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<div align="center">Section B: Short Essay</div>

1) Explain the differences between diminishing marginal returns and decreasing returns to scale.

Definitions:

- **Factors of Production (FoP)**: Inputs required for the production of an economic good; includes labor, capital, land, and entrepreneur.
- **Short Run**: The period of time when at least one factor of production is constant
- **Long Run**: The period of time when all factors of production are variable
- **Diminishing marginal returns**: The phenomenon in which there is a decrease in marginal returns as one factor of production is increased, in the short run
- **Decreasing returns to scale**: The increase in average costs as all the factors of production are increased, beyond a certain point, in the long run.
- **Total Product (TP)**: The total amount of good that a firm produces at a given labor (or any other FoP)
- **Marginal Product (MP)**: The rate of change of TP as labor changes; $MP = \dfrac{\Delta TP}{\Delta L}$
- **Average Product (AP)**: The average product per unit of labor; $AP = \dfrac{TP}{L}$

     As firms try to produce more, they experience a decline of returns in different time scales: diminishing marginal returns, and decreasing returns to scale. It is important to distinguish the duration and causes of these phenomena.

     Diminishing Marginal returns occurs in the short run, where at least one factor of production is fixed. Therefore, as the firm increases a variable factor of production (usually labor), there is initially a stage of Division of labor—during which the marginal product increases—and then a stage of the law of diminishing returns. Diminishing marginal returns indicates an increase in the **marginal returns, or the rate of change of output; there still might be an increase in the total output of the product**.
     The law of diminishing returns is caused by the fact that when some FoPs are fixed, there is a limit to in which firms can produce. For example, in a fast food restaurant, the owner sees that the current production is not able to keep up with demand, and decides to hire more workers. Initially, people specialize into their own jobs; one could be serving, another could be taking orders, another could be cooking, and another could be washing. They work together efficiently to increase product, and therefore, as each worker is employed, the additional return gets bigger (increase in marginal product). However, as the owner hires more and more workers, there might not be enough space in the kitchen, and people could bump into each other, hindering each other's efficiencies. Also, having too much people work in the same place could cause arguments, which would also decrease the overall efficiency. These can result in a decrease in marginal product, known as diminishing marginal returns. We can visualize these phenomena in the following diagram.

[Diagram A, B]
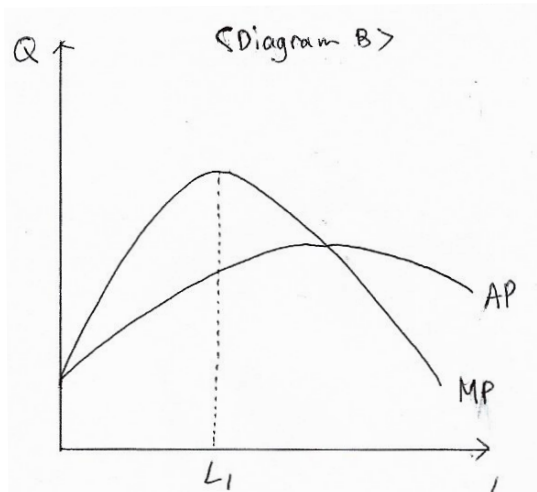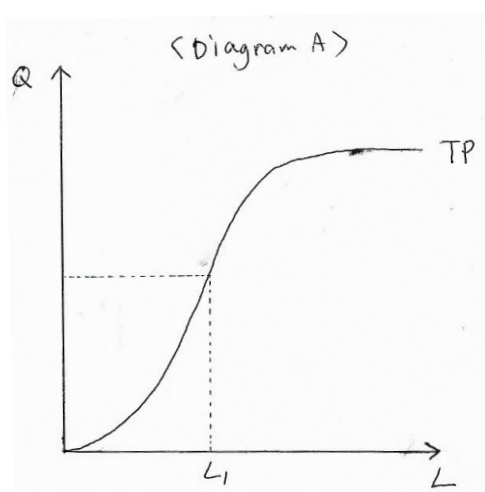
As the firm increases the labor, the it sees a big increase in the output Q, until when Labor $= L_1$, in the graph of TP. We can also see that the marginal product is increasing, and reaches its maximum point at L_1. This increase in marginal returns is caused by the division of labor, as explained above.

When the firm hires more workers, however, they see a drop in the rate of increase of total product, equally signifying a drop in the marginal product. This part shows that the additional benefit of an additional unit of labor gets lower; the law of diminishing marginal returns.

On the other hand, **in the long run, when the firms plan ahead to vary all of the factors of production, decreasing returns to scale can occur.** After the firm grows and takes advantage of economies of scale to lower average costs, as try to expand more, they might experience decreasing returns to scale, and see the change in average costs going up again; **the increase in average cost (of FoP) is proportionally bigger than the increase in output quantity**. For example, the firm might increase all of their FoP by 10%, but only get 5% increase in the output quantity. It is important to note that this is an rise in the **increase of average costs per increase of output quantity**; a somewhat different concept from diminishing marginal returns.

[Diagram C]
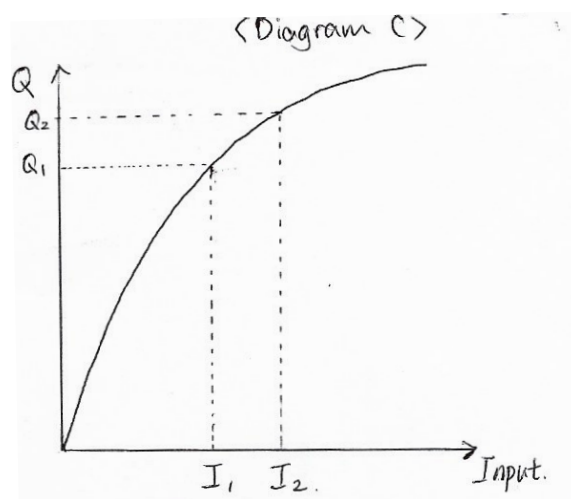
As the firm increases its production scale by increasing the input from I_1 to I_2, we can see that there is an increase in the output quantity from Q_1 to Q_2. However, the increase in output is proportionally smaller than the increase in input; $\dfrac{I_2 - I_1}{I_1} > \dfrac{Q_2 - Q_1}{Q_1}$. This shows decreasing returns to scale; the decreasing rise in output per increased input, as the firm gets bigger.

Conclusively, the law of diminishing marginal returns indicates a decreasing **Marginal Product** when input is increased in the **Short Run**, while decreasing returns to scale describes the increase in **Average Costs proportional to the Output Quantity** in the **Long Run**. These are completely different, yet easily confusable terms, and it is important to distinguish between the two by examining their differences.

2) Explain the differences between economies of scale and diseconomies of scale.

Definitions (Additional to previous definitions):

- **Economies of Scale**: a reduction in costs of a firm by increasing their scale of production
- **Diseconomies of Scale**: an increase in costs of a firm by increasing their scale of production
- **Long Run Average Costs (LRAC)**: The average cost of a product, per unit quantity produced, in the long run

      Firms experience fluctuations in the costs of production as they increase their size in the long run, by planning and increasing all of their factors of production. However, there are two big trends in these cost changes, known as economies of scale and diseconomies of scale, that most firms experience as they increase production in the long run.

      Economies of scale are the advantages in costs the firm gains as they increase their scale; they explain the reasons why as the firm gets bigger, their average costs may go down. This is cause by many factors, including technical reasons, such as the cube increase of volume per squared increase in container building material, or that they can afford to use more expensive, advanced machinery to increase efficiency. Also, bigger firms can negotiate better bulk deals from their suppliers, or motivate regional governments to directly or indirectly provide infrastructure and specialized human resources. These result in the overall decrease in the LRAC as the output of the firm is increased.

      On the other hand, **Diseconomies of scale explain the reasons why when the firm is very big, their average costs high start to increase.** As explained in the previous question, bigger firms experience much more difficulty in managing the huge number of employees or capital, and employees in bigger firms could lose a sense of identity and motivation, resulting in less productive workers. These causes, overall, work to increase the LRAC of the firm as firms increase their output.

      For example, in a multinational fast food chain, workers in the human resources sector of a regional branch, would have a hard time managing the schedules, balancing work satisfaction, and handling complaints from all of the workers from all of the chains. Also, they might lose the sense of identity, as the managerial position has nothing to do with the main product of their company—fast food. Therefore, they might lose motivation and be less productive, not showing up to work, or not working efficiently. We can see this phenomena in the following diagram:

[Diagram D]
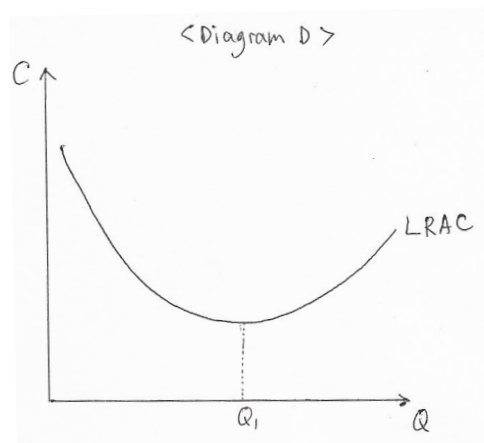
      On the diagram, the point until Q_1, when costs decrease as the firm increases production, is caused by economies of scale, while the point after Q_1, when costs increase as the firm increases production, is caused by diseconomies of scale. It is important to note that this graph shows the Long Term Average Costs, and the changes to the Average Costs are only due to the scale of the firm.

      Although these two phenomena are both caused by an increase in output, the two have completely opposite effects, one reducing and the other increasing LRAC. Also, the effects occur at different points in the output quantity; economies of scale occur when the firm is relatively small, and try to increase their size, while diseconomies of scale occur when the firm is already big, but tries to further increase their output.

3) Explain why a firm in a perfectly competitive market might make be making negative economics profits (losses) in the short term, and yet carry on.

Definitions (Additional to previous definitions):

- **Total Costs (TC)**: The total cost of producing all of the goods at a certain quantity
- **Average Costs (AC)**: The cost of producing a unit of good, at a certain quantity; $AC = \dfrac{TC}{Q}$
- **Marginal costs (MC)**: The increase in the cost of production when the output quantity is increased; $MC = \dfrac{\Delta TC}{\Delta Q}$
- **Revenue**: The total income of a business selling an economic good; Revenue = Price · Quantity
- **Profit (π)**: Difference between the Revenue and the Total Cost; $\pi = \text{Revenue} - TC$
- **Perfect competition (Short Run)**: A market that meets the following conditions:
  1. There is a large number of firms and consumers
  2. All firms produce homogenous goods
  3. There is perfect and complete information
  4. There is perfect mobility
  Which lead to the fact that the firms are **price takers**, i.e. have no control over the price of the good
- **Perfect competition (Long Run)**: A market that meets the conditions of Short Run Perfect Competition, and:
  5. There is free exit and entry into and out of the market

Assuming that the objective of a firm is to maximize their profits, it might be strange to see firms carry on producing while they make negative economics profits. However, this behavior can be explained by accurately understanding the meaning of the term economic profit, and the concept of Average and Variable Costs.

Economic profit is the difference between the total revenue and economic costs. Economic costs, however, is different from what we normally know—accounting costs. Economic costs include implicit costs as well as explicit costs, covering all of the opportunity costs of production, while Accounting costs consider explicit costs. For example, accounting costs for a car company might include the cost of raw materials, employee wages, rent, transportation costs, etc. However, the economics costs of the same company, additional to all of the accounting costs, includes, for example, revenue lost by not producing motorbikes, or by renting out their capital to another firm.

Therefore, it is completely possible that even if the firm is making negative economic profits, they are still making accounting profits, as well as paying rents, giving salaries to employees, etc. They are not in the best possible situation, but will still continue to stay in the market.
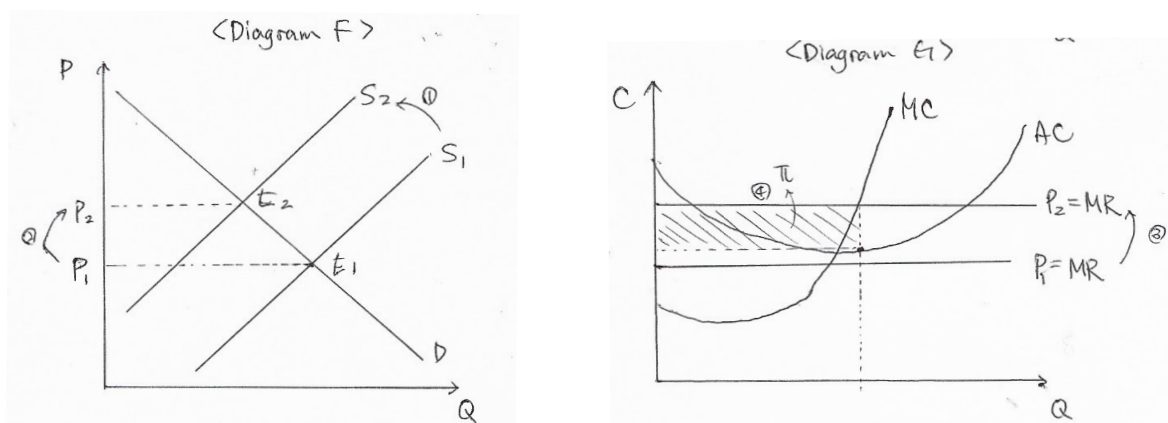
[Diagram E]
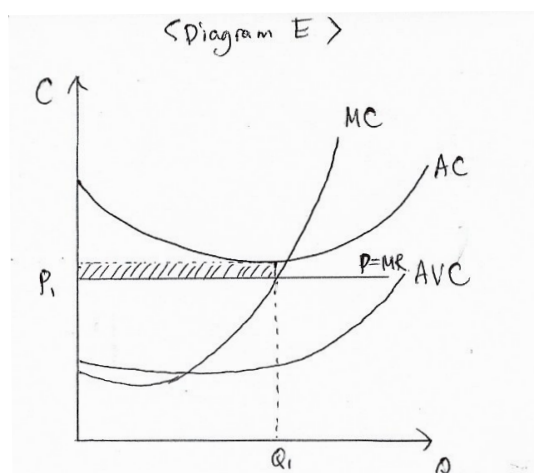
In Diagram E, we can see a firm that is making an economic loss; the market price is lower than the minimum average costs for production at every output point, and because the firm is a price taker in the perfectly competitive market, they cannot change the price. They minimize their loss at the point where MC = MR at Q_1, and its amount is equal to the area of the shaded region. However, the price is above Average Variable Cost at Q_1, meaning that they are still covering their Fixed Costs, meaning that they may still be making an accounting profit.

An additional point about the firm is that in the long run, as the market is perfectly competitive, some firms, seeing the losses, will leave the market. This will shift the supply curve to the left, in turn increasing the price. The incentive to join and leave the market by profits and losses, adjusts the amount of firms in the market, to lead the individual firm to a state where economic profit is zero. We can see this process in the following diagrams:

[Diagram F, G]

As the firms in the market make losses, some firms will leave the market. This will result in a (1) decrease in supply, shown in Diagram F, as a shift in the supply curve to S_2. The market reaches the new equilibrium at E_2, where (2) price is P_2. In the individual firm's diagram, (3) the price has changed to P_2, above the Average Cost. (4) The firm is now at the point where MR = MC, and $\pi > 0$, where its amount is equal to the area of the shaded region.

It is important to note that, as the other potential firms see the profit, they will join the market, increase supply, decrease price, and ultimately balance out when $\pi = 0$.

Therefore, a firm that is not making economic profit might carry on producing in the short run, because they are still making accounting profit (i.e. covering explicit costs), waiting for other firms to leave the market, causing a shift in the supply curve, an increase in the market price, and minimize their losses.