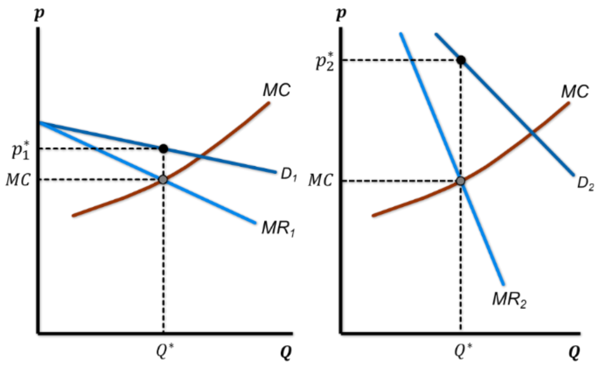
Practice Set 4 – KEY

Monopoly & Market Efficiency

This set contains practice material for your own use. It is highly recommended to work on the problems on your own. Do not just read the provided solutions. Instead, try to solve the problems and use the solutions only when you are stuck. Reading problems that someone else has solved has the same value on your preparation like watching someone running a marathon on TV and then expecting to be able to run it, too! If you have questions on this set, please ask your section's teaching assistant.

1. Show how market power increases with the gradient of the demand curve the firm is facing.

When the demand is horizontal (gradient is zero), price equals MC, thus, market power is zero. When the demand is downward sloping but relatively elastic (small gradient of D_1 in the left figure), the MC = MR equality occurs below the demand curve and the distance between p and MC shows the existence of market power. As the demand's gradient increases (right figure), the MC = MR equality is located further below the demand curve and the distance between p and MC increases, showing the increase in market power.



2. A market faces demand $p = 10 - 2Q$, while the marginal cost of production is $MC = 2$.
   (a) If this market is populated by a large number of identical firms, what will be the price and the total quantity?

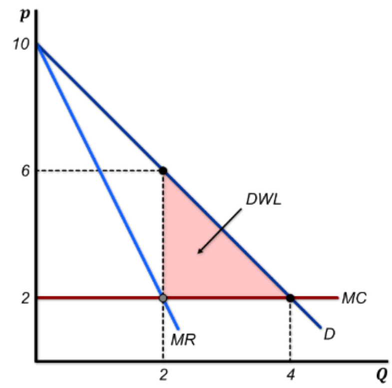
   If this market resembles a PC structure, the price will be equal to MC or $p = 2$. At $p = 2$, total quantity will be $2 = 10 - 2Q$ or $Q = 4$.

   (b) If the market is exploited by a single firm, at what price will this firm be selling?

   Marginal revenue will be $MR = 10 - 4Q$. $MR = MC$ implies $10 - 4Q = 2$ or $Q = 2$. Such quantity will be absorbed by the market at a price given by the demand $p = 10 - 2 \cdot 2$ or $p = 6$.

   (c) Calculate the DWL when the market is exploited by a single firm.

   The height of the DWL will be from the monopoly price (6) to the MC (2). That is, $\mathbf{height} = 6 - 2 = 4$. The base of the DWL will be from the monopoly quantity (2) to the PC quantity (4). That is, $\mathbf{base} = 4 - 2 = 2$. Thus, the $DWL = 4 \cdot 2 \cdot 0.5 = 4$.



3. Market demand for a monopolist is $p = 14 - 2q$. Subtract the revenue for 5 units from the revenue for 4 units to show that the marginal revenue of the 5th unit is lower than the price.

For $q = 5, p = 14 - 2 \cdot 5 = \$4$; so, revenue is $5 \cdot \$4 = \$20$.
For $q = 4, p = 14 - 2 \cdot 4 = \$6$; so, revenue is $4 \cdot \$6 = \$24$.
Marginal revenue for the 5th unit is $\$20 - \$24 = -\$4 < \$4$.

4. Katerina is the only seller of lemonade in the nationhood. The demand for lemonade is $p = 30 - 2q$, where q are glasses of lemonade and p is the price per glass. Her marginal cost is $MC = q$ and her fixed cost is 2.

(a) Make a table with Katerina's FC, MC, AC, TC, p and profit for quantities from 1 to 15.

q	FC	MC	AC	TC	p	*Profit*
1	*2*	*1*	*3*	*3*	*28*	*25*
2	*2*	*2*	*2.5*	*5*	*26*	*47*
3	*2*	*3*	*2.67*	*8*	*24*	*64*
4	*2*	*4*	*3*	*12*	*22*	*76*
5	*2*	*5*	*3.4*	*17*	*20*	*83*
6	*2*	*6*	*3.83*	*23*	*18*	***85***
7	*2*	*7*	*4.29*	*30*	*16*	*82*
8	*2*	*8*	*4.75*	*38*	*14*	*74*
9	*2*	*9*	*5.22*	*47*	*12*	*61*
10	*2*	*10*	*5.7*	*57*	*10*	*43*
11	*2*	*11*	*6.18*	*68*	*8*	*20*
12	*2*	*12*	*6.67*	*80*	*6*	*-8*
13	*2*	*13*	*7.15*	*93*	*4*	*-41*
14	*2*	*14*	*7.64*	*107*	*2*	*-79*
15	*2*	*15*	*8.13*	*122*	*0*	*-122*

(b) How many glasses of lemonade should Katerina produce to maximize her profit?

Katerina's marginal revenue will be: $MR = 30 - 4q$. *Profit maximization will occur when* $MR = MC$ *or* $30 - 4q = q$ *or* $q = 6$.

(c) How much should Katerina charge per glass in order to maximize her profit?

We must plug $q = 6$ *in the demand function to see how much would consumers be willing to pay for a total of 6 glasses. That is* $p = 30 - 2 \cdot 6$ *or* $p = 18$.

(d) How much is the maximum profit that Katerina will make?

Katerina's profit for $q = 6$ *will be* $\Pi = p \cdot q - TC$ *or* $\Pi = 18 \cdot 6 - 23$ *or* $\Pi = 85$.

(e) How many whole glasses of lemonade would Katerina produce if she acted as a PC firm?

If Katerina acted as a PC firm, maximization of profit would occur when $p = MC$ *or* $30 - 2q = q$ *or* $q = 30/3$ *or* $q = 10$.

(f) How much would she charge if she acted as a PC firm?

We must plug $q = 10$ *in the demand function to see how much would consumers be willing to pay for a total of 10 glasses. That is* $p = 30 - 2 \cdot 10$ *or* $p = 10$.

(g) How much S-R profit would she make if she acted as a PC firm?

Katerina's profit for $q = 10$ *will be* $\Pi = p \cdot q - TC$ *or* $\Pi = 10 \cdot 10 - 57$ *or* $\Pi = 43$.

5. Consider the market of a PC good with a vertical market demand.

(a) Explain the economic meaning of a vertical demand curve.

A vertical demand curve (completely inelastic) suggests that consumers will buy a given quantity of the good, no matter its price. Such demand curves can be found in markets for strict necessities (surgery, insulin, chemo, etc.) or products that amount to small part of the household budget (water, salt, toothpicks etc.).

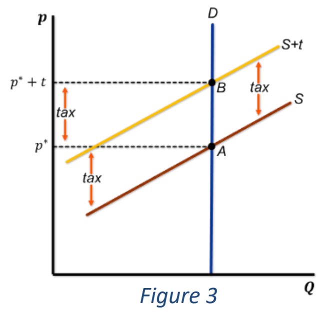


Figure 3

(b) A tax per unit is imposed on the good. Explain who will end up paying the burden of the tax.

The tax will shift the supply upwards by the value of the tax. Since the demand is vertical, the after-tax equilibrium quantity will remain the *same and the after-tax equilibrium price will increase as much as the tax (see figure 3). This means that the consumer will end up undertaking the entire burden of the tax.*

6. Calculate VC for $q = 500$ if $MC = 2q$.

   If $MC = 2q$, MC for the first unit is 2, for the second is 4, for the third is 6 and it continues in this manner till the 500th unit for which MC is 1,000. Then VC for 500 units is the sum of all MCs till the 500th units or

$$2 + 4 + 6 + \cdots + 996 + 998 + 1{,}000.$$

   This summation contains 500 terms and will take too long to type in a calculator. Thankfully, there is a neat shortcut to compute it fast. Observe that the first term (2) and the last term ($1{,}000$) sum up to $1{,}002$. Then, the second term (4) and the second-to-last term (998) also sum up to $1{,}002$. The third (6) and the third-to-last (996) again sum up to $1{,}002$ and this keeps happening as we move inwards pairing the terms of the summation. Since we have 500 total terms, it is as if we have 250 pairs of terms that each pair sums up to $1{,}002$. Thus, the sum should be equal to $250 \cdot 1{,}002 = 250{,}500$.

7. Explain how *lobbying* can increase the social cost of monopolies if it is used for rent-seeking.

   Lobbying money goes to support politicians who will arrange for monopoly rights in exchange. Resources spent on lobbying are not used to make production more efficient and often exceed the DWL.

8. Explain how *advertisement* can increase the social cost of monopolies if it is used for rent-seeking.

   In many monopolistic markets, resources spent on advertisement aim to change the industry standards by increasing advertisement requirements (for example consumers are more inclined to only buy products which are frequently advertised with high-quality advertisements). That is, advertisement is intended for the creation of barriers for potential entrants who do not have abundance of funds for advertisement, not for informing the consumers.

9. Explain how *building excess capacity* can increase the social cost of monopolies if it is used for rent-seeking.

   Monopolies invest in equipment which is not intended to be used in production. Instead, the excess capacity serves as a threat: "If you enter my territory, I will use my scale to increase production, flood the market and drop the price lower than your AC".

10. [*Optional – requires advanced mathematical skill*] A seller faces demand $p = 10 - q$.

    (a) Calculate the marginal revenue of the 3rd unit by subtracting the revenue for 2 units from the revenue for 3 units.

    For $q = 3, p = 10 - 3 = \$7$; so revenue is $3 \cdot \$7 = \$21$.
    For $q = 2, p = 10 - 2 = \$8$; so, revenue is $2 \cdot \$8 = \$16$.
    Marginal revenue for the 3rd unit is $\$21 - \$16 = \$5$.

    (b) Calculate the marginal revenue for the 3rd unit using the "double gradient" rule.

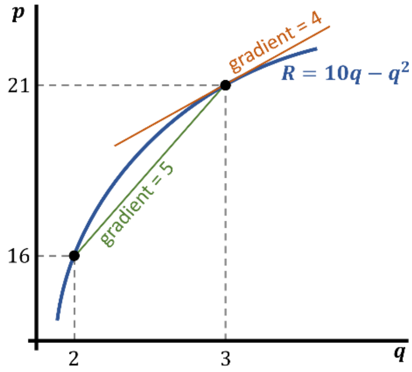
    $MR = 10 - 2q$, for $q = 3$, $MR = 10 - 2 \cdot 3 = \$4$.

    (c) Why do the two methods yield different marginal revenues?

They do not yield different marginal revenues; they just calculate slightly different things. The first method calculates the change in revenue from the second whole unit to the third whole unit. The second method calculates the rate of change of revenue (gradient) exactly at the third unit. Notice that revenue is

$$R = p \cdot q = (10 - q)q = 10q - q^2.$$

The gradient of this curve at $q = 3$ *is 4. If, however, you connect points (2,16) and (3,21) with a straight line, the gradient of that line will be 5. The first method yields a more precise estimate for* MR *when units are indivisible (production in bottles, packs, boxes of stuff etc.). The second method will be preferable when decimal units make sense (production in kg, liters, GB etc.). In this course, both methods can be used interchangeably.*



You are kindly requested to report any *typos, mistakes* or *proposals* for the improvement of this practice set key at kmarinakis@smu.edu.sg.