

**Chapter 1.5: Theory of the Firm I- Production, Costs, Revenues and Profit****Question 1**

The following table provides data for the total product (TP) of good Z and units of a variable input (labour) of a firm.

Units of variable input (labour)	Total product (TP) (thousand kilograms)	Marginal product (MP) (thousand kilograms)	Average product (AP) (thousand kilograms)
0	-		
1	3		
2	7		
3	12		
4	16		
5	19		
6	21		
7	22		
8	22		
9	21		

- Fill in the missing figures for marginal product (MP) and average product (AP).
- Outline whether the data describe production in the short run or in the long run.
- Using two diagrams, plot the TP curve in one and the MP and AP curves in the other, illustrating how the product curves are related to each other.
- Describe the law that explains the shape of the product curves.
- State the number of units of variable input with which diminishing returns begin, and show this in your diagram.

The table below shows how total product changes in response to changes in quantities of inputs for three firms.

Land (number of hectares)	Labour (number of workers)	Firm 1	Firm 2	Firm 3
1	10	100	100	100
2	20	220	180	200
3	30	350	250	300

- State which firm is experiencing constant, increasing or decreasing returns to scale.
- Construct a long-run average total cost curve, and referring to economies and diseconomies of scale, identify the range in which each of the above three firms is most likely operating.
- Describe two factors leading to economies of scale, and two factors leading to diseconomies of scale.
- Construct a diagram illustrating the relationship between short-run and long-run average total cost curves, and outline how average costs relate to each other in the short run and long run.

**Question 2**

Consider the following data on output and total cost corresponding to each level of output.

Output (TP) (thousand units)	0	1	2	3	4	5	6
Total cost (TC) (thousand €)	10	50	60	65	75	95	140
Total fixed cost (TFC) (thousand €)							
Total variable cost (TVC) (thousand €)							
Average fixed cost (AFC) (€)							
Average variable cost (AVC) (€)							
Average total cost (ATC) (€)							
Marginal cost (MC) (€)							
Total revenue (TR) (thousand €)							
Marginal revenue (MR) (€)							

- Outline whether this firm is operating in the short run or in the long run.
- For each level of output, find **TFC**, **TVC**, **AFC**, **AVC**, **ATC** and **MC**.
- Assuming that this firm has no influence over price, and sells each unit of output at €20 per unit, calculate **TR**, and using the total revenue and total cost approach, find the profit-maximizing level of output
- How much economic profit or loss will the firm earn?
- Calculate marginal revenue; using the **MC = MR** rule, find the profit-maximizing level of output and check if your results match with your answer for part (c).
- Using the data in the table, plot the **TC** and **TR** curves and find the profit-maximizing level of output graphically.
- Plot the **MC** and **MR** curves and find the profit-maximizing level of output graphically. (Does your answer match with your answer to part (f) and your calculations?)
- Using your data, plot the **MC**, **ATC** and **AVC** curves in a single diagram.
- Outline the reason for the shape of the curves you plotted in part (h).

**Question 3**

Consider the following data.

Output (TP)	0	1	2	3	4	5
Price	-	30	25	20	15	10
Total cost (TC)	5	25	40	50	65	85
Marginal cost (MC)	-					
Total Revenue (TR)	-					
Average Revenue (AR)	-					
Marginal Revenue (MR)	-					

- For each level of output, calculate/state **MC**, **TR**, **AR** and **MR**.
- Graph the **MC** and **MR** curves.
- Would the profit-maximizing firm produce (i) 2 units of output, (ii) 4 units of output? Explain.
- Calculate the amount of profit or loss earned by the profit-maximizing firm.
- State a level of output at which this firm earns negative economic profit, and calculate this amount.
- State the relationship between average revenue and price.
- Outline the factor responsible for the downward-sloping **MR** curve (or why the **MR** curve is not horizontal).
- State the cost figure that represents the firm's total opportunity costs at the profit-maximizing level of output.
- Outline the difference between implicit and explicit costs, and their relationship to economic costs
- State three alternative goals of firms (other than profit maximization).

### Chapter 1.6: Theory of the Firm II- Market Structures

#### Question 1

The following table provides output and cost data for a firm in perfect competition.

Output (Q)	Total Cost (TC)	Total Variable Cost (TVC)	Average Cost (ATC)	Average Variable Cost (AVC)	Marginal Cost (MC)
0	50				
1	80				
2	90				
3	95				
4	105				
5	125				
6	170				

- Fill in the columns for **TVC**, **ATC**, **AVC** and **MC**.
- Construct a graph plotting the **ATC**, **AVC** and **MC** curves.
- Identify in your diagram the firm's short-run breakeven price and shut-down price, and outline how you found them.
- Identify the firm's long-run shut-down price.
- Identify the price at which this firm would earn normal profit, and state how much output it would produce at this price.
- State the condition for productive efficiency; identify the level of output at which this firm would achieve productive efficiency.
- State the condition for allocative efficiency; identify the price per unit of output at which this firm would achieve allocative efficiency.
- Outline four assumed characteristics of perfect competition.
- Given a price of £20 per unit, calculate the amount of economic profit (positive or negative) that this firm would make if it profit maximizes, and outline whether the firm would stay in business in the short run.

**Question 2**

The following table shows price, quantity and cost data of a firm.

Price	Quantity	Marginal Cost (MC)	Total Revenue (TR)	Marginal Revenue (MR)	Average Revenue (AR)
6	1	5			
5	2	3			
4	3	2			
3	4	3			
2	5	5			
1	6	7			

- Calculate/state total revenue, marginal revenue and average revenue.
- Construct a graph plotting marginal revenue, average revenue and marginal cost, and show the demand curve facing the firm.
- Identify the market structure that cannot represent this firm.
- Outline how the price elasticity of demand changes along this demand curve (no calculations necessary).
- Referring to the concept of price elasticity of demand, determine the maximum level of output this firm would be willing to produce and outline why the firm would not be willing to produce more.
- Determine the revenue-maximizing level of output and the profit-maximizing level of output, and identify them both on your graph.
- Describe three assumed characteristics of a monopoly.
- Describe three assumed characteristics of monopolistic competition.
- If average total costs of the firm at the profit-maximizing level of output are \$3, find the firm's economic profit or loss per unit of output and its total economic profit or loss.