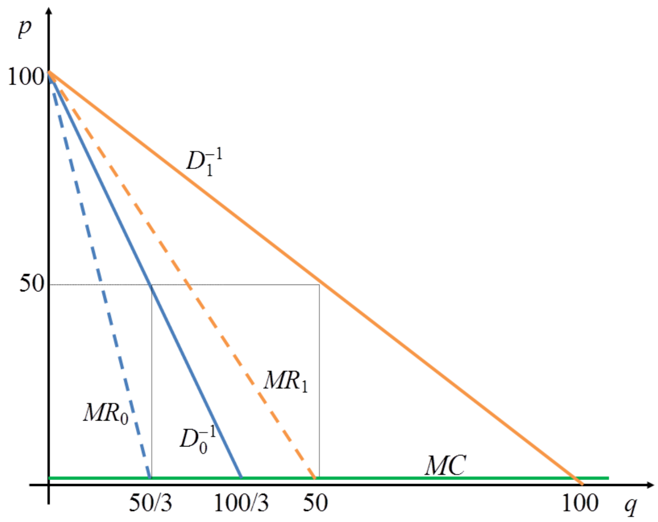
Answers to Chapter 11 Homework Questions (pages 393-397 in the textbook)

1. The picture illustrates.



And algebra confirms: assume we have simple linear (inverse) demand (D^0): $p = 100 - 3q$, and zero costs $MC = 0$. Then, the optimal monopoly quantity is

$$\begin{aligned} MR^0(q^M) &= MC(q^M) \\ \frac{d[(100-3q)q]}{dq} &= 0 \\ 100 - 6q^M &= 0 \\ q^M &= 50/3. \end{aligned}$$

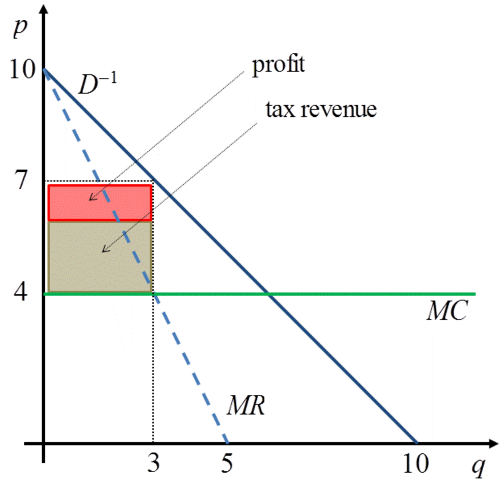
which implies that $p^M = 100 - 3q^M = 100 - 3(50/3) = 50$. Now, consider a specific shift in a demand curve such that the curve pivots around the intercept with the y-axis. After the shift the new (inverse) demand (D^1) is: $p = 100 - q$. You can now easily verify that the optimal monopoly quantity is $q^M = 50$ and $p^M = 50$. In each case the price is same: 50. For a different example see the page textbook

2. Suppose the demand is again linear: $p = 10 - q$. Further assume the marginal cost is $MC = 4$. There is no fixed cost. Imposing lump sum tax just cuts into monopoly's profits just like a fixed cost would. Without any tax the optimal production is:

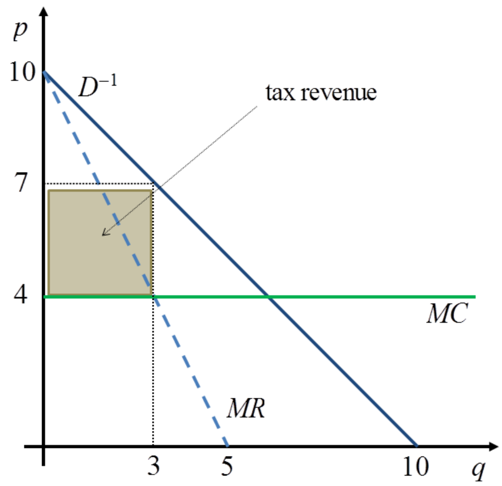
$$\begin{aligned} MR^0(q^M) &= MC(q^M) \\ \frac{d[(10-q)q]}{dq} &= \frac{d[4q]}{dq} \\ 10 - 2q^M &= 4 \\ q^M &= 3. \end{aligned}$$

The monopoly price is: $p^M = 10 - q^M = 10 - 3 = 7$; and the profit is: $p^M \times q^M - MC \times q^M =$

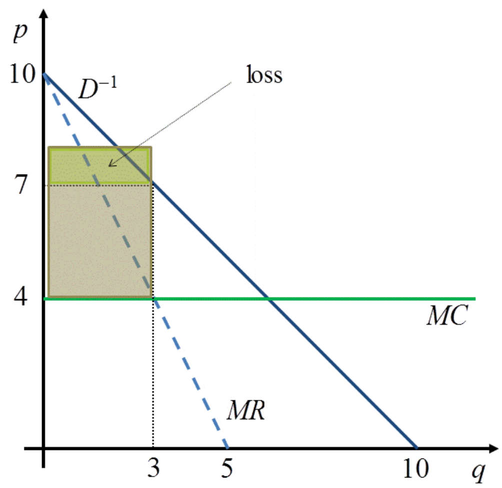
$21 - 12 = 9$. If the lump sum tax is smaller then 9 the monopolist still makes profit.



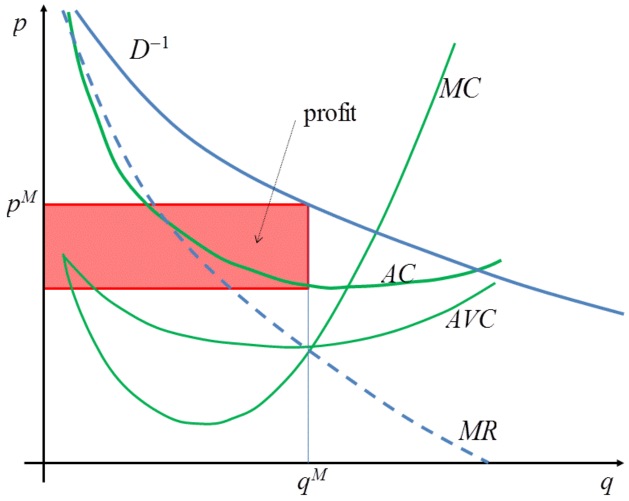
If te tax is equal to 9 then monopolist makes no profit and just breaks even.



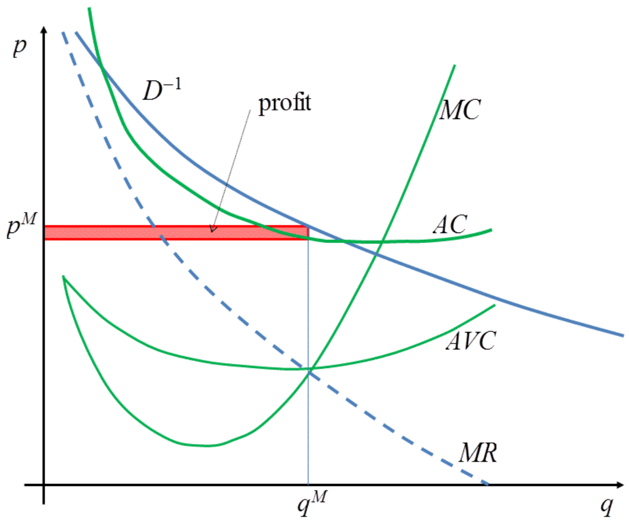
And if the tax is greater than 9 then the monopolist makes losses and is forced out of business.



3. Monopoly is unlikely to be profitable when it has high fixed costs. The fixed costs factors into the average cost function (see the pictures) which tells us the total cost per unit. The pictures illustrate how this function determines the profit. In the first picture the monopolist has relatively low fixed costs and so the AVC curve is low. The profits are large.

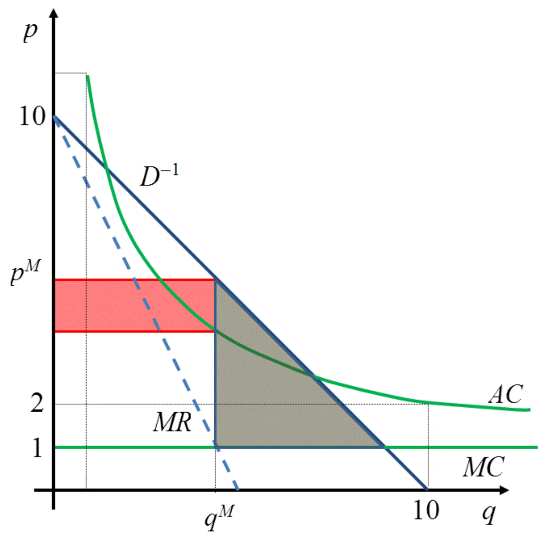


In the next picture the monopolist has high fixed costs and the AC curve is high. The profits are low.



4. The picture is self-explanatory. The deadweight-loss is the loss of welfare (gains from trade to either firms or consumers) due to optimal monopoly pricing which results in higher prices than in competitive markets. In the competitive market the firm would have supplied the whole market at the competitive equilibrium price which is at the intersection of the demand curve and the supply curve. The supply curve is upward-sloping portion of the MC curve which is above the shut-down price (where the AVC intersects MC). The deadweight loss is

therefore the triangular area shown in gray color.



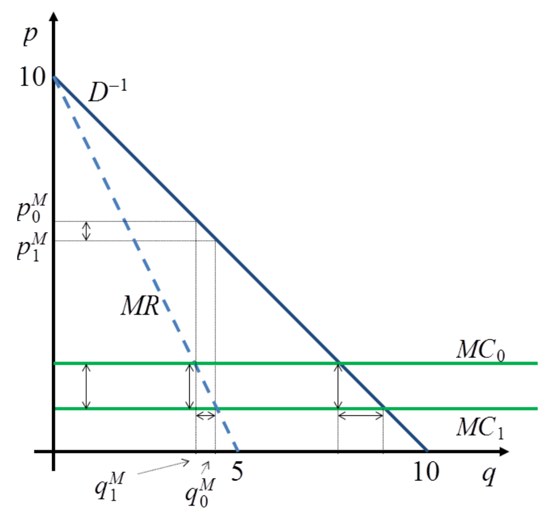
5. Solution is in the textbook at the end of Chapter 11.

9. When the MR overlaps with the (inverse) demand function. When does this happen? When the (inverse) demand function is completely flat: for example with the (inverse) demand being $p = 10$ (flat line at value 10). Then the marginal revenue is

$$MR(q) = \frac{d[10 \times q]}{dq} = 10$$

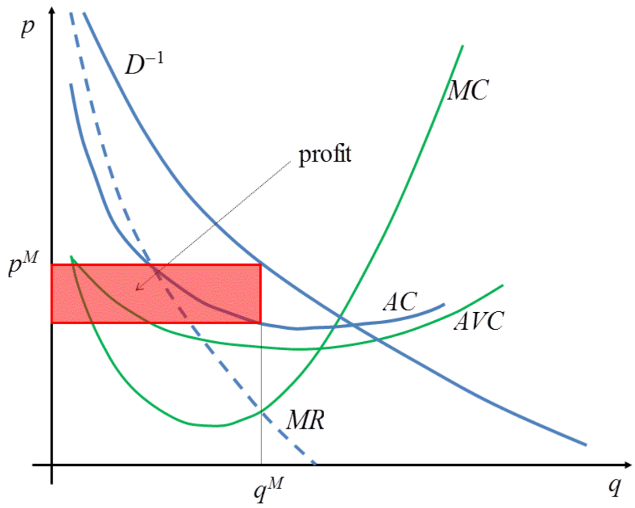
which means that the MR overlaps with the (inverse) demand. Now, the optimal monopoly quantity is at the intersection of MC and MR and at that quantity the price is must be equal to MC because MR and the (inverse) demand overlap. This is exactly the situation that the firm faces in a competitive market.

13. The reason is that the MR curve is always steeper than the (inverse) demand function. (Well, there is one exception to this discussed in problem 9.) But because the MR is steeper than D decreasing the MC will result in lower increase in the quantity than would have been necessary for the price drop to correspond to the drop in MC (from MC_0 to MC_1) This is part of a general point: that the monopolist always produces less than would have been socially desirable.

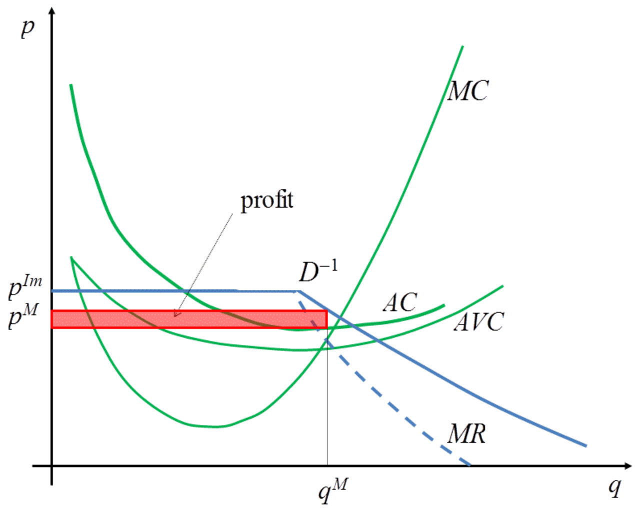


18. The competitive import industry basically sets a price at which the consumers can buy the same product from someone else than the monopolist. This way the import industry serves as an "outside option" for the consumer. The monopolist can of course set its price in any way it likes; even higher than the import price, but then none of the consumers would buy. Therefore with the import industry the monopolist faces a demand function which is flat (just like in the competitive market) at the import price and only after the whole demand is met at the price equal to the import price then the demand continues in its previous downward-sloping direction. This downward-sloping portion of the demand is called the "residual demand."

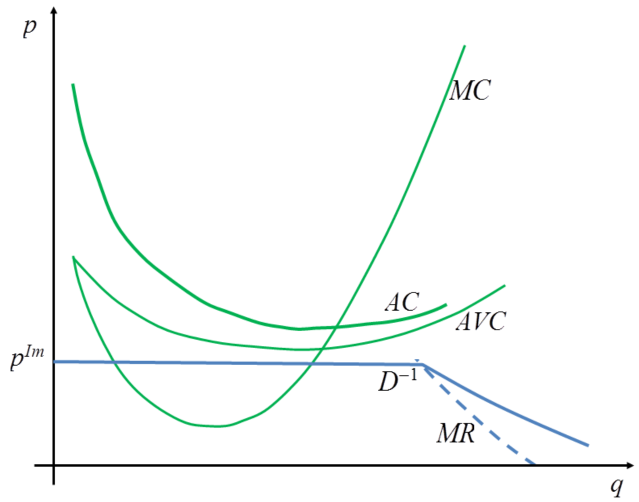
    The first picture below shows the case without import industry.



The next picture shows the case with the import industry setting price p^{Im}. Notice how the flat portion of the (inverse) demand curve influences the MR. MR has to overlap the flat portion of D. Then, once D becomes downward-sloping, MR becomes also downward-sloping and steeper. The monopolist optimally chooses production and price where $MR(q^M) = MC(q^M)$.



Finally the last picture shows the case where the import price p^{Im} is so low that the monopolist cannot cover its production costs and is forced out of business.



22. Solution is in the textbook at the end of Chapter 11.

23. The inverse demand curve is $p = 100 - q$. Costs: $C(q) = 10 + 5q$. The profit π is the difference between total revenue and total cost

$$p(q)q - C(q).$$

Choosing the production q optimally so that the profit is maximized gives:

$$\max_q p(q)q - C(q)$$
$$\max_q (100 - q)q - 10 - 5q$$

differentiating and setting the derivative to zero gives us the optimality condition

$$\begin{aligned} MR(q^M) - MC(q^M) &= 0 \\ (100 - 2q^M) - 5 &= 0 \\ q^M &= 47.5. \end{aligned}$$

The price is

$$p^M = 52.5.$$

The profit is

$$\begin{aligned} p^M \times q^M - 10 - 5 \times q^M &= 52.5 \times 47.5 - 10 - 5 \times 47.5 \\ &= 2246.3 > 0. \end{aligned}$$

(If the profit were negative the monopolist would shut down and produced zero.) The answer is the same if the cost function changes to $C(q) = 100 + 5q$. The reason is that fixed cost does not change the marginal cost curve which determines the optimal production. This means the q^M and p^M are the same as before. The only thing that changes is profit

$$\begin{aligned} p^M \times q^M - 100 - 5 \times q^M &= 52.5 \times 47.5 - 100 - 5 \times 47.5 \\ &= 2156.3 > 0 \end{aligned}$$

which is still positive so the answer is indeed the same as with fixed cost 10.

24. The inverse demand curve is $p = 10q^{-\frac{1}{2}}$. The revenue is $10q^{-\frac{1}{2}} \times q = 10q^{\frac{1}{2}}$. Total cost is $C(q) = 5q$. following the same steps as in the previous exercise we get:

$$\begin{aligned} MR(q^M) &= MC(q^M) \\ \frac{1}{2} \times 10 \times (q^M)^{-\frac{1}{2}} &= 5 \\ \frac{1}{\sqrt{q^M}} &= 1 \\ q^M &= 1. \end{aligned}$$

The monopoly price is $p^M = 10$ and profit is 5.

32. Solution is in the textbook at the end of Chapter 11.