Question 1
There are 200 firms in an industry. Half of the firms use newer technology resulting in a cost function \( c(Q) = 200 + Q^2 \), while the remaining firms’ cost functions are \( c(Q) = 200 + 2Q^2 \). Market demand is \( Q_D(P) = 3,450 - 40P \). Thus, \( P(Q) = 86.25 - 0.025Q \). The industry is competitive (i.e., \( P = MC \)).

(a) Determine the equilibrium price and quantity and the profits of both types of firms.

(b) Now suppose that the firms with the inferior technology exit the market (their profit in (a) should be negative). Determine the new equilibrium price, quantity and firm profits.

(c) Determine the loss to the consumers when the high-cost firms exit the market (recall that the area underneath \( P(Q) \) between two values \( Q_1 \) and \( Q_2 \) measures the benefit to all consumers from increasing consumption from \( Q_1 \) to \( Q_2 \)).

(d) Taking the effect of firm profits into account determine by how much welfare increases or decreases when the high-cost firms exit the market.

(e) Should the government subsidize the industry such that all producers will remain in the market? Your answer should be based on the argument in (d). Does your answer change if the high-cost firms are domestic firms and the low-cost firms are foreign, and all the demand for the product is from domestic consumers only?

Question 2
Consider a Cournot Oligopoly. One firm has costs \( C_1(Q_1) = 10Q_1 \) while the other firm’s cost function is \( C_2(Q_2) = 12Q_2 \). The demand for both firms products \( Q = Q_1 + Q_2 \) is \( Q_D(P) = 200 - 2P \).

(a) Determine the equilibrium price \( P \), the market shares \( s_1, s_2 \), and the quantities \( Q_1, Q_2 \) produced by both firms.

(b) Suppose more firms with the newer technology enter the market. How many firms with the new technology must be in the market such that the firm with the old technology makes negative profits. In other words, suppose there is one firm with the high costs, and \( n \) firms with the low costs. At what level \( n \) will profits of the high-cost firm be negative?

Question 3
Suppose a market demand function is given by \( Q_D(P) = 1,000 - 10P \). The product can be produced with a cost function \( c(Q) = 10,000 + 20Q \).

(a) Determine \( Q \) and \( P \) and the firm’s profit if there is a single firm.

(b) Determine total output \( Q \), the equilibrium price, and the profit of each firm if there are two firms (i.e., a Cournot oligopoly).
(e) Determine $Q$, the equilibrium price, and the profit of each firm if there are 10 firms.

(d) Determine the welfare gain or loss between situations (a) and (b).