SOLUTIONS TO TEXT PROBLEMS:

Quick Quizzes

1. The marginal product of labor is the increase in the amount of output from an additional unit of labor. The value of the marginal product of labor is the marginal product of labor times the price of the good.

   A competitive, profit-maximizing firm decides how many workers to hire by hiring workers up to the point where the value of the marginal product of labor equals the wage.

2. A brain surgeon has a higher opportunity cost of enjoying leisure than a janitor because the surgeon's wage is so much higher. That's why doctors work such long hours—because leisure is so expensive for them.

3. An immigration of workers increases labor supply but has no effect on labor demand. The result is an increase in the equilibrium quantity of labor and a decline in the equilibrium wage, as shown in Figure 1. The decline in the equilibrium wage causes the quantity demanded of labor to increase. The increase in the equilibrium quantity of labor causes the marginal product of labor to decrease.

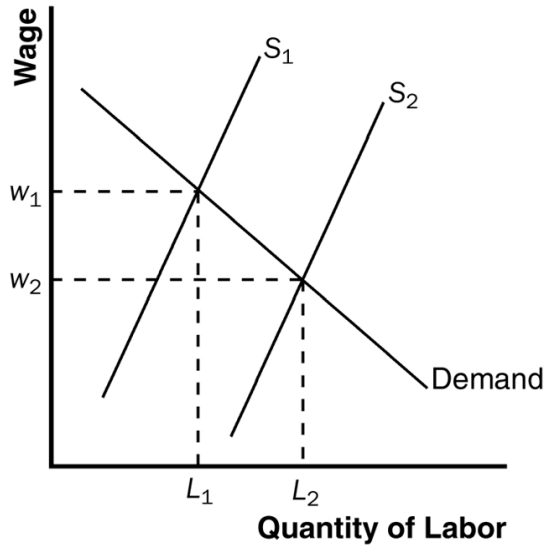

Figure 1

4. The income of the owners of land and capital is determined by the value of the marginal contribution of land and capital to the production process.

   An increase in the quantity of capital would reduce the marginal product of capital, thus reducing the incomes of those who already own capital. However, it would increase the incomes of workers because a higher capital stock raises the marginal product of labor.

Questions for Review

1. A firm's production function describes the relationship between the quantity of labor used in production and the quantity of output from production. The marginal product of labor is the increase in the amount of output from an additional unit of labor. Thus the marginal product of labor depends directly on the production function. The value of the marginal product of labor is the marginal product of labor multiplied by the market price of the output.

   A competitive, profit-maximizing firm hires workers up to the point where the value of the marginal product of labor equals the wage. As a result, the value-of-marginal-product curve is the labor-demand curve.

2. Events that could shift the demand for labor include changes in the output price, technological change, and changes in the supply of other factors.

3. Events that could shift the supply of labor include changes in tastes, changes in alternative opportunities, and immigration.

4. The wage can adjust to balance the supply and demand for labor while simultaneously equaling the value of the marginal product of labor. Supply and demand for labor determine the equilibrium wage. Firms maximize profits by choosing the amount of labor where the wage is equal to the value of the marginal product of labor.

5. A large immigration would increase the supply of labor, thus reducing the wage. With more labor working with capital and land, the marginal product of capital and land is higher, so rents earned by owners of land and capital would increase.

Problems and Applications

1. a. The law requiring people to eat one apple a day increases the demand for apples. As shown in Figure 2, demand shifts from D_1 to D_2, increasing the price from P_1 to P_2, and increasing quantity from Q_1 to Q_2.

   b. Since the price of apples increases, the value of marginal product increases for any given quantity of labor. There is no change in the marginal product of labor for any given quantity of labor. However, firms will choose to hire more workers and thus the marginal product of labor at the profit-maximizing level of labor will be lower.

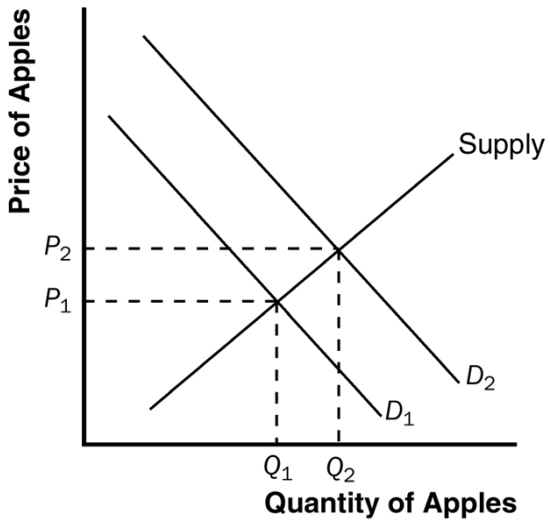

Figure 2

c. As Figure 3 shows, the increase in the value of marginal product of labor shifts the demand curve of labor from D_1 to D_2. The equilibrium quantity of labor rises from L_1 to L_2, and the wage rises from w_1 to w_2.

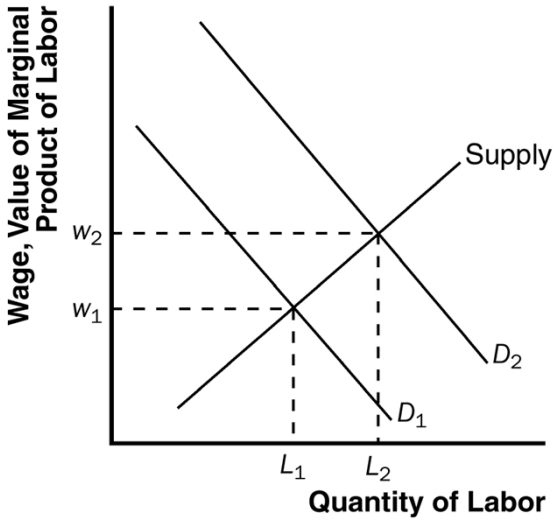

Figure 3

2. Henry Ford made the statement that "It is not the employer who pays wages—he only handles the money. It is the product that pays wages." In the language of economics, he means that the demand for labor is a derived demand. Wages depend on the price of the final product (which is determined by the demand for the product) and the productivity of workers.

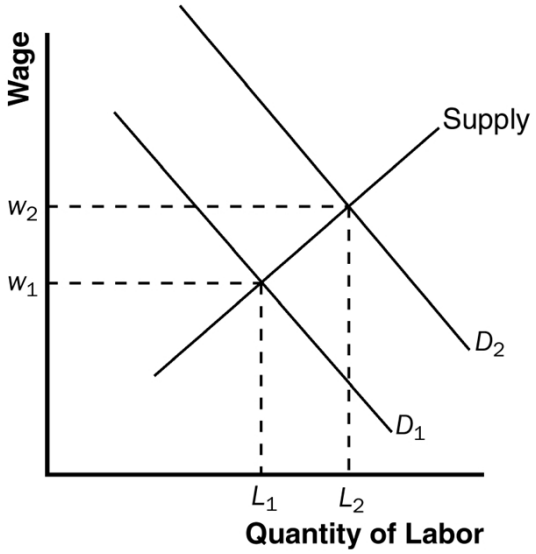

Figure 4

3. a. If Congress were to buy personal computers for all American college students, the demand for computers would increase, raising the price of computers and thus increasing the value of marginal product of workers who produce computers. This is shown in Figure 4 as a shift in the demand curve for labor from D_1 to D_2. The result is an increase in the wage from w_1 to w_2 and an increase in the quantity of labor from L_1 to L_2.

   b. If more college students major in engineering and computer science, the supply of labor in the computer industry rises. This is shown in Figure 5 as a shift in the supply curve from S_1 to S_2. The result is a decrease in the wage from w_1 to w_2 and an increase in the quantity of labor from L_1 to L_2.

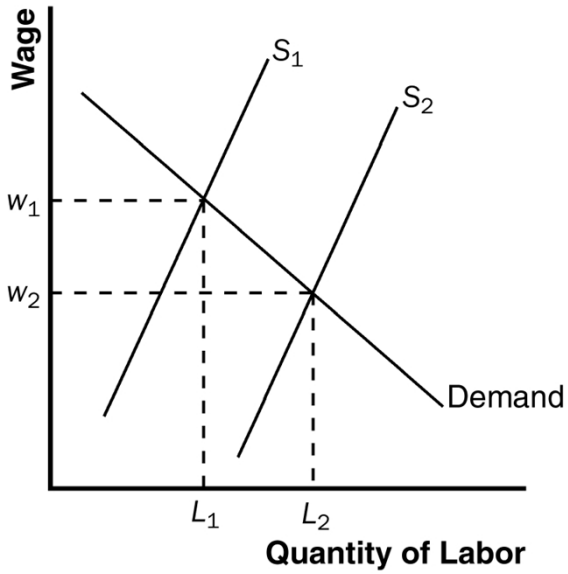

Figure 5

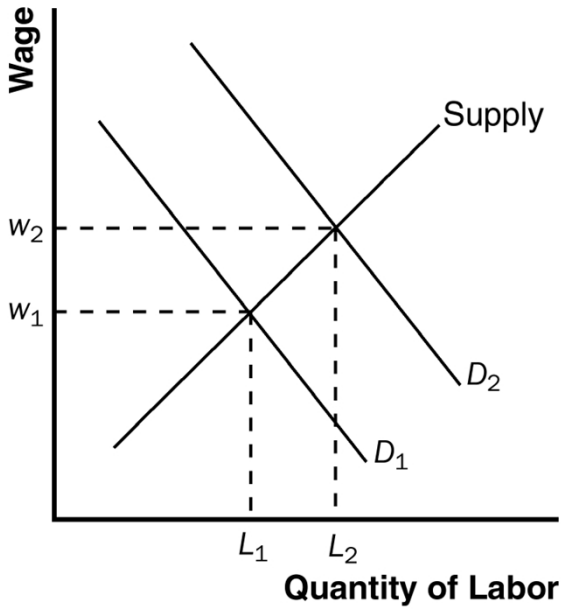

Figure 6

c. If computer firms build new manufacturing plants, this increases the marginal product of labor and the value of the marginal product of labor for any given quantity of labor. This is shown in Figure 6 as a shift in the demand curve for labor from D_1 to D_2. The result is an increase in the wage from w_1 to w_2 and an increase in the quantity of labor from L_1 to L_2.

4. Since your uncle is maximizing his profit, he must be hiring workers such that their wage equals the value of their marginal product. Since the wage is \$6 per hour, their value of marginal product must be \$6 per hour. Since the value of marginal product equals the marginal product times the price of the good, and since the price of a sandwich is \$3, the marginal product of a worker must be 2 sandwiches per hour.

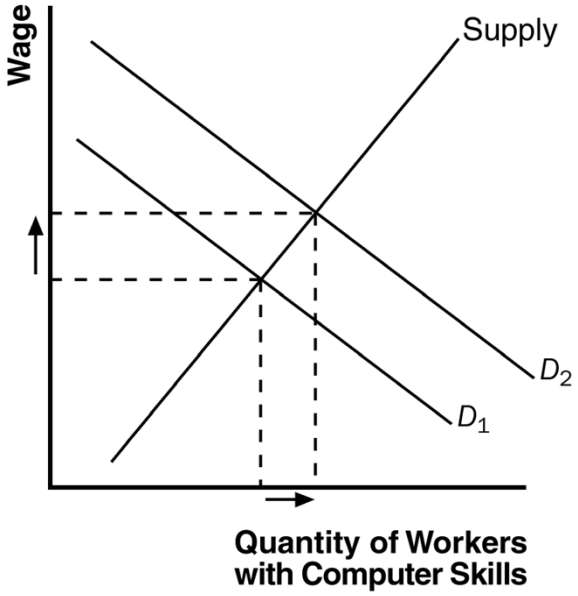

Figure 7

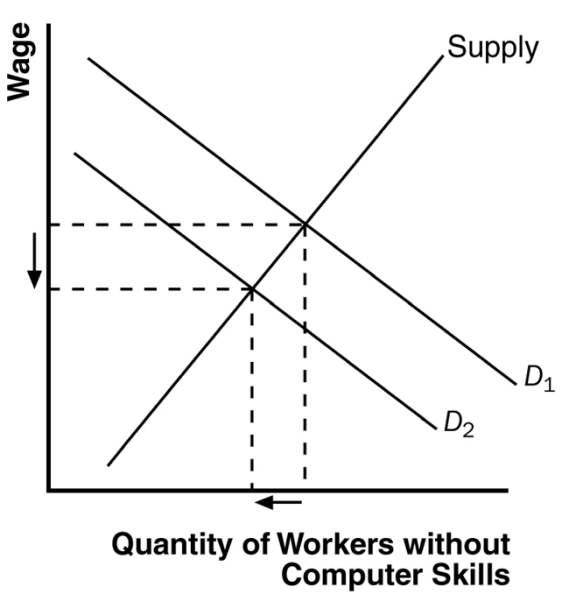

Figure 8

5. Technological advance increases the marginal product of workers who have computer skills and decreases the marginal product of workers who don't have such skills. In the labor markets, the increased marginal product of workers with computer skills shifts the demand for these workers to the right (Figure 7), while the demand for workers without computer skills shifts to the left (Figure 8). The result is an increase in wages for those with computer skills and a decrease in wages for those without such skills.

6. a. When a freeze destroys part of the Florida orange crop, the supply of oranges declines, so the price of oranges rises. Since there are fewer oranges in a given area of orange trees, the marginal product of orange pickers declines. But since the price of oranges rises, the value of the marginal product of orange pickers could rise or fall, depending on whether the marginal product falls more or less than the price rises. Thus you cannot say whether the demand for orange pickers will rise or fall.

   b. If the price of oranges doubles and the marginal product of orange pickers falls by just 30 percent, then the value of marginal product for a particular quantity of orange pickers increases, shifting the demand for orange pickers to the right, and increasing the equilibrium wage of orange pickers.

   c. If the price of oranges rises by 30 percent and the marginal product of orange pickers falls by 50 percent, then the value of marginal product for a particular quantity of orange pickers decreases, shifting the demand for orange pickers to the left, and reducing the equilibrium wage of orange pickers.

7. a. Figure 9 shows the U.S. capital market when there is an inflow of capital from abroad. The inflow of capital shifts the supply curve to the right, from S_1 to S_2. The result is a reduction in the rental rate on capital from r_1 to r_2 and an increase in the quantity of capital from K_1 to K_2.

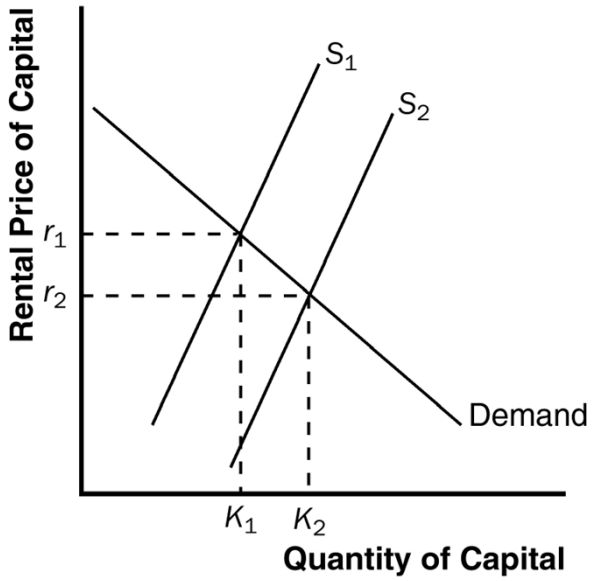

Figure 9

b. The increase in capital increases the marginal product of labor and the value of marginal product of labor for any given quantity of labor. Figure 10 shows this as a shift in the demand for labor from D_1 to D_2. As a result, the wage rate rises from w_1 to w_2 and the quantity of labor rises from L_1 to L_2.

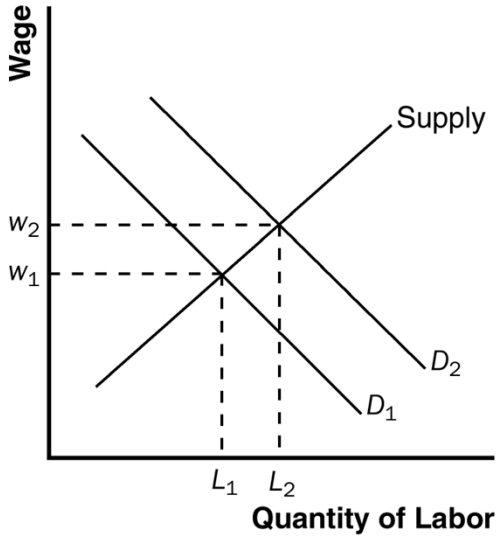

Figure 10

8. The following table shows the marginal product of labor and the value of the marginal product of labor:

L	*Q*	*MPL*	*VMPL*
0	0	---	---
1	7	7	70
2	13	6	60
3	19	6	60
4	25	6	60
5	28	3	30
6	29	1	10

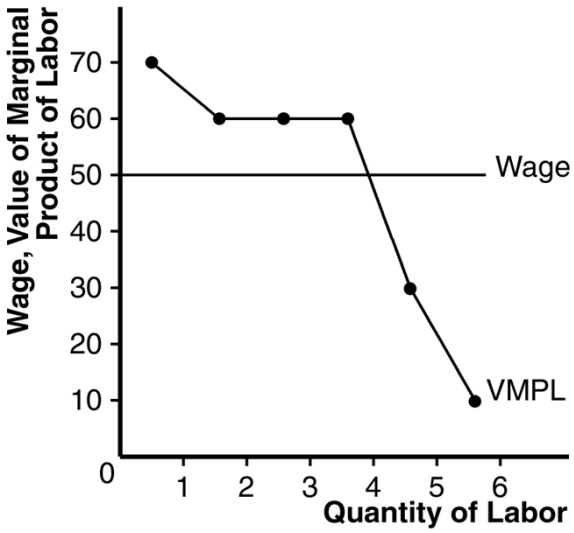

Figure 11

Figure 11 plots the firm's demand for labor. Since the wage is $50 per day, the firm should hire four days of labor. For each of the first four days of labor, the value of the marginal product of labor exceeds the wage. But for more than four days of labor, the value of the marginal product is less than the wage. So the firm maximizes profit by hiring four days of labor.

9. a. If a firm already gives workers fringe benefits valued at more than $3, the new law would have no effect. But a firm that currently has fringe benefits less than $3 would be affected by the law. Imagine a firm that currently pays no fringe benefits at all. The requirement that it pay fringe benefits of $3 reduces the value of marginal product of labor effectively by $3 in terms of the cash wage the firm is willing to pay. This is shown in Figure 12 as a downward shift in the firm's demand for labor from D_1 to D_2, a shift down of exactly $3.

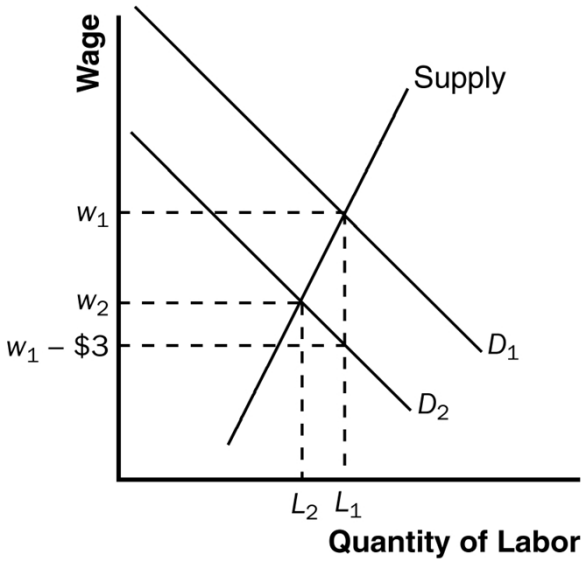

Figure 12

b. Since the supply curve has a positive but finite slope, the new equilibrium will be one in which the new wage, w_2, is less than the old wage, w_1, but $w_2 > w_1 - \$3$. The quantity of labor also declines.

c. The preceding analysis is incomplete, of course, because it ignores the fact that the fringe benefits are valuable to workers. As a result, the supply curve of labor might increase, shown as a shift to the right in the supply of labor in Figure 13. In general, workers would prefer cash to specific benefits, so the mandated fringe benefits aren't worth as much as cash would be. But in the case of fringe benefits there are two offsetting advantages: (1) fringe benefits aren't taxed; and (2) firms offer cheaper provision of health care than workers could purchase on their own. So whether the fringe benefits are worth more or less than $3 depends on which of these effects dominates.

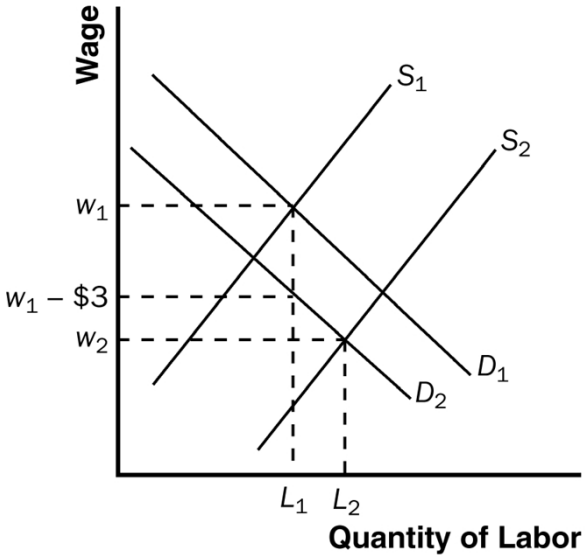

Figure 13

Figure 13 is drawn under the assumption that the fringe benefits are worth more than \$3 to the workers. In this case, the new wage, w_2, is less than w_1 - \$3 and the quantity of labor increases from L_1 to L_2.

If the shift in the supply curve were the same as the shift in the demand curve, then $w_2 = w_1$ - \$3 and the quantity of labor remains unchanged.

If the shift in the supply curve were less than the shift in the demand curve, then $w_2 > w_1$ - \$3 and the quantity of labor decreases.

In all three cases there is a lower wage and higher quantity of labor than if the supply curve were unchanged.

d. Since a minimum-wage law would not allow the wage to decline when greater fringe benefits are mandated, it would lead to increased unemployment, because firms would refuse to pay workers more than the value of their marginal product.

10. a. A union is like a monopoly firm in that it is the only supplier of labor, just as a monopoly is the only supplier of the good.

b. Just as a monopoly firm wants to maximize profits, a labor union may wish to maximize the labor income of its members.

c. Just as the monopoly price exceeds the competitive price in the market for a good, the union wage exceeds the free-market wage in the market for labor. And just as the quantity of output of a monopoly is less than the quantity produced by a competitive industry, employment by a unionized firm is less than employment by a non-unionized firm, since the union wage is higher.

d. Unions might wish to maximize total labor income of their members, or they might want the highest wage possible, or they might wish to have the greatest employment possible. In addition, they may wish to have improved working conditions, increased fringe benefits, or some input into the decisions made by a firm's management.