

# Practice Problem Set 11

180.102 Elements of Microeconomics - TA Section 03

Pinda Wang, 8 November 2024

## Part I. Monopoly

1. A monopolist faces the following market demand function:  $P = 24 - Q_d$ . Its total cost and marginal cost are given by:  $TC = Q^2 + 36$ ,  $MC = 2Q$ . Suppose the monopolist does not price-discriminate: it charges the same price to every consumer.
  - (a) Derive the firm's MR curve.
  - (b) Calculate the equilibrium price and quantity under such a monopoly. What is the monopolist's profit?
  - (c) Calculate the equilibrium price and quantity under perfect competition.
  - (d) In a graph, draw the consumer surplus and producer surplus under monopoly. In another graph, draw the consumer surplus and producer surplus under perfect competition.
  - (e) Calculate the consumer surplus, producer surplus, and deadweight loss under monopoly and perfect competition respectively.
  - (f) We know that monopolies are inefficient because the quantity under monopoly is less than under perfect competition. Can a subsidy to the monopolist eliminate this inefficiency? If so, calculate the amount of subsidy. If not, explain why.

# Solutions to Practice Problem Set 11

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## Part I. Monopoly

1. (a)  $TR = PQ = (24 - Q)Q = 24Q - Q^2 \implies MR = \frac{dTR}{dQ} = 24 - 2Q$ .

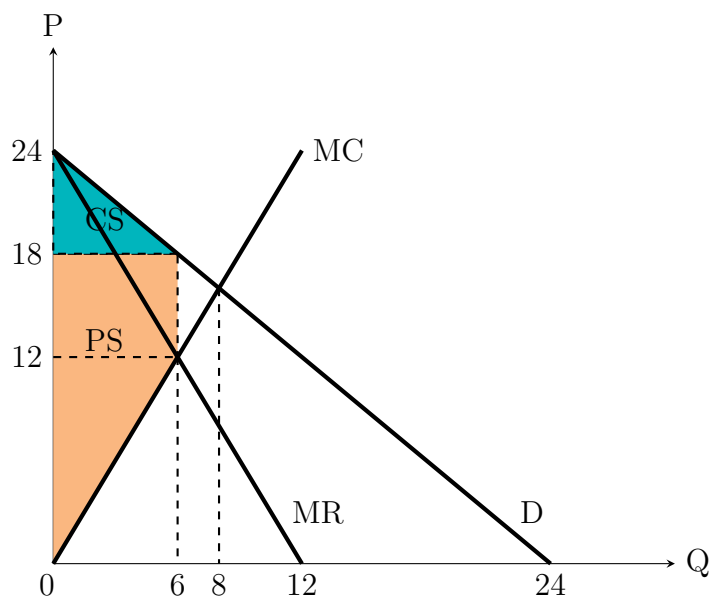
(b) The equilibrium under monopoly is achieved when  $MR = MC$ :

$$\begin{aligned} 24 - 2Q &= 2Q \\ \implies Q_m^* &= 6, P_m^* = 24 - Q_m^* = 18 \end{aligned}$$

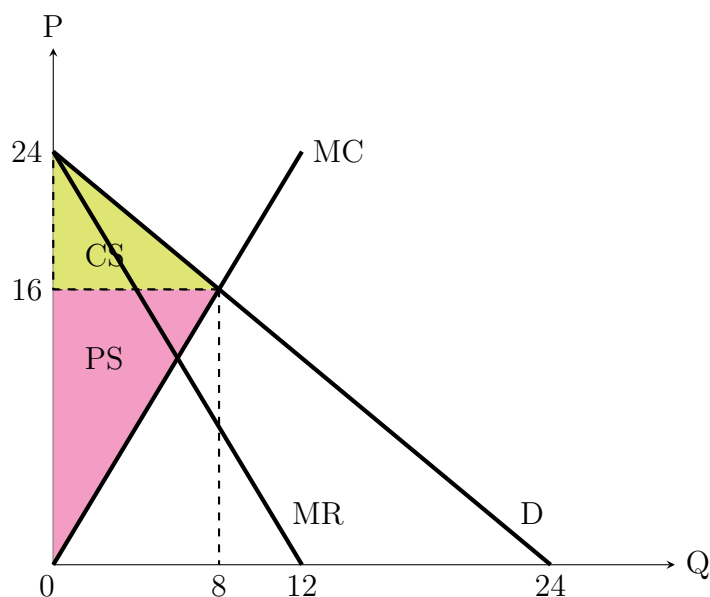
(c) Under perfect competition, equilibrium is achieved when  $D = MC$ :

$$\begin{aligned} 24 - Q &= 2Q \\ \implies Q^* &= 8, P^* = 16 \end{aligned}$$

(d) The graph under monopoly:



The graph under perfect competition:



(e) Under monopoly:

$$CS = 6 \times (24 - 18)/2 = 18$$

$$PS = (18 + (18 - 12)) \times 6/2 = 72$$

$$DWL = (18 - 12) \times (8 - 6)/2 = 6$$

Under perfect competition:

$$CS = (24 - 16) \times 8/2 = 32$$

$$PS = 16 \times 8/2 = 64$$

$$DWL = 0$$

(f) Yes, a subsidy to the monopolist can eliminate the inefficiency.

Suppose the government subsidizes the monopolist  $s$  dollars per unit of good. This shifts the MC curve downwards by  $s$ . (If you don't see why, consult Chapter 6 of Mankiw and remind yourself that a per-unit subsidy works to the opposite of taxation.) The new MC curve is:  $MC' = 2Q - s$ . For the market to be efficient, quantity needs to be the same as under perfect competition, i.e.  $Q = 8$ :

$$MC' = 2Q - s = 24 - 2Q = MR$$

$$Q = 8$$

Solving the above two equations together, we get:

$$s = 8$$