1) I have drawn in the demand curve, LRAC, and LRMC curve for a natural monopolist who enjoys substantial economics of scale.
   a. Draw in MR and label it.
   b. Indicate the perfectly competitive price, $P_C$ and quantity, $Q_C$ (where demand equals LRMC),
   c. Indicate the regulated price, $P_R$, and quantity, $Q_R$, that would guarantee zero economic profits,
   d. Indicate the monopoly price, $P_M$ and quantity, $Q_M$. 
2) Market equilibria.
   a. I have drawn in the industry demand (D) and a horizontal supply curve (S) for a competitive market.
   b. Indicate the equilibrium price \( P_c \) and quantity \( Q_c \).
   c. Now draw the equilibrium price \( P_m \) and quantity \( Q_m \) for a monopolist assuming the same industry demand and supply curves.
   d. Label the lost consumer’s surplus as (LCS), the lost producer’s surplus as (LPS), and the redistribution from the consumer to producer (as REDIST), when the market changes from a competitive one to a monopoly. If any of these areas is zero, say so.
3) Cartel Instability. Complete the following model that illustrates why a cartel is inherently unstable. The average and marginal cost for each of \( n \) competitive firms is drawn in fig. 1 and the sum of all firm's marginal costs (\( \sum_i MC_i \)) is drawn in fig. 2 along with the aggregate demand curve, D.

a. First, in fig. 2, determine and label the competitive price and quantity as \( P_c \) and \( Q_c \). Extend \( P_c \) to the left until it intersects the MC curve in fig. 1. Label the output by the typical competitive firm as \( q_c \).

b. Now assume that the industry becomes a cartel. Draw in MR in fig. 2. and label the profit-maximizing cartel output for the industry as \( Q_m \) and, by extending a horizontal line to fig. 1, the required output for each firm in the cartel as \( q_m \). In fig. 2, indicate the industry cartel price as \( P_m \) and extend a horizontal line until it intersects MC in fig. 1.

c. Now in fig. 1, label how much the cartel firm would wish to produce if cheating is not punished and does not cause \( P_m \) to fall. Label this amount as \( q_{\text{cheat}} \).

d. If all cartel firms produce this amount, why will total cartel output expand to the competitive level (compare \( q_c \) and \( q_m \)).
4) I have started off the model of the dominant firm and competitive fringe.
   a. Derive the residual demand curve and the residual marginal revenue curve for the
dominant firm.
b. Indicate optimal output as $Q_d$ and price $P_d$ for the dominant firm.
c. Extend $P_d$ to the left and indicate profits for each member of the competitive
   fringe.
d. Label this rectangle as $\pi_f$.
e. Indicate the rectangle that gives the profits of the dominant firm. What are long
   run firm profits under perfect competition? ___________________
5) Using the results from problem 2, draw in the reaction curves for the two firms using the competitive output and monopoly output levels obtained there.
   a. Label each curve.
   b. Label the Cournot equilibrium.
   c. Rank total Cournot output \( Q_{\text{Cournot}} \) compared to monopoly output \( Q_M \) and competitive output \( Q_{\text{Comp}} \).
   d. Rank equilibrium Cournot price \( P_{\text{Cournot}} \) compared to monopoly price \( P_M \) and competitive price \( P_{\text{Comp}} \).
   e. In the Cournot model, does either firm know the complete reaction function of his rival?
   f. In the Cournot model, what assumption does each firm make about his rival’s production?
6) Stackelberg Model:
   a. The leader is firm 1 and the follower is firm 2. I have drawn the reaction curve for the follower (firm 2) in panel b).
   b. I have also drawn in Aggregate Demand. Draw the residual demand curve for the leader (firm 1) in panel a) and label it $D_r$.
   c. Derive firm 1’s residual marginal revenue curve and label it $MR_r$.
   d. Indicate the optimal output for firm 1 and firm 2 as $q_1^*$ and $q_2^*$. The production of firm 1 equals the production in what market?
   e. Rank production under perfect competition ($Q_{comp}$) compared to total production under Stackleberg ($Q_S$), production under monopoly ($Q_M$) and total production under Cournot ($Q_{Cournot}$).
   f. Rank price under perfect competition ($P_{comp}$) compared to price under Stackleberg ($P_S$), price under monopoly ($P_M$), and price under Cournot ($P_{Cournot}$).