Costs

1. In a small town, there is a mousepad factory which employs workers at $8 an hour, for forty-hour weeks. There is an old composer in town, who expects to complete an opera in a year's time. On the other hand, if he were not composing, he could give harp lessons, and charge his students $15 an hour. What is his opportunity cost in writing his opera? Explain the assumptions you made in deriving this answer.

2. A firm can choose between two production technologies for a new product line. If it installs technology 1, its yearly costs will be \( C_1(q) = 3600 + 65q + 36q^2 \). If it installs technology 2, they will be \( C_2(q) = 900 + 900q + q^2 \).

   - What is the firm's long-run average cost curve?
   - What is the firm's minimum efficient scale of production?
   - Which technology would the firm prefer (purely from a cost standpoint) if it expected to sell 30 units in summer and 10 units in winter each year?
   - What if it were more optimistic about summer sales? Explain.

3. A firm produces both pencils and erasers in a ratio of 2:3. Its costs are \( C(q_1, q_2) = 3200 + 0.1q_1 + 2q_1^2 + 0.2q_2 \), where \( q_1 \) is the output of pencils and \( q_2 \) the output of erasers.

   - Derive its ray average cost function
   - Derive its minimum efficient scale (MES) of production
   - What is the MES if it produces only pencils?
   - What is the MES if it produces only erasers?

Perfect competition

4. (CP, pg. 86, #3) Suppose a competitive market consists of identical firms with a constant long-run marginal cost of $10. (There are no fixed costs in the long run). Suppose the demand curve is given by \( q = 1000 - p \).

   (a) What are the price and quantity consumed in the long-run competitive equilibrium?

   (b) Suppose one new firm enters that is different from the existing firms. The new firm has a constant marginal cost of $9 and no fixed costs but can only produce 10 units (or fewer). What
are the price and the quantity consumed in long-run competitive equilibrium? Are these the same as in (a)? Explain.

(c) Are positive economic profits inconsistent with a long-run competitive equilibrium?

(e) In the long-run competitive equilibrium, must the profit of the marginal entrant be zero?

5. Suppose a firm’s costs are \( C(q) = 100 + 10q - 6q^2 + 3q^3 \). If all fixed costs are sunk, at what price will it shut down? If a percentage \( \alpha \) of the fixed costs are sunk, at what price will it shut down?

Monopoly

6. (CP, pg. 119, #3) If the demand curve is \( q = 5/p \), what is the elasticity of demand? What is total revenue when \( p = 1 \) and when \( p = 30 \)? If production costs $1 per unit, and the smallest production level is 1 unit, how much should the monopolist produce?

7. A market with demand \( q = 16/p^2 \) is supplied by a monopoly with costs \( C(q) = 6 + q^2/8 \). Calculate the equilibrium price, output, and monopoly profits. What would the equilibrium be if the market were supplied competitively by firms and each individual firm had the same costs?