

9. The number of repairs produced by a computer repair shop depends on the number of workers as follows:

Number of Workers	Number of Repairs (Per Week)
0	0
1	8
2	20
3	35
4	45
5	52
6	57
7	60

Assume that all inputs (office space, telephone, utilities) other than labor are fixed in the short run.


- Add two additional columns to the table, and enter the marginal product and average product for each number of workers.
 - Over what range of labor input are there increasing returns to labor? Diminishing returns to labor? Negative returns to labor?
 - Over what range of labor input is marginal product greater than average product? What is happening to average product as employment increases over this range?
 - Over what range of labor input is marginal product smaller than average product? What is happening to average product as employment increases over this range?
10. Since the end of World War II, manufacturing firms in the United States and in Europe have been moving farther and farther outside of central cities. At the same time, firms in finance, insurance, and other parts of the service sector have been locating near the downtown areas in tall buildings. One major reason seems to be that manufacturing firms find it difficult to substitute capital for land, while service-sector firms that use office space do not.
- What kinds of buildings represent substitution of capital for land?
 - Why do you think that manufacturing firms might find it difficult to substitute capital for land?
 - Why is it relatively easier for a law firm or an insurance company to substitute capital for land?
 - Why is the demand for land likely to be very high near the center of a city?
- *e. One of the reasons for substituting capital for land near the center of a city is that land is more expensive near the center. What is true about the relative supply of land near the center of a city? (*Hint:* What is the formula for the area of a circle?)

11. Ted Baxter runs a small, very stable newspaper company in southern Oregon. The paper has been in business for 25 years. The total value of the firm's capital stock is \$1 million, which Ted owns outright. This year the firm earned a total of \$250,000 after out-of-pocket expenses. Without taking the opportunity

cost of capital into account, this means that Ted is earning a 25 percent return on his capital. Suppose that risk-free bonds are currently paying a rate of 10 percent to those who buy them.


- What is meant by the "opportunity cost of capital"?
 - Explain why opportunity costs are "real" costs even though they do not necessarily involve out-of-pocket expenses.
 - What is the opportunity cost of Ted's capital?
 - How much excess profit is Ted earning?
12. A firm can use three different production technologies, with capital and labor requirements at each level of output as follows:

Daily Output	Technology 1		Technology 2		Technology 3	
	K	L	K	L	K	L
100	3	7	4	5	5	4
150	3	10	4	7	5	5
200	4	11	5	8	6	6
250	5	13	6	10	7	8

- Suppose the firm is operating in a high-wage country, where capital cost is \$100 per unit per day and labor cost is \$80 per worker per day. For each level of output, which technology is the cheapest?
 - Now suppose the firm is operating in a low-wage country, where capital cost is \$100 per unit per day but labor cost is only \$40 per unit per day. For each level of output, which technology is the cheapest?
 - Suppose the firm moves from a high-wage to a low-wage country but that its level of output remains constant at 200 units per day. How will its total employment change?
13.  The following table gives the amount of capital per worker for several industries in the U.S. economy for a recent year:

Mining	\$692,077
Finance insurance and real estate	310,281
Agriculture	127,310
Manufacturing	122,587
Retail trade	37,930
Services	23,798

Give an example of a particular type of firm in each of these sectors (e.g., agriculture: farm) and describe the kind of capital that it uses in production (e.g., tractor, barn, and computer). How do you think technology has changed the production process in each of these sectors over the past couple of decades?

14.  Think of all the activities that you engage in every day that could be classified as *production*. Production means taking inputs and using them to produce some output. For example, driving a car uses land, labor, and capital (a car and a road) to produce transportation. Studying uses a book, paper, labor, a building (library), the Internet, and so on to produce human capital . . . knowledge and skills. You may work in a restaurant or a dining hall as a part-time job. Discuss the ways in which some of these activities have changed over the last few years. Have these activities become more or less capital intensive? Has your productivity changed?

Note: Problems marked with an asterisk are more challenging.

