3. According to Table 4.1, by how much will unit sales of (a) coffee, (b) shoes, and (c) airline travel decline when price goes up by 10 percent? What will happen to total revenue in each case?

a. The quantity demanded of coffee will decline by 3% (0.5 pt) and total revenue will increase (0.5 pt).

b. The quantity demanded of shoes will decline by 9% (0.5 pt) and total revenue stay about the same (0.5 pt).

c. The quantity demanded of airline travel will decline by 24% (0.5 pt) and total revenue will decrease (0.5 pt).
4. According to the Headline on p. 64, what is the price elasticity of demand for alcohol among college students?

The article states that the quantity demanded will decrease by 33% when price goes up $1.00. You calculate the percentage change in price by taking the change in price, $1.00, and dividing it by $2.67 (the average of the starting and ending prices). This is equal to 37%. The price elasticity is 33% divided by 37%, which results in an elasticity of 0.89 (1 pt). This is slightly inelastic.
6. In 1998, President Clinton proposed an additional $1.10 per pack tax that would have increased cigarette prices roughly 60 percent. According to the Headline on p. 97, by how much would teen smoking have dropped in response to such a tax?

\[
\text{Elasticity of demand} = 0.7 = \frac{\% \Delta Q_d}{0.60} = 0.60 \times 0.7 = 0.42
\]

The quantity demanded of cigarettes by teens would decrease by 42 percent (1 pt) given a $1.10 per pack tax on cigarettes.
a. What is the marginal utility of each pizza?

- first slice, $MU = 47$
- second slice, $MU = 45$ (92-47)
- third slice, $MU = 30$ (122-92)
- fourth slice, $MU = 13$ (135-122)
- fifth slice, $MU = 2$ (137-135)
- sixth slice, $MU = -17$ (120-137)
- seventh slice, $MU = -50$ (70-120)

b. Economists have found that after some point, the more you have of something, the less valuable each additional unit. (1 pt) After the first slice of pizza, the initial good feeling decreases. While the second slice is still very enjoyable, it is not as good as the first slice. The same pattern continues until we get to the sixth slice, which actually makes you feel stuffed and uncomfortable, resulting in a decrease of additional satisfaction. The situation worsens with the seventh slice.
8. Economists estimate price elasticities by using average price and quantity to compute percentage changes. Thus,

\[ E = \frac{Q_1 - Q_2}{P_1 + P_2} \frac{2}{P_1 - P_2} \]

Using this formula,

a. Compute \( E \) for a popcorn price increase from 20 cents to 40 cents per ounce (Figure 4.5)

\[
\frac{16 - 4}{16 + 4} \frac{2}{0.20 - 0.40} = \frac{12}{0.20 + 0.40} = \frac{12}{0.30} = \frac{12}{0.666} = -1.8 \text{ and } |E| = 1.8 \quad (1 \text{ pt})
\]

b. Compute \( E \) for New York City cigarettes (see Headline, p. 100 and text)

\[
\frac{1563 - 2922}{1563 + 2933} = \frac{2933 - 2922}{7.50 - 6.08} = \frac{0.61}{1.42} = -2.9 \text{ and } |E| = 2.9 \quad (1 \text{ pt})
\]

(okay if used $6.00 instead of $6.08)
Chapter 5

1. What is the marginal physical product of each successive worker in Figure 5.1?

*The MPP’s are 15, 19, 10, 4, 2, 1, 0, -4.* (0.5 pt each)

2. Compute *average* fixed costs and *average* variable costs in Figure 5.3 for all rates of output. At what rate of output
(a) is average fixed costs the lowest?
(b) is average variable cost the lowest?
(c) is average total cost the lowest?

(a) *The minimum AFC is $2.35 at 51 units of output.* (1 pt)
(b) *The minimum AVC is $7.50 at 20 units of output.* (1 pt)
(c) *The minimum ATC is $11.75 at 40 units of output.* (1 pt)

4. What is the value of fixed costs in the foregoing table?

*Fixed costs are those costs that do not change with output. Since variable costs are zero when output is zero, any costs that exist when output is zero must be the fixed costs. As a result, the fixed costs in this problem are $100 (1 pt).*

**Note:** You should notice that ATC is minimized at two levels of output. This is just the result of using whole numbers in the example. Where MC=ATC, ATC will always be at its minimum.
5. Suppose the mythical Tight Jeans Corporation leased a second sewing machine, giving it the following production function:

<table>
<thead>
<tr>
<th>Number of workers:</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Output:</td>
<td>0</td>
<td>20</td>
<td>46</td>
<td>64</td>
<td>72</td>
<td>78</td>
<td>81</td>
<td>82</td>
<td>80</td>
</tr>
</tbody>
</table>

a. Graph the production function. (1 pt)
b. On a separate graph, illustrate marginal physical product. (1 pt)
c. At what level of employment does the law of diminishing returns become apparent?
d. At what level of employment does MPP become negative?
e. Why does MPP become negative?

Production Function

![Production Function Graph]

At what level of employment does the law of diminishing returns become apparent?
b. The law of diminishing marginal returns becomes apparent when the third worker is hired. Up to, and including the second worker, the MPP of labor increases. When the third worker (1 pt) is hired, the MPP begins to decline.

d. As shown on the graph above, the MPP becomes negative when the 8th worker (1 pt) is hired.

e. MPP becomes negative because the workers become so crowded (1 pt) around the two sewing machines that adding the 8th worker actually causes the total output to fall.
6. Using the data in problem 5, and a wage of $10 per worker, compute the marginal cost of increasing output from 72 to 78 pairs of jeans.

   The marginal cost is calculated as (Change in Total Cost)/(Change in Output). Assuming that labor is the only variable cost, if one additional worker is paid $10 and results in total output increasing by 6 pairs of jeans, then the marginal cost is calculated as $10/6 = $1.67 (1 pt)

7. Using Figure 5.3 as a guide, compute total profits at a price of $18 per unit and output of (a) 40 units, (b) 50 units. Why does total profit decline when output increases?

   a. Total revenue = price x output = $18 x 40 = $720. Total cost = output x ATC = 40 x $11.75 = $470. Therefore, profit = total revenue – total cost = $720 - $470 = $250. (1 pt)

   b. Total revenue = price x output = $18 x 50 = $900. Total cost = output x ATC = 50 x $13.40. Therefore, profit = total revenue – total cost = $900 - $670 = $230. (1 pt)

   Total profit falls when output increases because marginal costs are rising faster than marginal revenue.