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Economics 201

### **Profit Max with a Natural Monopoly**

Assume that a natural monopolist has the following demand and cost related curves:

$$\begin{aligned}\text{Demand:} & \quad P = 100 - Q \\ \text{Marginal Revenue:} & \quad MR = 100 - 2Q \\ \text{Average Cost:} & \quad AC = 15 + \frac{400}{Q} \\ \text{Marginal Cost:} & \quad MC = 15\end{aligned}$$

#### **Why is this a natural monopoly?**

The answer stems from the monopolist's natural (cost-related) barriers to entry. The relative position of the AC and MC curves give the natural monopolist a cost advantage over its competition. Taking a closer look at these equations, you'll see that AC is always going to be greater than MC. Remembering the relationship between marginal and average values, AC will be declining as long as MC is below it. In general then, for a natural monopoly, AC is said to decrease (as Q increases) through "some relevant range of market output".

#### **Profit Max**

If the monopolist set her own output and price, this firm will produce where  $MR = MC$ :

$$100 - 2Q = 15$$

$$Q^* = 42.5$$

$$P = 100 - (42.5)$$

$$P^* = \$57.50$$

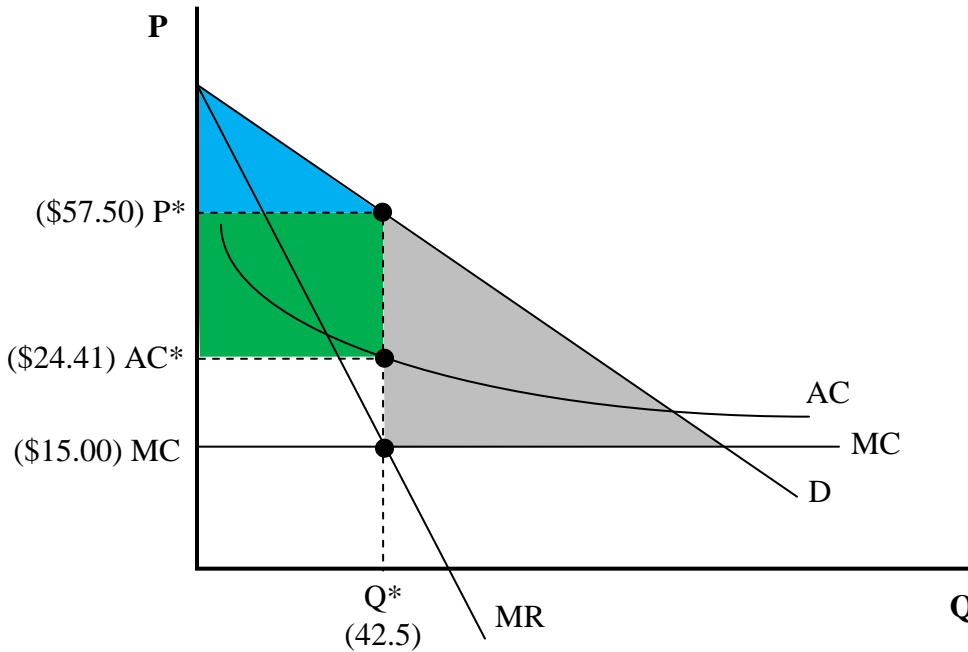
Therefore:  $Q^* = 42.5$  and  $P^* = \$57.50$

To determine the firm's profits, we plug these equilibrium values into the profit equation. Note that we must also calculate AC, by plugging  $Q^*$  into this equation as well.

$$\pi = \left( 57.50 - \left( 15 + \frac{400}{42.5} \right) \right) (42.5)$$

$$\pi = \$1406.33$$

On a graph, it looks like this:



Given that the monopolist sets a price based on  $MR = MC$  and not  $P = MC$ , the monopoly price is greater than what would occur within a more competitive market (\$15). This higher price makes consumer surplus (shaded blue in the graph) smaller in the monopoly setting (vs perfect competition).

One problem with this result is that since the monopolist produces less output than what is possible under perfect competition, the monopolist generates some deadweight loss (shaded gray on the graph) -- which represents the net benefit that is not received by anyone, as a result of the monopolist setting a price greater than  $MC$  (i.e.  $P > MC$ ).