

# Optimizing with respect to price

- $\pi = D(p)p - c(D(p)) - F$ . We get the similar results.
- $\frac{d\pi}{dp} = D(p) + D'(p)p - c'(D(p))D'(p)$ .
- $\Rightarrow D(p) + D'(p)p - c'(D(p))D'(p) = 0$ , first order condition.
- Solving the first order condition, we get the monopoly price  $p^m$ .
- We get the monopoly quantity by substituting the monopoly price  $p^m$  in the demand function  $D(p) = q$ .

# Example 1

- Suppose the market demand curve is  $A - p = q$ , where  $A$  is positive real number real number and  $p$  is price and  $q$  is the output.
- Inverse demand function is  $A - q = p$ .
- The cost function of the monopolist is  $c(q) = cq + F$ .
- Production function is constant returns to scale.
- We assume that  $A > c$ .
- The profit of the monopolist is
$$\pi = (A - q)q - cq - F.$$

## Example 2

- Suppose the market demand curve is  $A - p = q$ , where  $A$  is positive real number real number and  $p$  is price and  $q$  is the output.
- Inverse demand function is  $A - q = p$ .
- The cost function of the monopolist is  $c(q) = cq^2 + F$ .
- Production function is decreasing returns to scale.
- The profit of the monopolist is
$$\pi = (A - q)q - cq^2 - F.$$

## What causes monopoly?

- Natural monopoly : due to high fixed cost only one firm is feasible.
- Patent: if a firm has developed as new product or technology that firm may have patent right over it. So only that firm can produce that product or use that technology. If any other firm wants to produce that new good or use that technology, it has to pay royalty.
- License system: License system of the government can also give rise to monopoly.

# Pricing Strategy of a Monopolist

- A monopolist may resort to different pricing strategy. A monopolist can sell different units at different price.
- Selling different units of output at different prices is called price discrimination.
- First degree price discrimination
- Second degree price discrimination
- Third degree price discrimination.

- In first degree price discrimination each quantity is sold to a consumer at the maximum price that the consumer is willing to pay.
- Each unit is sold at the maximum price a consumer is willing to pay. So there is no consumer surplus. So it is called perfect price discrimination.
- If two persons have different demand curve, each will be charged different price for the same quantity. Because the maximum amount the two consumers are willing to pay are different.
- This type of strategy is difficult to implement.

- In practice, the monopolist can bundle the output. Suppose at  $q^*$ ,  $MC(q) = f(q)$ .
- Monopolist sell a bundle of  $q^*$  units of output at the amount  $\int_0^{q^*} f(x)dx$ . It is shown in figure.
- The whole area under the demand curve is the amount a consumer has to pay to get the bundle of  $q^*$  units.
- The output is sold in the form of this bundle assuming that the demand function of each consumer is similar.
- The consumer surplus is zero. It is extracted by the monopolist.

- The outcome in first degree price discrimination market is Pareto optimal.
- The output produced in the case of first degree price discrimination is at the point where  $p = MC$ .
- The output level is same as perfectly competitive market.
- The total surplus which is sum of consumer surplus and producer surplus goes to the producer. It is same as the perfectly competitive market outcome.
- The consumer earns no surplus.
- This is also Pareto optimal because, if we want to make anyone better-off from this state some else has to made worse -off.
- See class notes