1) Regulated Natural Monopolist
   (a.) I have drawn the Demand and LRAC curve for a regulated natural monopolist.
   (b.) Draw in the LRMC curve that is consistent with a LRAC curve that always slopes downward.
   (c.) Label the regulated price \( P_R \) and quantity \( Q_R \) that would allow the regulated firm to earn zero economic profits.
   (d.) Label the price \( P_C \) and quantity \( Q_C \) that would exist if the regulatory commission set price equal to LRMC.
   (e.) Draw in marginal revenue (MR) and the monopoly price \( P_M \) and quantity \( Q_M \).
   (f.) Why is \( P = LRMC \) not feasible in the long run? ____________________________
2) I have started off the model of the dominant firm and competitive fringe. In panel (a) I have drawn the marginal cost for the fringe firm (MCₐ), the average cost for the fringe firm (ACₐ), and the fringe supply curve, S.

a) In panel (b) I have drawn the aggregate demand curve, D. Derive and label the residual demand curve (Dₐ) and the residual marginal revenue curve (MRₐ) 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 with a rectangle labelled π_f.

d) Indicate profits for the dominant firm with a rectangle labelled as π_d.

e) In the absence of predatory pricing, why is it clear that the dominant firm does not wish to eliminate the competitive fringe from production? ________________
3) Assume that MC=$10 and use the following demand curve:

\[ P = 70 - \frac{1}{2} Q \]

a) I have drawn and labelled the demand curve, D.
b) Use the MC curve and indicate the competitive output as \( Q_c \).
c) Draw in the MR curve and indicate the monopoly output as \( Q_m \).
4) Using $Q_m$ and $Q_c$ from the last question, draw the Cournot reaction functions for firms 1 and 2, assuming two firms in the industry:
   a) Label the appropriate curve as $R_1$ or $R_2$.
   b) Label the Cournot equilibrium and $q^*_1$ and $q^*_2$.
   c) Using inequalities rank output under Cournot ($Q_{cournot}$), $Q_c$, and $Q_m$.

d) Using inequalities rank price under Cournot ($P_{cournot}$), $P_c$ and $P_m$.

e) In the Cournot model, what assumption does each firm make about the production of the other firm? ________________________________.
5) Stackelberg Model:

a) The leader is firm 1 and the follower is firm 2. Using the results from item 4, draw in the reaction curve for the follower (firm 2) in panel b).

b) Using the demand function in question 3, plug in the monopoly output and obtain the monopoly price. Using this price, now 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 \( q_2^* \).

e) The leader’s output level always equals what level solved for in problem 3? ___.

f) What is the total production of the two firms? ________.

g) Give the rank ordering of output under Competition \( (Q_c) \), Monopoly \( (Q_m) \), Cournot \( (Q_{\text{cournot}}) \), and Stackelberg \( (Q_s) \).

h) Give the rank ordering of prices under Competition \( (P_c) \), Monopoly \( (P_m) \), Cournot \( (P_{\text{cournot}}) \), and Stackelberg \( (P_s) \).

i) Are the follower’s profits under Stackelberg greater or less than his profits under Cournot? ____________

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