. \]
Currently, the company sells 900 cookies per day. Use marginal revenue to estimate the increase in revenue if the company increases sales by one cookie per day. 
A) $0.56  
B) $92.00  
C) $0.92  
D) $56.00

14) A company estimates that the daily cost (in dollars) of producing $x$ chocolate bars is given by 
\[ C(x) = 1635 + 0.02x + 0.0004x^2. \]
Currently, the company produces 600 chocolate bars per day. Use marginal cost to estimate the increase in the daily cost if one additional chocolate bar is produced per day. 
A) $0.50  
B) $62.00  
C) $0.62  
D) $50.00

Professor Prieto-Valdes2
15) The total cost, in dollars, to produce \( x \) DVD players is \( C(x) = 70 + 7x - x^2 + 2x^3 \). Find the marginal cost when \( x = 3 \).

   A) $125  
   B) $136  
   C) $55  
   D) $66

16) Suppose that the daily cost, in dollars, of producing \( x \) televisions is

   \[ C(x) = 0.003x^3 + 0.1x^2 + 62x + 620, \]

   and currently 60 televisions are produced daily. Use \( C(60) \) and the marginal cost to estimate the daily cost of increasing production to 63 televisions daily. Round to the nearest dollar.

   A) $5481  
   B) $5673  
   C) $5635  
   D) $5667