Excel Lab Activity **Topic: Maximize Profit** **Business Math Applications**

Learning Goals: Students will learn to calculate total revenue, marginal revenue, total cost, marginal cost, and profit for a perfectly competitive firm. They will use this information to determine the profit-maximizing level of output (quantity), and observe what happens when we change or alter the following:
a) what happens to profit if only the fixed cost changes?
b) what happens to profit if the price remains the same but the total cost and marginal cost both change?
c) what happens to profit if only the price changes?

Directions:
Open a blank spreadsheet. Then create columns for price, quantity, revenue, marginal revenue, total cost, marginal cost, and profit. There are seven (7) columns of information. Be able to describe in words what each column represents. Give your company a name. You make and sell custom t-shirts, sweatshirts, and hoodies. For this problem we are producing and selling hoodies with company logos on them. The price of a hoodie is $50 (sell price). The cost of making hoodies is based on the quantity (Q). The current total cost is $20 + 10Q + 2Q^2$ and the ***marginal cost*** is $10 + 4Q$. Create a text box on each sheet to answer any/all questions.

You will submit a completed spreadsheet document that has FOUR tabs or sheets. On the first sheet, calculate total revenue, total cost, marginal cost, and profit for this company if the quantity goes from zero (0) to 15. The quantities may not seem like a lot, but we can assume that a quantity of 1 is really 1,000. So, numbers are in the "thousands" of hoodies. **This is part 1**:

	A	B	C	D	E	F	G
1	**Revenue and Cost for a perfectly competitive firm**						
2	Price	Quantity (Q)	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost	Profit
3	50	0	=A3*B3	50	=20+10*B3+2*B3^2	=10+4*B3	=C3-E3
4	50	1	50	50			
5	50	2	100	50			
6	50	3	150	50			
7	50	4	200	50			
8	50	5	250	50			
9	50	6	300	50			
10	50	7	350	50			
11	50	8	400	50			
12	50	9	450	50			
13	50	10	500	50			
14	50	11	550	50			
15	50	12	600	50			
16	50	13	650	50			
17	50	14	700	50			
18	50	15	750	50			

What we start with:
Revenue = price * quantity: $R = 50Q$

Total cost = $20 + 10Q + 2Q^2$
The "20" in this formula is "fixed cost".
Anything multiplied by Q or Q^2 is what we call "variable cost" because it depends on Q.

Marginal cost (the cost to increase production by 1) is given:
Marginal cost = $10 + 4Q$

Now find the row that maximizes profit. **Verify that marginal revenue = marginal cost** in this row! Highlight the ROW using YELLOW or GOLD - you can use the "Fill Color" bucket and color the entire row to show what quantity of production and sales would maximize profit.

Question to answer: At what quantity (of production and sales) do we see the greatest profit?

Part 2: Now we will change only the "fixed cost". Observe what happens to profit, and answer the questions: 1) At what quantity do we see the greatest profit? 2) Does it have anything to do with the fact that marginal cost and marginal revenue stayed the same?
The top few rows are shown here:

	A	B	C	D	E	F	G
1	Price	Quantity	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost	Profit
2	50	0	0				
3	50	1	50	50			
4	50	2	100	50			
5	50	3	150	50			
6	50	4	200	50			
7	50	5	250	50			
8	50	6	300	50			
9	50	7	350	50			
10	50	8	400	50			

What happens if only the fixed cost changes and marginal cost remains the same?
Total cost = **30** + 10*Q + 2*Q^2
Marginal cost = 10 + 4Q
Does maximum profit occur at the same quantity as before?

Part 3: Now we will change the "variable cost" which means that both total cost and marginal cost will also change. 1) At what quantity do we see the greatest profit? 2) Explain any difference from before. What changed and why did it matter?
The top few rows are shown here:

	A	B	C	D	E	F	G
1	Price	Quantity (Q)	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost	Profit
2	50	0	0				
3	50	1	50	50			
4	50	2	100	50			
5	50	3	150	50			
6	50	4	200	50			
7	50	5	250	50			
8	50	6	300	50			
9	50	7	350	50			
10	50	8	400	50			

Change variable cost:
Total Cost = 20 + 15*Q + 1.75*Q^2
Marginal Cost = 15 + 3.5*Q
Observe what happens to profit when cost and marginal cost

Part 4: Lastly, let's observe what happens when the price changes. Instead of $50 we will lower the price to $42. This also affects the marginal revenue. Answer the same two questions as with Part 3. What changed and why did it matter?
The top few rows are shown here:

	A	B	C	D	E	F	G	H
1	Price	Quantity (Q)	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost	Profit	
2	42	0	0	42				
3	42	1	42	42				
4	42	2	84	42				
5	42	3	126	42				
6	42	4	168	42				
7	42	5	210	42				
8	42	6	252	42				
9	42	7	294	42				

Change only the price:
Notice columns A and D are the new sell price.
Total cost and Marginal Cost are the same as before:
Total cost = **20** + 10*Q + 2*Q^2
Marginal cost = 10 + 4Q

Please make sure to insert a text box on each sheet with the answers to questions. Also, quantity should go from 0 to 15 on all sheets with every column completed with the appropriate formulas.