MATH 119 Chapter 4: Derivative Applications

Class Note

Ex 1: Read example 3 and 4 on page 191.

Ex 2: An appliance firm determines to sell q radios, the price per radio is given by $p = 300 - q$ it also determines that the total cost of producing q radios is given by: $C(q) = 1000 + 0.5\ q^2$.

a) find the total revenue function

b) find the total profit function ($P = R - C$)

c) how many radios must be produced and sell to maximize the profit

d) what is the maximum profit? (When $P' = 0$ or when $R' = C'$ as in section 2.6)

e) what is the price per radio must be charged to maximize the profit?

Ans: a) $R = 300q - q^2$. *b)* $P = -1.5q^2 + 300q - 1000$.

c) 100. *d) 14000* *e) 200.*

Ex 3: A theater determine that if the admission price is \$ 10, it averages 100 people in attendance. But for every increase of \$ 2, it loses 5 customers from the average number. Every customers spends an average of \$ 2 on concessions. What admission price should the theater charge in order to maximize the revenue?

Solution:

- Revenue from tickets = (New Price) (New # of tickets)
  = $(10 + 2x)(100 - 5x)$
- Revenue from concessions = \$ 2 (New # of customers)
  = \$2 $(100 - 5x)$

- Total Revenue = Revenue from Tickets + Revenue from Concessions
  $R = (10 + 2x)(100 - 5x) + 2(100 - 5x)$

Find R' and make it = 0 and solve.

(Answer: $x = 7$ or new price is \$ 24)

Ex 4: An apartment complex with 220 units can fill all units when the rent is \$480 per month. It is estimated that for each \$15 per month increase in rent, 5 units will become vacant. The complex has a fixed monthly costs of \$60,000 and a maintenance cost of \$60 for each unit rented. What monthly rent should be charged to maximize the profit?

Solution:

- Revenue R = (New Price) (New # of units) = $(480 + 15x)(220 - 5x)$
- Cost C = \$ 60 (New # of units) + \$60,000 = $60(220 - 5x) + 60000$

- Profit P = Revenue - Cost

Find P' and make it = 0 and solve.

(Answer: new rent is \$600)

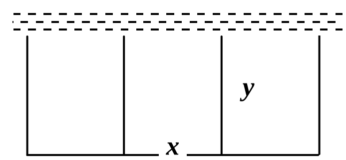
More Derivative Applications

The following are applications on area and perimeter. It requires **two** equations with **two** variables:

1) The first equation is from the given information, the second one is to maximize or minimize.
2) Make the second equation with **one** variable using the first equation and then solve using the steps of section 4.1 and 4.2.

Perimeter: The sum of all sides.
Area: = Length . Width

Ex 5: A farmer wants to enclose three rectangular areas next to a river using 400 feet of fencing. What is the largest area that can be enclosed? *(note that the farmer doesn't have to fence the sides next to the river)*



Equation 1, Given: Perimeter = 400 *or* $400 = x + 4y$

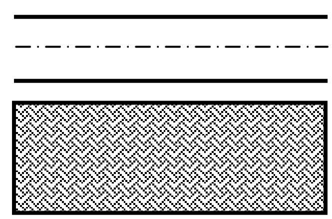
Equation 2, Find: Max Area *or* $A = x.y$

- Isolate a variable from the first equation: $x = 400 - 4y$
- Substitute in the second equation: $A = x.y = (400 - 4y).y$
  $= 400y - 4y^2$

Find A' and make it = 0, and solve. *Use this space to solve in class:*

(Answer: 50 by 200)

Ex 6: A rectangular lot is to be fenced off along the highway. The fence along the highway costs $ 6 per ft, on the other three sides $ 2 per ft. Find the largest area that can be fenced off for $ 320.



Equation 1, Given: total cost = $320 *or* $320 = \$8x + \$4y$

Equation 2, Find: Max Area *or* $A = x.y$

- Isolate a variable from the first equation: $y = (320 - 8x) / 4 = 80 - 2x$
- Substitute in the second equation: $A = x.y = (80 - 2x).x$
  $= 80x - 2x^2$
- Find A' and make it = 0, and solve. *Use this space to solve in class*

(Answer: 40 by 20, A = 800)