PART I: Multiple Choice (5 points each, 60 points in total)

1. The table below shows the short-run production function for Albert’s Pretzels. The marginal productivity of labor

   (a) rises then falls as the amount of capital increases.
   (b) falls then rises as the amount of labor increases.
   (c) is greater than or equal to the average productivity of labor for all amounts of labor.
   (d) is less than or equal to the average productivity of labor for all amounts of labor. (√)

<table>
<thead>
<tr>
<th>Labor</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

2. Joey’s Lawncutting Service rents office space from Joey’s dad for $300 per month. Joey’s dad is thinking of increasing the rent to $400 per month. As a result Joey’s marginal cost of cutting grass will

   (a) decrease by $100.
   (b) increase by $100 divided by the amount of grass cut.
   (c) not change. (√)
   (d) increase by $100.

3. Suppose the production of VCRs can be represented by the following production function: \( q = L^{0.4}K^{0.4} \). The firm currently produces \( q_1 \) units. If all inputs doubled, the new level of output will equal

   (a) \( 2^{0.4}q_1 \).
   (b) \( 2^{0.8}q_1 \). (√)
   (c) \( 0.8q_1 \).
   (d) \( 1.6q_1 \).

4. If a competitive firm finds that it maximizes short-run profits by shutting down, which of the following must be true?

   (a) \( p < AVC \) only for the level of output at which \( p = MC \).
   (b) \( p < AVC \) only if the firm has no fixed costs.
(c) $p < AVC$ for all levels of output. (√)
(d) The firm will earn zero profit.

5. The figure below shows the isoquants for producing steel. When producing less than 10,000 tons there are

(a) decreasing returns to scale.
(b) constant returns to scale.
(c) diseconomies of scale.
(d) increasing returns to scale. (√)

6. Suppose the total cost of producing T-shirts can be represented as $TC = 50 + 2q$. Which of the following statements is TRUE at all levels of production?

(a) $MC = AVC$ (√)
(b) $MC = AC$
(c) $MC > AFC$
(d) All of the above.

7. If the marginal cost of producing a good is increasing as a firm produces more of the good, then which of the following must be TRUE? (Suppose L is the only variable input.)

(a) AFC is rising.
(b) AVC is rising.
(c) $MC > AVC$.
(d) $MP_L$ is falling. (√)

8. If an isocost line crosses the isoquant twice, a cost minimizing firm will

(a) use a different isocost line to select the bundle of inputs. (√)
(b) use the input bundle associated with the intersection on the higher point of the isoquant.
(c) use the input bundle associated with the intersection on the lower point of the isoquant.
(d) Both B and C.

9. The figure below shows the cost curves for a competitive firm. If the market price is $15 per unit, the firm will earn profits of

(a) $0.
(b) $4.
(c) $40.
(d) $160. (√)

![Cost Curves](image)

10. A special license is required to operate a taxi in many cities. The number of licenses is restricted. More drivers want licenses than are issued. This describes a non-perfectly competitive market because

(a) taxi services are very different.
(b) firms cannot freely enter and exit the market. (√)
(c) transaction costs are high.
(d) the government generates revenue from the licenses.

11. Suppose that for each firm in the competitive market for potatoes, long-run average cost is minimized at $0.20 per pound when 500 pounds are grown. If the long-run supply curve is horizontal, then

(a) some firms will enjoy long-run profits because they operate at minimum average cost.
(b) the long-run price will be $0.20 per pound. (√)
(c) each consumer will purchase $100 worth of potatoes.
(d) the long-run price will be set just above $0.20 per pound.
12. If a competitive firm cannot earn profit at any level of output during a given short-run period, then which of the following is LEAST likely to occur?

(a) It will shut down in the short run and wait until the price increases sufficiently.
(b) It will exit the industry in the long run.
(c) It will operate at a loss in the short run.
(d) It will minimize its loss by decreasing output so that price exceeds marginal cost. (√)

PART II: Short Answer (10 points each, 40 points in total)

1. What are the functions for MC and AC if $TC = 100q + 100q^2$? Are the returns to scale increasing, decreasing, or constant?

**Solution 1**

\[
MC = \frac{dTC}{dq} = 100 + 200q \\
AC = \frac{TC}{q} = 100 + 100q
\]

⇒ $AC < MC$, ∴ there’s DECREASING RTS

2. Suppose the production function for T-shirts can be represented as $q = L^{0.25}K^{0.75}$. When $K = 1$ and $q = 2$, what is the slope of the isoquant?

**Solution 2**

\[
2 = L^{0.25}(1)^{0.75} \implies L = 16
\]

\[
MP_L = \frac{\partial q}{\partial L} = 0.25L^{-0.75}K^{0.75} \\
MP_K = \frac{\partial q}{\partial K} = 0.75L^{0.25}K^{-0.25}
\]

Slope of isoquant = \(-\frac{MP_L}{MP_K}\) = \(-\frac{0.25}{0.75} \cdot \frac{K}{L}\) = \(-\frac{K}{3L}\)

Evaluating at $K=1$ and $L=16$: slope of isoquant = \(-\frac{K}{3L}\) = \(-\frac{1}{48}\)

3. Consider the following short-run production function: $q = 5L^2 - \frac{1}{3}L^3$. At what level of L do diminishing marginal returns begin? At what level of L do diminishing returns begin?

**Solution 3**

\[
MP_L = \frac{\partial q}{\partial L} = 10L - L^2
\]

*Diminishing MARGINAL return: $MP_L$ is decreasing*
\[ \frac{\partial MP_L}{\partial L} = 10 - 2L < 0 \]

\[ L > 5 \]

**Diminishing return: \( MP_L < 0 \):**

\[ 10L - L^2 < 0 \implies L > 10 \]

4. Suppose that for each firm in the competitive market for potatoes, long-run average cost is minimized at $0.20 per pound when 500 pounds are grown. The demand for potatoes is \( Q = \frac{10000}{p} \). If the long-run supply curve is horizontal, then how much money will consumers spend, in total, on potatoes?

**Solution 4**

\[ P = 0.2 \implies Q_D = \frac{10000}{p} = 50,000 \]

\[ Total \ Expenditure = P \cdot Q_D = 10,000 \]