Part A: Multiple Choice Questions (3 points each, total 30 points)

1. Diminishing marginal returns occur when _______.
   A. the average product of the variable input eventually diminishes
   B. the marginal product of an additional worker is less than the marginal product of the previous worker hired
   C. the firm hires cheap, less-skilled workers in place of expensive, high-skilled workers
   D. total product diminishes

2. The long run is a time frame in which
   A. the quantities of some factors of production are fixed and the quantities of other factors of production can be varied.
   B. the quantities of all factors of production can be varied.
   C. the quantities of all factors of production are fixed.
   D. all costs are sunk costs.

3. Which of the following statements is correct?
   A. As output increases, total cost and total fixed cost increase by the same amount.
   B. As output increases, total cost and total fixed cost increase but not necessarily by the same amount.
   C. As output increases, total cost increases and total fixed cost decreases.
   D. Total fixed cost plus total variable cost equals total cost.

4. A company could produce 99 units of a good for $316 or produce 100 units of the same good for $320. The marginal cost of the 100th unit
   A. is $3.20.
   B. is $4.00.
   C. is $320.
   D. cannot be calculated with this information.
5. At point d in the figure on the right, the average product of labor equals
   A. 15.
   B. 4.
   C. 3.75.
   D. approximately 1.

6. In perfect competition, the product of a single firm
   A. has many perfect substitutes produced by other firms.
   B. has many perfect complements produced by other firms.
   C. is sold under many differing brand names.
   D. is sold to different customers at different prices.

7. Which of the following is NOT an assumption of perfect competition?
   A. many firms
   B. many buyers
   C. restrictions on entry into the market
   D. each firm sells an identical product

8. A perfectly competitive firm that is producing a positive quantity of a good maximizes its economic profit if it produces so that
   A. total revenue = total cost.
   B. marginal revenue = marginal cost.
   C. average revenue = average total cost.
   D. average total cost = average variable cost.

9. In the figure on the right, between 20 and 25 units per hour, the firm experiences
   A. economies of scale.
   B. diseconomies of scale.
   C. constant returns to scale.
   D. increasing total fixed costs.
10. Marginal cost is the increase in total _______ that results from a one-unit increase in _______.
   A. fixed cost; the fixed input
   B. cost; output
   C. variable cost; the variable input
   D. fixed cost; output

Part B: Essay Questions (70 points)

1. The figure below shows the market price and costs of a perfectly competitive firm. (20 points)

   A. What is the profit maximizing output if the market price is $10? (5+5 points)

   Answer: When the market price is $10, the profit maximizing output ($Q^*$) is 25. That is the output produced at the point where $P=MR=MC$ for the perfectly competitive firm.

   B. Calculate the profit or loss for the firm, and show the area on the graph above. (6+4 points)

   Answer:
   
   $\text{Profit} = TR - TC = Q \times (P - ATC) = 25 \times (10 - 12.5) = -62.5$

   OR
   
   $\text{TR} = P \times Q = 10 \times 25 = 250$
   $\text{TC} = ATC \times Q = 12.5 \times 25 = 312.5$
   $\text{Profit} = \text{TR} - \text{TC} = 250 - 312.5 = -62.5$

   Note: For $Q=25$, ATC is assumed to be equal to 12.5 (see the graph). The profit is the area labeled on the graph as ABCD.
2. *Star Cash Wash* hires students at $10 an hour to wash cars. It rents equipment at $15 an hour. The table sets out its total product schedule. (50 points)

<table>
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<tr>
<th>Labor (students)</th>
<th>Output (cars washed per hour)</th>
<th>FC ($)</th>
<th>VC ($)</th>
<th>TC ($)</th>
<th>AFC ($)</th>
<th>AVC ($)</th>
<th>ATC ($)</th>
<th>MC ($)</th>
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A. Calculate *Star Cash Wash’s* costs and fill the table. (2+21 points)

**Answer:** Answers are in bold font in the table above.

B. Draw Marginal Cost (MC), Average Variable Cost (AVC), and Average Total Cost (ATC) curves on the same graph below. (12 points)

![Graph showing marginal cost (MC), average variable cost (AVC), and average total cost (ATC)](image)

C. How many cars *Star Cash Wash* would be washing if the price in the market is equal to $3? How much would be the amount of the profit/loss (specify)? Explain. (2+5.5 points)

**Answer:** It would produce at the point where MC=MR=P, so quantity would be 17. It will incur a loss equal to 17x(3-3.3)= -$5.1. Although it is incurring an economic loss, it would still prefer to produce because if it does not produce, the amount of the loss would be even higher. That would be equal to the fixed cost, in other words $15 of loss.

D. How many cars *Star Cash Wash* would be washing if the price in the market is equal to $2? How much would be the amount of the profit/loss (specify)? Explain. (2+5.5 points)

**Answer:** It would not produce anything because $2 is lower than the shutdown price. Therefore, the amount of the loss would be equal to the fixed cost (15$ of loss).