

Assignment 2

1. Consider a long-run production in which there are only two inputs labor and capital, and the input prices for labor and capital are wage (w) and interest rate (r), respectively. Suppose that at the equilibrium levels of labor and capital (L^*, K^*), the marginal product of labor (MP_L) and marginal product of capital (MP_K) are 6 and 8, respectively.

1.a) Calculate the marginal rate of technical substitution (MRTS), and state the cost-minimization conditions of this firm, given that the required output is fixed at Q_0 . If the market wage rate (w) is \$3, what is the interest rate at the equilibrium?

$$|MRTS_{LK}| = \left| \frac{\Delta K}{\Delta L} \right| = \frac{MP_L}{MP_K} = \frac{6}{8} = \frac{3}{4} = 0.75$$

∴ Marginal rate of technical substitution is $\frac{3}{4}$ #

Cost minimization conditions happen when

$$\frac{MP_L}{w} = \frac{MP_K}{r}$$

$$\frac{MP_L}{MP_K} = \frac{w}{r}$$

$$MRTS = MRMS \text{ #}$$

$$|MRMS_{LK}| = \left| \frac{\Delta K}{\Delta L} \right| = \frac{w}{r}$$

$$\frac{3}{4} = \frac{3}{r}$$

$$r = \frac{3 \times 4}{3}$$

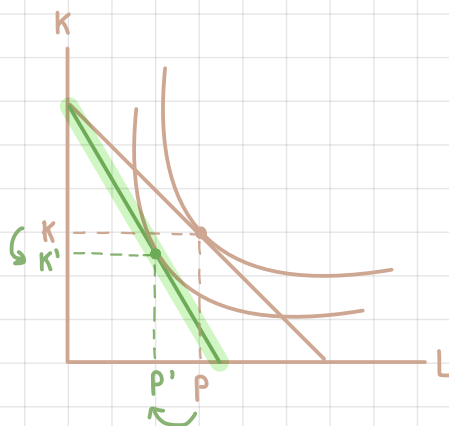
∴ Interest rate is 4 #

1.b) Suppose now that the wage rate (w) increases to \$4, *ceteris paribus*. Draw a diagram to illustrate the changes in the cost-minimizing combination of inputs.

$$TC = rK + wL$$

$$TC_1 = 4K + 3L$$

$$TC_2 = 4K + 4L$$



2. Suppose that in the long-run production of wine, a firm uses two inputs: workers (L) and machines (K). At the required output of 3,000 bottles of wine, the firm's least-cost input combination is 200 units of L and 50 units of K , and the per-unit input prices for L and K are \$10 and \$20, respectively. Suppose further that at this least-cost combination of inputs, the marginal product of the 50th machine (MP_K) is 8 bottles of wine.

2.a) Draw a diagram to illustrate this firm's cost-minimization decision, where L is on the x-axis and K is on the y-axis. Also, explain the firm's cost-minimization conditions.

Cost minimization conditions:

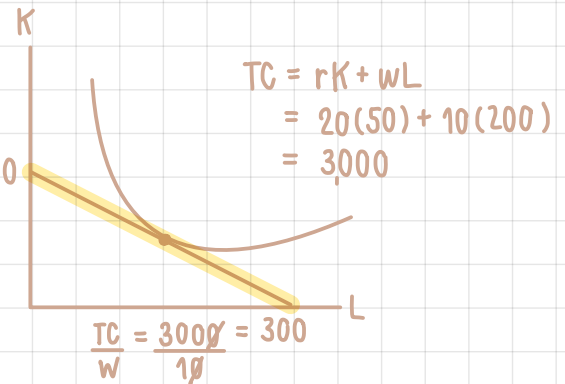
$$MRTS = MRMS$$

$$\left| \frac{\Delta K}{\Delta L} \right| = \frac{w}{r}$$

$$\left| \frac{-150}{300} \right| = \frac{10}{20} = \frac{1}{2} = 0.5$$

To produce the same amount of output as 1 machine, it requires 2 labors. #

$$\frac{TC}{r} = \frac{3000}{20} = 150$$



2.b) At the equilibrium in part a., what is the marginal product (MP_L) of the 200th workers?

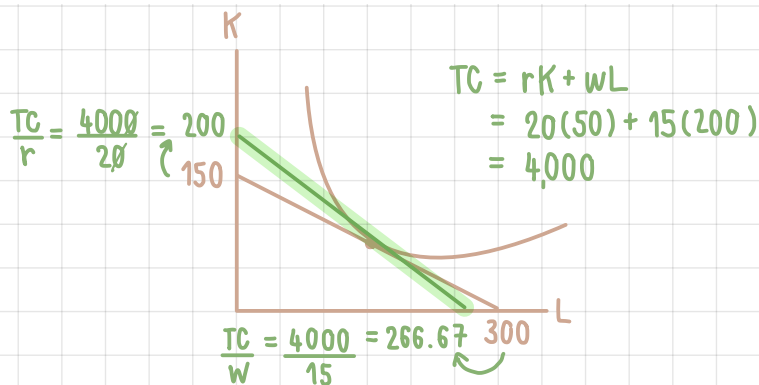
At equilibrium $K = 50$, $L = 200 \rightarrow MP_K = 8$

$$\frac{MP_L}{MP_K} = \left| \frac{\Delta K}{\Delta L} \right| = \frac{w}{r}$$

$$\frac{MP_L}{8} = \frac{10}{20}$$

$$MP_L = 4 \text{ bottles of wine \#}$$

2.c) Suppose that the input price for L increases to \$15 per unit, while the input price for K and the required amount of output are the same. Draw another diagram to illustrate the change in the least-cost input combination.

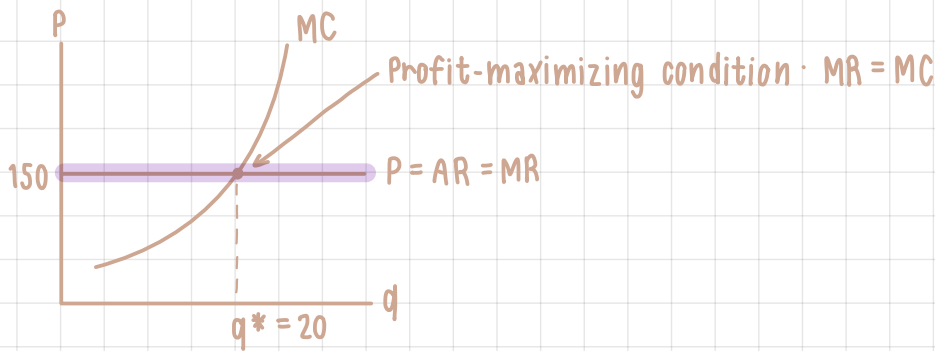


2.d) Explain the difference between short-run and long-run production.

- Short-run production means that there is at least one fixed factor utilized, a factor which assumed to be constant in the short-run.
- On the other hand, long-run production occurs when a firm can adjust the amount of all factors of production.

3. Consider a perfectly competitive market, in which the current equilibrium price is 150 baht per unit.

3.a) Suppose that a firm in this market sells 20 units of its output. State the profit-maximizing condition of this firm, and draw a diagram to illustrate how the equilibrium quantity is determined.



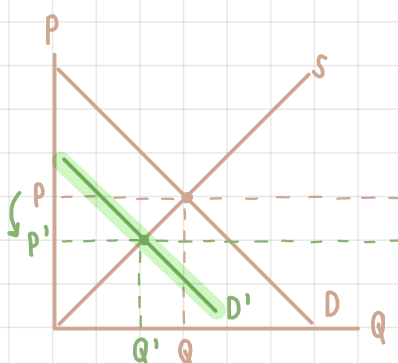
3.b) At this equilibrium quantity of 20 units, suppose that the firm's average total cost is 180 baht, and its average fixed cost is 60 baht. Calculate this firm's average variable cost, total revenue, total cost, and profit.

Average variable cost .	Total revenue :	Total Cost :	Profit :
$AC = AFC + AVC$	$TR = P \cdot q$	$AC = \frac{TC}{q}$	$\pi = TR - TC$
$AVC = AC - AFC$	$= 150 \times 20$	$TC = AC \cdot q$	$= 3,000 - 3,600$
$= 180 - 60$	$= 3,000 \text{ \$ \#}$	$= 180 \times 20$	$= -600 \text{ \$ \#}$
$= 120 \text{ \$ \#}$		$= 3,600 \text{ \$ \#}$	

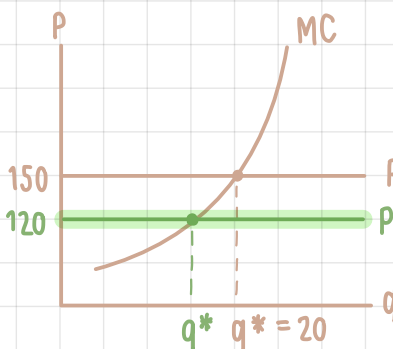
3.c) From part b., should this firm stay in the market in the short run? Justify your answer.

From part b $TR < TC$ and $\pi < 0$ mean that the firm has loss, but $P > AVC$ ($150 > 120$) In short-run firm can't adjust the amount of fixed factor at all. Eventhough there is no production, firm must pay for fixed cost. In this case the firm should stay in the market, producing and selling at q^* Because when $P > AVC$, the difference between P and AVC is a part of revenue and it can be used to pay for fixed cost. Making the firm in Least Loss situation

3.d) Suppose now that the market demand decreases, and the market price decreases to 120 baht per unit. Draw two diagrams to illustrate: (i) the change in the equilibrium price and quantity in the market, (ii) how the change in the market price affects the firm equilibrium quantity and profit. Would your answer from part c. change?



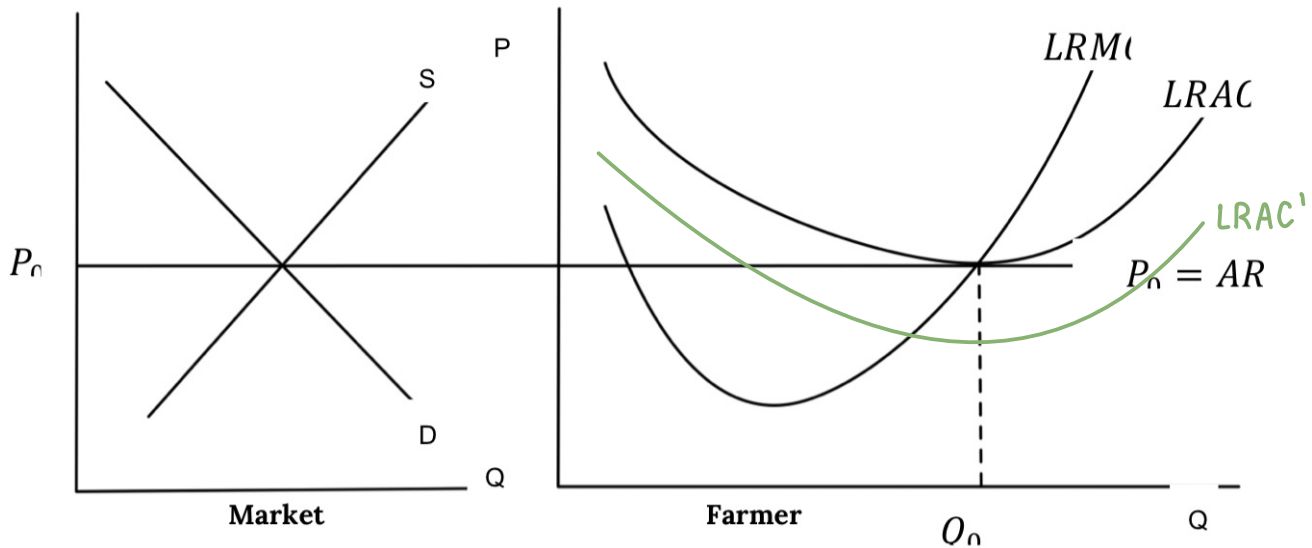
Equilibrium price & quantity in market decrease



Equilibrium quantity & profit of the firm also decrease

When new market price decreases to 120 \$ per unit, making $P = AVC$. In this situation, the firm can decide to stay in the market producing and selling at q^* , or do zero-unit production. Because both options give indifferent result

4. A Thai rice farmer is in a long run equilibrium in a **perfect competition** and produces at the quantity Q_0 as shown in the graph below.

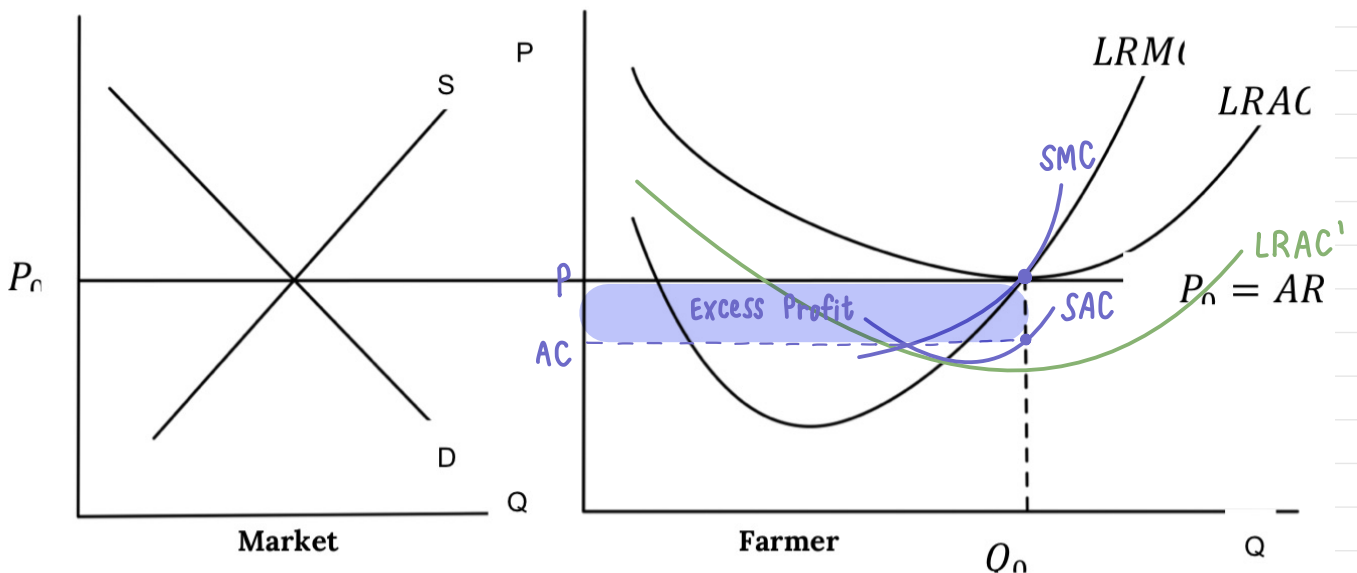


4.a) The government grants a lump sum subsidy to every farmer. How will this change the LRAC? Explain why LRMC does not change.

- When government gives a lump sum subsidy to the farmers, the fixed costs will be lower. It makes LRAC curve shift down to LRAC' because the long run average cost has been reduced.
- LRMC does not change because lump sum subsidy affects only the average total cost (fixed cost)

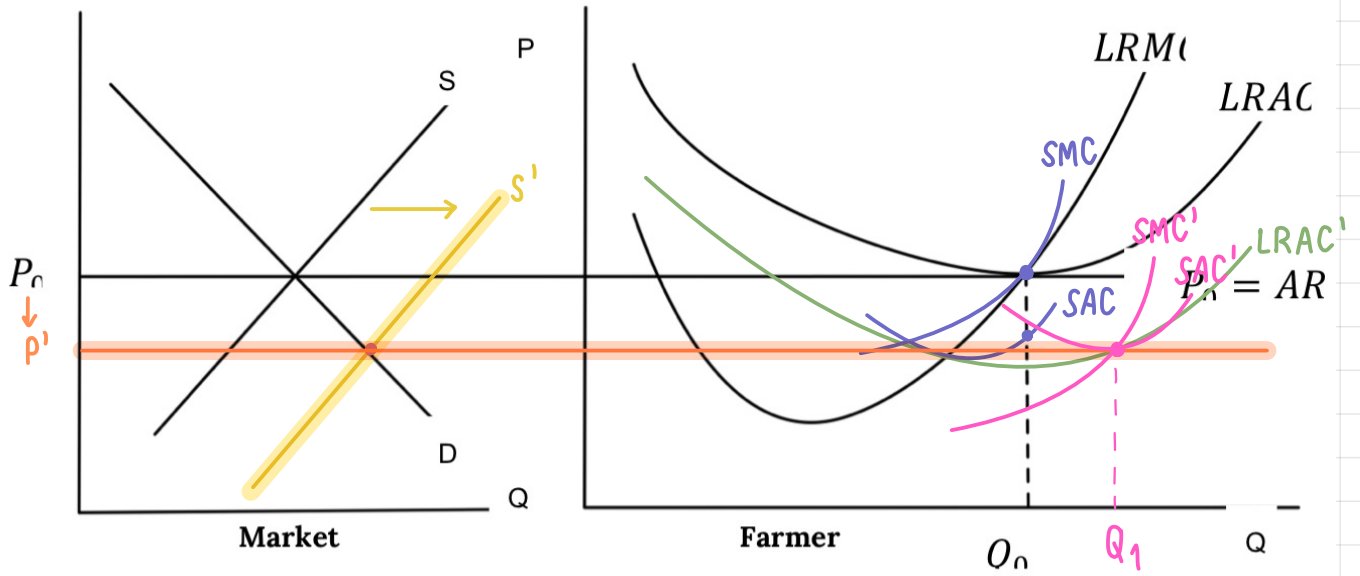
4.b) (10 Points) Will the lump sum subsidy change the quantity the farmer wants to produce to maximize his profit? Show in the graph that the farmer now earns an Excess Profit. Explain.

The lump sum subsidy will not change any profit maximizing quantity because lump sum subsidy only lowers the fixed cost. There is an excess profit because the average cost is less than profit. $P > AC$ at Q_0 on SAC. The excess profit = $(P - AC) \cdot Q_0$



4.c) (10 Points) Demonstrate how this Excess Profit will affect the market price in the Long Run that allows new entry to the market.

When there is an excess profit and no barrier to entry the market, it will attract new farmers to compete in the market. The supply will increase (graph shift to the right) causing the decrease in price level and the rising in optimal quantity to maximize profit.

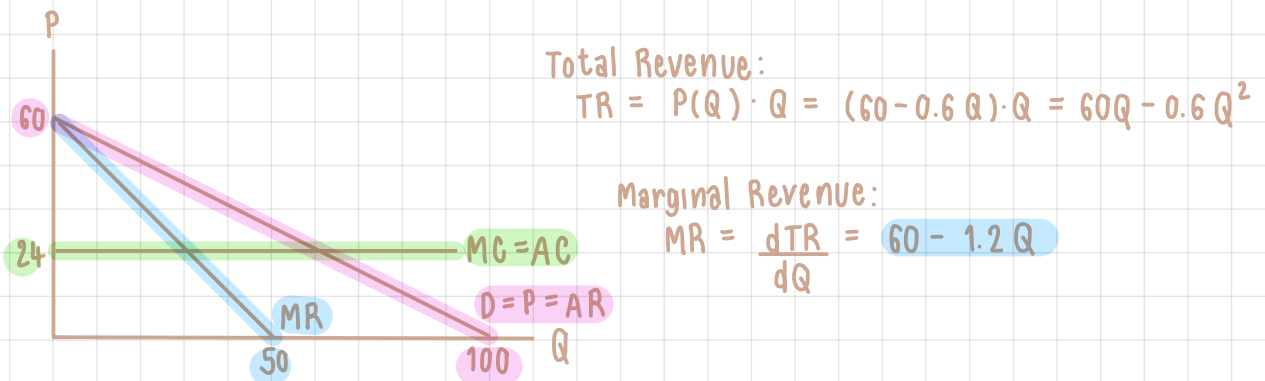


5. House and Land (HL) is the monopolist in a luxury housing market. It is a very efficient firm in which workers can construct houses with constant marginal cost and average cost. The demand and cost functions for HL are given as follows. (P is in million-baht unit).

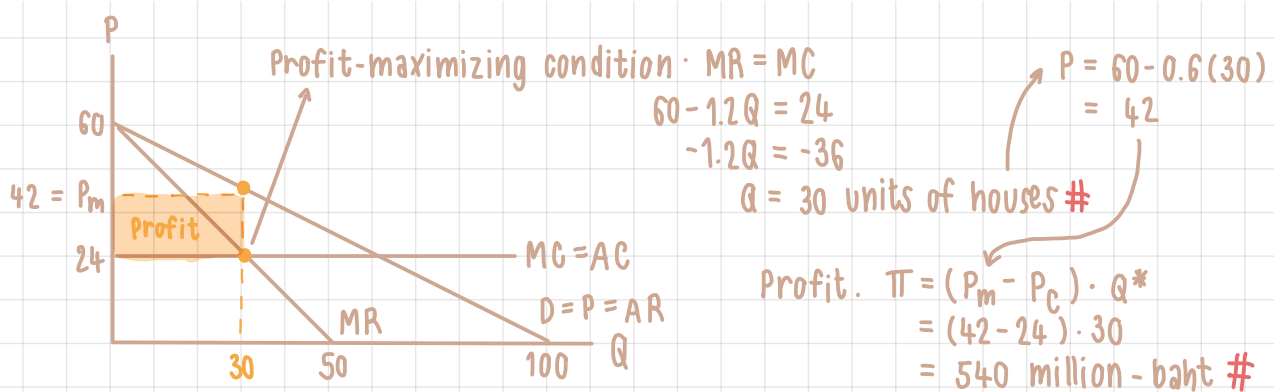
$$P = 60 - 0.6Q$$

$$MC = AC = 24$$

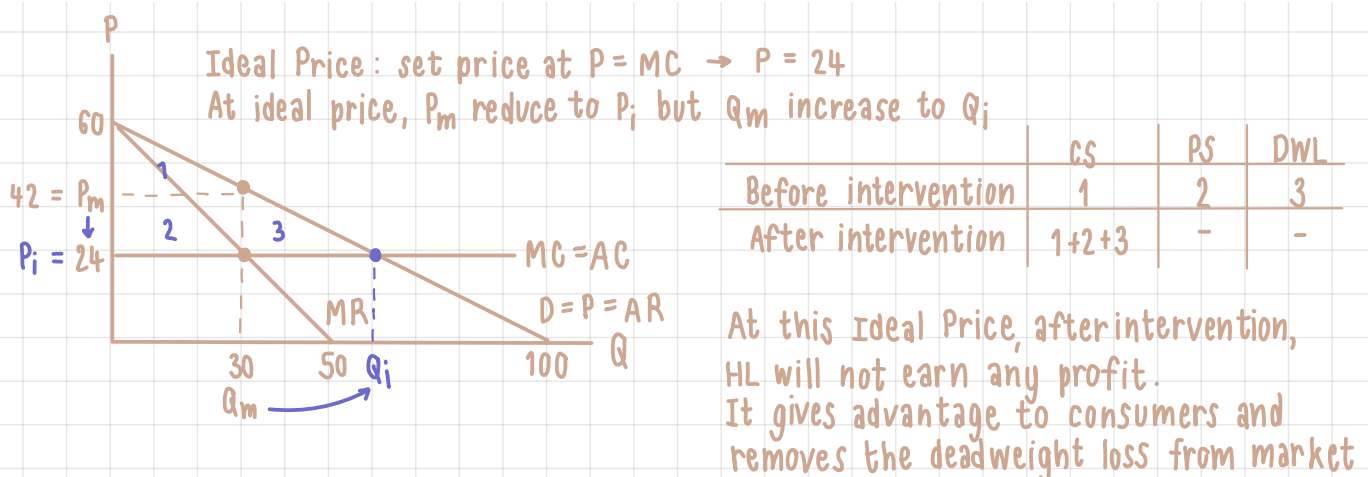
5.a) Derive the marginal revenue function. Draw a diagram to illustrate the demand, marginal revenue, marginal cost, and average cost curves.



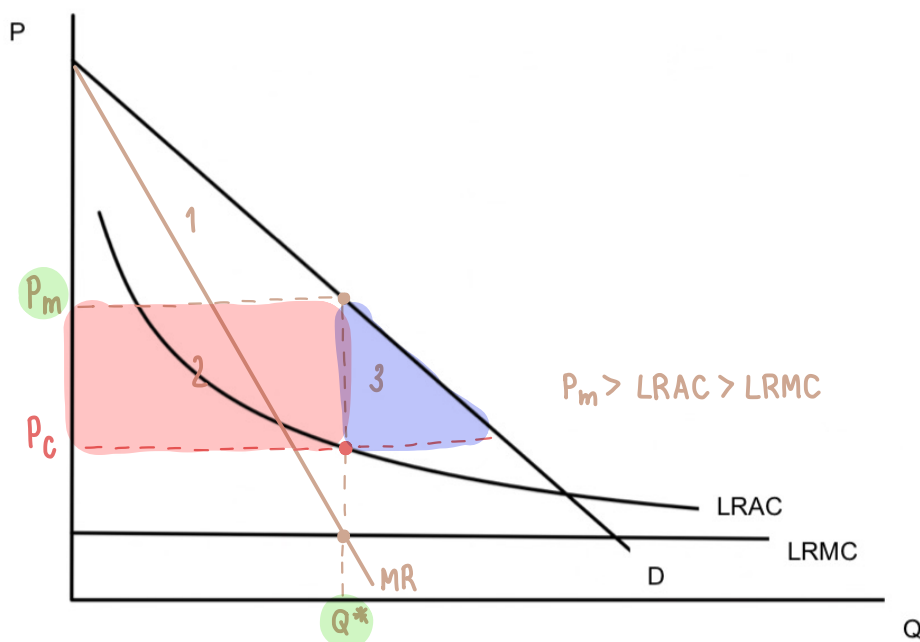
5.b) State the profit-maximizing condition for HL, and determine the optimal units of houses. Also, indicate the profit in the diagram, and explain how this profit can be derived.



5.c) The government tries to encourage more people to have access to luxury houses, so they launch a policy forcing HL to sell their houses at the ideal price. Draw another diagram to indicate the ideal price and determine the corresponding quantity at this price. Illustrate the social welfare before and after the intervention in the diagram and discuss.



6. The producer of the upcoming vaccine for COVID-19 is a monopoly who wants to price their vaccine to maximize profit. The cost of producing the vaccine is mostly fixed cost involving the research so that the Long Run Average Cost (LRAC) keeps declining the more vaccine is produced. The Long Run Marginal Cost (LRMC) is a small constant cost at all production level.



6.a) If the demand of vaccine is downward sloping as usual, show the equilibrium price and quantity that will maximize the profit. State the equilibrium conditions. Identify the profit and the deadweight loss to the society.

- Q^* is where $MR = MC \rightarrow MR = LRMC$
- $P^* = P_m \rightarrow P_m > LRAC > LRMC$
- Profit: 2 or $\Pi = (P_m - P_C) \cdot Q^*$
- Deadweight loss: 3

6.b) Assumed that monopoly price is \$50 per dose, marginal cost \$10, calculate the Lerner's index of monopoly power.

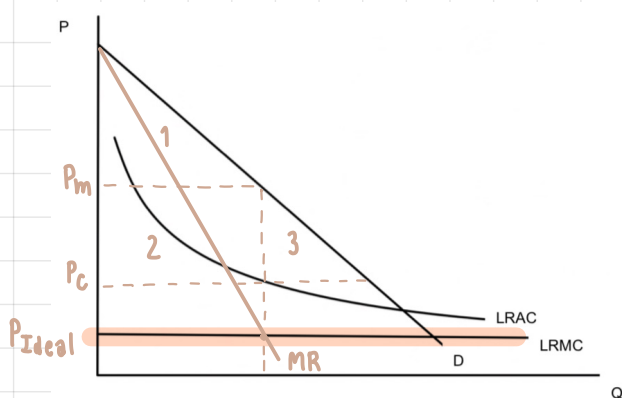
$$\begin{array}{l} P_m > MC \\ 50 > 10 \\ \checkmark \end{array}$$

Lerner's index: $L = \frac{P - MC}{P}$

$$L = \frac{50 - 10}{50} = \frac{40}{50} = \frac{4}{5} = 0.8 \#$$

6.c) Determine the Ideal Price? Will the monopoly earn any profit at this Ideal Price? Explain.

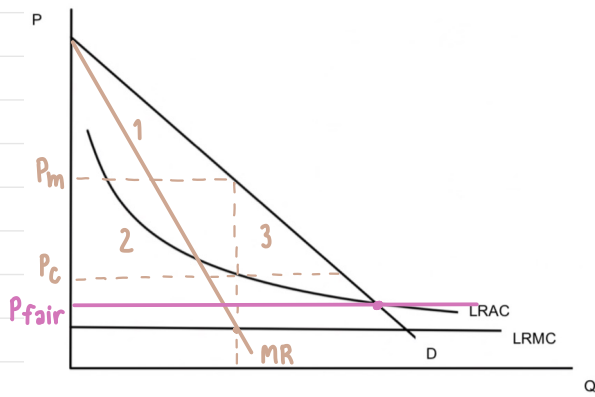
Ideal Price: set price at $P = MC \rightarrow$ set $P = 10\$$



The firm will not earn any profit at this Ideal Price. The firm will face loss situation. It gives advantage to consumers
Consumer surplus = 1+2+3

6.d) Determine the Fair Price? Is there still deadweight loss at this Fair Price? Explain.

Fair Price : set price at $P = AC$ → set $P > 10 \$$



The firm will not earn any profit at this ideal Price. The firm will face loss situation.

It gives advantage to consumers
Consumer surplus = 1+2+3