**Activity 2.5.4a – Historic Hotels**

You and your team work as financial consultants. Your primary function is to provide clients financial advice. You have a client who just inherited a historic hotel in Boston, Massachusetts. Your client’s situation is described below.

Ms. Amanda Graham has just inherited a historic hotel. She would like to keep the hotel but she has little experience in hotel management. The hotel has 80 rooms. The previous owner told Ms. Graham that all of the rooms are occupied when the daily rate is $180 per room. The previous owner also stated that the number of occupied rooms depends on the daily rate. For every 5$ increase in the daily rate, one fewer room is occupied. Also, there is a $4 daily cost for maintaining and servicing each occupied room.

Ms. Graham would like to know what the daily rate should be in order to maximize the daily profit.

1. What variables impact Ms. Graham’s daily profit?
2. The number of occupied rooms depends on the daily rate (price per room). What type of mathematical relationship exists between the number of occupied rooms and the daily rate?
3. Let *n* be the number of occupied rooms and let *r* be the daily rate for each room. Create a function for *n* in terms of *r*.
4. Our goal is to find the daily rate that maximizes the daily profit. The profit is the difference between the daily revenue (money taken in) and the daily cost (money spent). Create functions for the daily revenue and daily cost.
5. Let *p* represent the daily profit. Create an equation for *p* in terms of *r*. What type of mathematical function is this?
6. Use the functions developed above to complete the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Daily Rate  (Per room)  *r* | Number of Occupied Rooms, *n* | Daily Revenue | Daily Cost | Daily Profit,  *p* |
| 180 |  |  |  |  |
| 185 |  |  |  |  |
| 190 |  |  |  |  |
| 200 |  |  |  |  |
| 210 |  |  |  |  |

1. What daily rate will produce a maximum daily profit? What is the maximum daily profit?
2. You and your team decide to provide Ms. Graham some additional information. What should the daily rate be in order for the daily profit to be more that $13,000? Justify your answer.
3. What is a greater threat to Ms. Graham’s profits: a $10 increase to the daily maintenance cost per room, or a change in consumer behavior such that for every $3 increase in the daily rate, one fewer room is occupied? Explain your answer.
4. What other variables should be considered and included in this mathematical model to make it more realistic?