MAT 125: Paper Description

Your biologist / engineer / fashion mogul friend has developed a new calculus hat which allows its wearer to instantly solve any calculus problem. The two of you are forming a new company to produce, market, and sell the hat. You’ve secured venture capitalist funding as well as a facility in which you can manufacture up to 5000 hats per year. It is your job as CEO / CFO / COO to analyze all business aspects of the venture and make financial decisions to ensure you are successful.

The venture capitalists have asked you to produce by 6:50pm on March 5, 2015 an approximately 5 page typed written report analyzing pertinent aspects of your cost, revenue, and profit analyses as detailed below. They expect a well written and organized document consisting of supporting mathematical analysis but mainly of verbal descriptions of the meanings and implications of the mathematical results. The report should be a cohesive narrative, potentially with appropriately selected sections, and should not simply be separate, individual responses to the particular questions they raised. Graphs and plots are encouraged wherever they are a helpful means of explanation. They will judge your report at a rate of 40% for mathematical derivations, 30% for interpretations, and 30% for presentation. Once they are satisfied with your financial analysis they will release additional funding so you and your partner can start production and begin your calculus revolution.

Cost

a) You have determined that it will take an employee 15 minutes to manufacture one unit and that a competitive wage for the employee is $10/hour. Determine your production cost \( C_P(x) \).

b) In order to produce your product, you must initially purchase equipment for $15,000. This equipment then requires maintenance of $0.50 for each unit produced. Determine your equipment cost \( C_E(x) \).

c) You have determined that in order to order and store components for your product you will incur a fixed average inventory cost of \( \bar{C}_I = $42 \). Using this inventory cost, your production cost, and your equipment cost, determine your total cost \( C(x) \).

d) Determine your marginal total cost \( C'(x) \) at production levels of 2000, 2500, and 3000 units and compare each with the actual change in total cost for one additional unit at each level.

e) Determine the intervals for units produced for which your total cost \( C(x) \) is increasing or decreasing.

f) Determine the number of units that minimizes your average cost per unit \( \bar{C}(x) \).

g) Determine the number of units that minimizes your total cost \( C(x) \).
Revenue

a) You have determined that if you sell your product for $400 you will sell 1000 units while if you sell your product for $200 you will sell 3000 units. Assuming a linear model, determine the demand equation $p(x)$ for your product.

b) Determine whether the demand is elastic and interpret the result.

c) Determine your revenue $R(x)$.

d) Determine your marginal revenue $R'(x)$ at a production levels of 2000, 2500, and 3000 units and compare each with the actual change in revenue for one additional unit at each level.

e) Determine the intervals for units produced for which your revenue $R(x)$ is increasing or decreasing.

f) Determine the number of units that maximizes your revenue $R(x)$.

Profit

a) Determine your total profit $P(x)$.

b) Determine your marginal profit $P'(x)$ at production levels of 2000, 2500, and 3000 units and compare each with the actual change in total profit for one additional unit at each level.

c) Determine the intervals for units produced for which your profit $P(x)$ is increasing or decreasing.

d) Determine the number of units that maximizes your profit $P(x)$.

e) Determine your break even point.