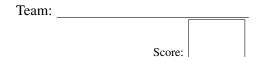# Decision Report 4

MATH 144 Applied Calculus for Business

Optimization: Maximizing Profit

In your previous decision report, you determined formulas for revenue $R(q)$ in thousands of dollars, and marginal revenue $MR(q)$ in dollars per unit, and predicted approximately what quantity would maximize revenue. The data table you created also related quantity, price, revenue, and marginal revenue predicted by several of your test markets, such as in this example:

Market #	National Quantity q (thousand)	Price p ($/unit)	Revenue R ($thousand)	Marginal Revenue MR ($/unit)
1	1377	265.76	365,893	15.56

The data in this example indicates that, if 1,377 thousand units were produced and sold at $265.76 per unit, a total sales revenue of $365,893 thousand dollars would be earned — *and*, each <u>additional</u> unit produced from this quantity would <u>increase</u> revenue by $15.56 .

However, would that increase in revenue be worth it? The answer to this question must balance marginal revenue with **marginal cost**, the <u>additional</u> cost that would be incurred to produce that one <u>additional</u> unit. In the example, when more than 1,200 thousand units are produced, the variable cost of producing one more unit is $72, so one additional unit *would cost more to produce than it would make in additional sales revenue*:

Market #	Quantity q (thousand)	Price p ($/unit)	Revenue R ($thousand)	Marginal Revenue MR ($/unit)	Marginal Cost MC ($/unit)	Marginal Profit MP ($/unit)
1	1377	265.76	365,893	15.56	72	-56.44

Therefore, at this production level and price point, producing one more unit will result in a net loss of $56.44. At this stage, the product is being "overproduced," and producing one *fewer* unit would result in a net additional profit of $56.44 — suggesting that the point of maximum profit is likely *less* than $q = 1377$ thousand units.

Decision: What quantity of your product should be produced in order to earn a *maximum* amount of profit, neither over- nor under-producing? What unit price must be charged at this optimal quantity, and how much total revenue, cost, and profit would there be at this quantity? Report your findings in a preliminary memo to your Vice President, including a table of data and/or graph.

Deliverable: In addition to adding marginal cost and marginal profit columns to your table of values from the previous decision, your team should record the algebra used in determining the point(s) of maximum profit using marginal revenue and marginal cost. Add your optimal solution to your table as an additional row.