Business Applications

typically found in RIT's Algebra for Mgmt. Science (1016-225) and Calculus for Mgmt. Science (1016-226)

I. Total Revenue, Total Cost, Total Profit

    a. Total Revenue (R) from the sale of *x* units = R(*x*): $R(x) = (\text{price per unit})(x)$

        R(*x*) = (price per unit)(# of units)

    b. Total Cost (C) of production and sale of *x* units = C(*x*): $C(x) = (\text{cost per unit})(x) + \text{fixed costs}$

        Total cost is made up of 2 parts:

            1. fixed costs (e.g. rent, utilities, etc)

            2. variable costs (costs directly related to the number of units produced)

    c. Total Profit (P) from the production and sale of *x* units = P(*x*): $P(x) = R(x) - C(x)$

        Total profit is the difference between the amount received from sales (revenue) and cost of production.

II. Marginal Revenue, Marginal Cost, and Marginal Profit

    a. Marginal Revenue $\left(\overline{MR}\right)$

            1. If R(*x*) is linear, then $\overline{MR}$ is the slope of the revenue function.

            2. <u>Calculus for Management Science</u>: $\overline{MR}$ is the derivative of the revenue function

    b. Marginal Cost $\left(\overline{MC}\right)$

            1. If C(*x*) is linear, then $\overline{MC}$ is the slope of the cost function.

            2. <u>Calculus for Management Science</u>: $\overline{MC}$ is the derivative of the cost function

III.

    a. Marginal Profit $\left(\overline{MP}\right)$

            1. If P(*x*) is linear, then $\overline{MP}$ is the slope of the profit function.

            2. <u>Calculus for Management Science</u>: $\overline{MP}$ is the derivative of the profit function

IV. Break Even Point

    a. The point at which the revenue equals the cost: Find *x* such that R(*x*) = C(*x*)

        which is another way of saying…

        The point at which profit equals zero: Find *x* such that P(*x*) = 0

    b. When the revenue function is greater than the cost function, there is a <u>profit</u>: $R(x) > C(x)$

    c. When the cost function is greater than the revenue function, there is a <u>loss</u>: $C(x) > R(x)$

V. Supply, Demand and Market Equilibrium

    a. *p* = price and *q* = quantity

    b. The <u>law of supply</u> states that the quantity supplied for sale will increase as the price of a product increases.

    c. The <u>law of demand</u> states that the quantity demanded will increase as price decreases or that the quantity demanded will decrease as price increases.

    d. The intersection of a supply function and the demand function is the point when the quantity of a commodity demanded is equal to the quantity supplied; this is called <u>Market Equilibrium</u>.

            1. The price at that intersection point is the <u>Equilibrium Price</u>.

            2. The quantity at that intersection point is the <u>Equilibrium Quantity</u>.

VI. **Optimization (Max / Min) in <u>Algebra for Management Science</u>**
  a. When finding the maximum (minimum) of a quadratic function, find the vertex
       1. The graph of a Quadratic function ($y = ax^2 + bx + c$) is a parabola.
       2. Vertex of a parabola: Use $x = \dfrac{-b}{2a}$ to find the x value and then sub x in to get y…(x, y)

  b. If a revenue function is a parabola opening down, then the vertex is the MAXIMUM REVENUE.
       Vertex of revenue function = (# of units, $ maximum revenue)

  c. If a profit function is a parabola opening down, then the vertex is the MAXIMUM PROFIT.
       Vertex of profit function = (# of units, $ maximum profit)

  d. If a cost function is parabola opening up, then the vertex is the MINIMUM COST.
       Vertex of cost function = (# of units, $ minimum cost)
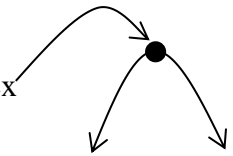
VII. **Optimization (Max / Min) in <u>Calculus for Management Science</u>**
  To find the maximum (minimum) value,
       1. Use derivative rules to take the derivative of the function
       2. Set the derivative equal to zero and solve

VIII. If the question asks you to find…
  a. Break-even point(s)
       1. Determine the revenue and cost functions.
       2. Set the revenue function equal to the cost function and solve.
            OR
       1. Determine the profit function.
       2. Set the profit function equal to zero and solve.

  b. Market Equilibrium
       1. Determine the supply and demand functions.
       2. Set the equations equal to each other and solve for q. Then find the corresponding p.

  c. Maximum Revenue, Maximum Profit, Minimum Cost
       1. Determine the revenue, profit or cost function
       2. Depending on what course the student is in…
            Algebra: Find the vertex
            Calculus: Take the derivative and set it equal to zero