

1. What is the difference between a plant, a business firm, and an industry?

Ans: A plant is a physical structure that produces a product. A business firm is an organization which owns and operates plants. (Multiplant firms may be horizontally integrated, vertically integrated, or conglomerates.) An industry is a group of firms producing the same or similar goods or services.

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Learning Objective: 6.1

2. Give an example of each of the following: a horizontally integrated firm, a vertically integrated firm, and a conglomerate.

Ans: A horizontally integrated firm is a multiplant firm that has more than one plant at the same level of production: Zellers stores; Safeway supermarkets; Ford manufacturing plants are examples.

A vertically integrated firm is a multiplant firm that owns plants at various stages in the production process. For example, a steelmaker owns iron ore and coal mines, coke ovens, blast furnaces, rolling mills, forge shops, and other stages in the manufacture of steel products.

A conglomerate is a multiplant firm with more than one plant in unrelated fields. For example, a paper plant, a dog food manufacturer, and a furniture store may be owned by the same corporation.

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Learning Objective: 6.1

3. Name an industry and then give an example of a firm and a plant within that industry which demonstrates the difference between the three terms (industry, firm, and plant).

Ans: For example, one could choose the “fast-food industry.” McDonald's Corporation is a firm within that industry and the nearest McDonald's restaurant is a plant belonging to that firm. Another example might be the automobile industry. General Motors is a firm in that industry, and the Chevrolet manufacturing plant in Ste. Therese, Quebec, is a plant belonging to the firm.

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Learning Objective: 6.1

4. What are the advantages and disadvantages of a sole proprietorship?

Ans: The two major advantages of sole proprietorships are the ease of organization and the control of the firm by the owner. This control allows the owner to be his or her own boss and directly profit from the success of the business. The three disadvantages concern limits to financial capital to expand the business, the wide range of responsibility for business tasks that are required of the sole proprietor, and the fact that the owner is subject to unlimited liability for debts of the business.

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Learning Objective: 6.1 (extension)

5. What are the advantages and disadvantages of a partnership?

Ans: Partnerships have three significant advantages. First, they are easy to organize. Second, they permit more specialization in management than sole proprietorships. Third, they have access to greater financial resources because there are more owners.

There are four disadvantages to a partnership. First, there may be disagreements among the partners that affect the success of the business. Second, the access to financial resources for expansion of the business is limited by the assets or the borrowing capacity of the partners. Third, there can be problems in continuity if a partner dies or leaves the partnership. Fourth, partnerships are also subject to unlimited liability for debts, just as is the case with a sole proprietorship.

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Learning Objective: 6.1 (extension)

6. Define what is meant by a corporation and give two reasons why corporations dominate the Canadian business sector.

Ans: Corporations are legal business organizations which are distinct and separate entities from the individuals who own them. As such, corporations are treated as legal persons that can acquire resources, own assets, produce and sell products, incur debts, extend credit, sue and be sued, and carry on all functions which any other form of enterprise performs.

Corporations dominate the business sector in terms of sales because they are the most effective form of business for raising money capital with their ability to issue stocks and bonds. Therefore, the largest businesses tend to be corporations. Stockholders also have the advantage of limited liability which is important when there is much at risk, so again the larger firms have an incentive to incorporate.

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Learning Objective: 6.1

7. What are the three principal legal forms of business firms? What are the advantages and disadvantages of each?

Ans: The three principal legal forms of business firms are the sole proprietorship, partnership and corporation. Each has special characteristics and advantages and disadvantages. The sole proprietorship is easy to form, lets the owner be boss, and allows great freedom. The disadvantages are the lack of access to large amounts of financial capital, the difficulty of managerial specialization, and the unlimited liability of the owner. The partnership is also easy to form, and allows for more access to financial capital and permits more managerial specialization. The potential disadvantages are that partners may disagree, there are still limits to financial capital or managerial specialization, continuity of the firm over time is a problem, and there is unlimited liability for partners. The corporation can raise financial capital through the sale of stocks and bonds, has limited liability for owners, can become large in size, and has an independent life. The chief disadvantages are the double taxation of some corporate income, potential for abuse of this legal entity, and legal or regulatory expenses. There can also be a principal-agent problem with the separation of ownership and control of the firm.

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Learning Objective: 6.1 (extension)

8. Explain what “separation of ownership and control” of the modern corporation means. How is this situation a principal-agent problem?

Ans: In many large modern corporations there are thousands of stockholders, each with a very small share of the company. They have little or no power to make decisions in the corporation and only have the power to cast their share votes on a few decisions at the annual meeting of shareholders. The day-to-day decisions involving the corporation are made by the paid professional managers. In many cases, even the board of directors elected to represent the shareholders is largely at the mercy of management recommendations when it comes to making policy regarding the company. Thus, the shareholders of a large corporation are separated from the control of the corporation they own. This situation is an example of a principal agent problem where the interests of the principals (stock holders) differ from the interests of agents (managers).

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Learning Objective: 6.1

9. What is the real cost of putting an unemployed labourer to work raking leaves or digging holes and refilling them during a serious depression? Explain.

Ans: Because an unemployed labourer was not doing anything productive before giving him this menial task, then the real cost of employing the person is zero. In other words, no other production is being sacrificed in order to have this person rake leaves or dig holes. The only real cost is the opportunity cost of the unemployed worker's leisure. This answer assumes that there are no more productive jobs available to the worker than raking leaves or digging holes that would be suitable for this labourer.

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Learning Objective: 6.2

10. Why are costs important in economics? Why don't economists use the same cost data as accountants use?

Ans: Costs are important in economics in determining the allocation of resources based on what firms are willing to pay, which in turn depends on how much consumers are willing to pay for the products produced by these resources. Costs reflect the market prices of the resources used in production, but also economic costs include the opportunity cost of using some resources that may not have an explicit market price. Economists argue that the cost of all resources should be considered when determining the real cost of production.

Implicit costs are as important as the explicit costs, which are generally the so-called "accounting costs." For example, economists (but not accountants) would count the income forgone in the use of the owner's time as an economic cost, the interest forgone by using one's own funds, and so on. These implicit costs should be counted so one can judge the true economic or opportunity cost of production. If these costs are neglected, then an overallocation of resources could occur because not all of the production costs are being measured.

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Learning Objective: 6.2

11. Why is it important to distinguish between explicit and implicit costs?

Ans: Implicit costs are as important as the explicit costs, which are generally the so-called "accounting costs." For example, economists (but not accountants) would count the income forgone in the use of the owner's time as an economic cost, the interest forgone by using one's own funds, and so on. These implicit costs should be counted so one can judge the true economic or opportunity cost of production. If these costs are neglected, then an overallocation of resources could occur because not all of the production costs are being measured.

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Learning Objective: 6.2

12. Jane quit her job at Telus where she earned \$36,000 a year. She cashed in \$40,000 in corporate bonds that earned 10% interest annually to buy a mini-bus. Jane has decided to buy the mini-bus and set up a commuter service between Maple Ridge and Vancouver. There are 300 people who will pay \$800 a year each for the commuter service; \$650 from each person goes for gas, maintenance, insurance, depreciation, etc.

- (a) What are Jane's total revenues?
- (b) What are Jane's explicit costs?
- (c) What is Jane's accounting profit?
- (d) List two important implicit costs that Jane has not included.
- (e) What is Jane's pure economic profit (loss)? What actions should Jane take based on her pure economic profit (loss)?

Ans: (a) Total revenues are \$240,000.

(b) Explicit costs are \$195,000.

(c) The accounting profit is \$45,000.

(d) (1) Salary that she would have earned at Telus (\$36,000). (2) Interest on invested savings ($\$40,000 \times 10\% = \$4,000$). Total implicit costs are \$40,000.

(e) Economic profit is \$5,000. $240,000 - (\$195,000 + \$40,000) = \$5,000$. Since Jane expects to make a positive economic profit, she should remain in business.

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Learning Objective: 6.2

13. Jack quit his job at Canadian Tire where he earned \$28,000 a year. He cashed in \$30,000 in corporate bonds that earned 10% interest annually to buy a mini-bus. Jack has decided to buy the mini-bus and set up a commuter service between Delta and Vancouver. There are 200 people who will pay \$800 a year each for the commuter service; \$650 from each person goes for gas, maintenance, insurance, depreciation, etc.

- (a) What are Jack's total revenues?
- (b) What are Jack's explicit costs?
- (c) What is Jack's accounting profit?
- (d) List two important implicit costs that Jack has not included.
- (e) What is Jack's pure economic profit (loss)? What actions should Jack take based on his pure economic profit (loss)?

Ans: (a) Total revenues are \$160,000.

(b) Explicit costs are \$130,000.

(c) The accounting profit is \$30,000.

(d) (1) Salary that he would have earned at Canadian Tire (\$28,000). (2) Interest on invested savings ($\$30,000 \times 10\% = \$3,000$). Total implicit costs are \$31,000.

(e) Economic loss is \$1,000. $160,000 - (\$130,000 + \$31,000) = -\$1,000$. Since Jack expects to make an economic loss, he should not quit his job and use his savings to start the business.

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Learning Objective: 6.2

14. How can a firm be making an economic loss when it is making an accounting profit?

Ans: Although a firm is making an accounting profit, it has implicit costs that are not considered in the calculation of accounting profits. These implicit costs, which may be in the form of foregone wages, interest, rent or entrepreneurial income, exceed the amount of accounting profit and produce an economic loss.

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Learning Objective: 6.2

15. Distinguish between normal and economic profits.

Ans: A normal profit can be explained as the normal return that an entrepreneur must receive to cover the cost of the functions he or she performs in organizing and combining resources in the firm. It is a cost payment for the entrepreneurial ability and time invested in the business. An economic profit is any return above all costs including the normal profit or return that the entrepreneur must receive. It is sometimes called “pure” profit because it is over and above the return necessary to operate the business.

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Learning Objective: 6.2

16. Why is the distinction between fixed and variable cost important?

Ans: The importance in distinguishing between fixed and variable costs will become more apparent in later chapters when the firm's decision about price and output determination is examined. For now, the primary importance has to do with the distinction between the long run and the short run. Once fixed costs are incurred, a short-run period has been determined by the length of time that those costs are fixed, i.e., cannot be varied. The firm has no immediate control over these costs. Other costs that vary with the level of output then are variable costs. Later we will learn that they are important in determining the profit-maximizing or loss-minimizing level of output given the plant size and other fixed costs.

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Learning Objective: 6.2

17. Indicate whether the inputs below are variable (V) or fixed (F) in the short run.

	<u>Input</u>		<u>Output</u>
_____	Meat	in	hamburgers.
_____	Fire insurance	in	dry cleaning.
_____	Tires	in	automobiles.
_____	Property tax	in	textile production.
_____	Gasoline	in	trucking services.
_____	Depreciation	in	aircraft production.

Ans:

	<u>Input</u>		<u>Output</u>
<u>V</u>	Meat	in	hamburgers.
<u>F</u>	Fire insurance	in	dry cleaning.
<u>V</u>	Tires	in	automobiles.
<u>F</u>	Property tax	in	textile production.
<u>V</u>	Gasoline	in	trucking services.
<u>F</u>	Depreciation	in	aircraft production.

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Learning Objective: 6.2

18. What is the difference between the short run and the long run?

Ans: The short run is a period too brief for a firm to alter its plant capacity, but it can still change the degree to which the fixed plant is used. The long run is a period in which the firm can change all resources including the size and number of plants. It is often stated that the short run is a “fixed-plant” period and the long run is a “variable plant” period.

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Learning Objective: 6.2

19. Explain the difference between total product, marginal product and average product.

Ans: Total product is the total output of a particular good produced. Marginal product is the change in total product resulting from each additional input of labour. Average product is the total product divided by the total number of workers. It is also called labour productivity.

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Learning Objective: 6.3

20. What is the law of diminishing returns? Give a descriptive example.

Ans: The law states that as additional units of a variable resource such as labour are added to a fixed resource such as capital, beyond some point the additional, or marginal, product attributable to each additional unit of the variable resource will decline. An example would be a factory assembly line. The capital (assembly line) is fixed. As more and more workers (variable inputs) are assigned to work on the assembly line, the output produced by each additional worker is likely to decline at some point. The reasons for this decline are that the assembly line equipment may be fully utilized and beyond some point of production additional workers would only cause problems for the existing workers. Productivity, output per work hour, would fall as more workers are added.

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Learning Objective: 6.3

21. Why does the marginal product of labour increase initially in many production processes in the short run?

Ans: When a firm initially adds workers to the production process, the workers can specialize in individual tasks through the division of labour. As a result, the productivity of labour will rise as workers develop their skills through learning by doing and reduce the loss of production time from switching between tasks.

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Learning Objective: 6.3

22. What is the relationship between total product, marginal product, and average product shown by the law of diminishing returns?

Ans: Total product first increases at an increasing rate, but then it increases at decreasing rate. After it reaches a maximum, it then declines. The marginal product shows the slope of the total product curve. When total product is rising at an increasing rate, marginal product is rising. When total product is increasing at a decreasing rate, marginal product is still positive, but diminishing. When total product reaches a maximum, marginal product is zero. Total product declines when the marginal product becomes negative. The average product has similar characteristics to marginal product. It rises, reaches a maximum, and then declines. In the rising phase for average product, marginal product is greater than average product. Average product declines at the point at which the marginal product falls below average product.

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Learning Objective: 6.3

23. Comment on the problem with this statement: “Of course, there are diminishing marginal returns from adding more workers to a fixed quantity of plant and equipment because additional workers are not as good as initial workers.”

Ans: The law of diminishing returns assumes all units of variable inputs, which would be workers in this case, are of equal quality. Marginal product diminishes not because each additional worker who is hired is inferior to the previous worker, but because more workers are being used relative to the fixed plant and equipment that is available.

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Learning Objective: 6.3

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24. The table below shows the total production of a firm as the quantity of labour employed increases. The quantities of all other resources employed are constant. Compute the marginal and average products and enter them in the table.

<u>Units of Labour</u>	<u>Total product</u>	<u>Marginal product</u> <u>of labour</u>	<u>Average product of</u> <u>labour</u>
0	0	—	—
1	40	_____	_____
2	100	_____	_____
3	165	_____	_____
4	200	_____	_____
5	225	_____	_____
6	240	_____	_____
7	245	_____	_____
8	240	_____	_____

- (a) At what levels are there increasing returns to labour and at what levels are there decreasing returns to labour?
- (b) Describe the relationship between the total product and marginal product.
- (c) Describe the relationship between marginal and average product.

Ans:

<u>Units of Labour</u>	<u>Total product</u>	<u>Marginal product</u> <u>of labour</u>	<u>Average product of</u> <u>labour</u>
0	0	—	—
1	40	40	40
2	100	60	50
3	165	65	55
4	200	35	50
5	225	25	45
6	240	15	40
7	245	5	35
8	240	−5	30

- (a) There are increasing returns to labour through the third worker hired. Decreasing returns to labour set in with the fourth worker.
- (b) Where total product increases at an increasing rate, marginal product rises (from 0 to 65). Where total product is increasing at a decreasing rate, marginal product is positive but falling (from 65 to 5). Where total product declines, marginal product is negative.
- (c) Where marginal product is greater than average product, average product will rise. Where marginal product is less than average product, average product will fall. Marginal product intersects average product at maximum average product.

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Learning Objective: 6.3

25. Evaluate. If marginal product is falling then average product must also be falling.

Ans: This statement is not true. It is possible for average product to be rising when marginal product is falling because marginal product declines at a lower level of input use than does average product.

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Learning Objective: 6.3

26. Complete the following table by finding the average and marginal product. At what input-output level will average variable cost begin to rise? Explain.

<u>Inputs of labour</u>	<u>Total product</u>	<u>Average product</u>	<u>Marginal product</u>
0	0	_____	
1	8	_____	_____
2	18	_____	_____
3	25	_____	_____
4	30	_____	_____
5	33	_____	_____
6	34	_____	_____

Ans:

<u>Inputs of labour</u>	<u>Total product</u>	<u>Average product</u>	<u>Marginal product</u>
0	0	0	
1	8	8	8
2	18	9	10
3	25	8.33	7
4	30	7.50	5
5	33	6.60	3
6	34	5.67	1

With equal pay for each worker, average variable cost will begin to rise for the third worker's output because that is the point where average product begins to fall.

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Learning Objective: 6.3

27. Explain: “Whenever a number which is less than the previous average of a total is added to that total, the average will necessarily fall. Conversely, whenever a number which is greater than the previous average of a total is added to that total, the average will necessarily rise.” How does this help explain the relationship between the various short-run cost curves? Between the various productivity curves?

Ans: The statement is simply a fact of arithmetic. To find an average, one sums up the relevant numbers and divides by n , the number of those numbers. The addition of a new number means the sum must now be divided by $(n + 1)$ to get the new average.

This helps explain the relationship between the marginal cost curve and the average variable and average total cost curves. Whenever the marginal cost curve is below the average cost curve, it is like the addition of a number below the average, and the average cost curve (variable or total) will be falling. Whenever the marginal cost becomes greater than either average cost curve, that average cost will rise.

The same is true with the relationship between average and marginal product curves. As long as the marginal product is above the average product, average product will rise. When the marginal product falls below average product, average product will decline.

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Learning Objective: 6.3, 6.4

28. Evaluate. If average variable cost is increasing with output, then average total cost must also be increasing with output.

Ans: This statement is not true. Average total cost is the sum of average fixed cost and average variable cost. Even though average variable cost is rising, average fixed cost is always falling. Therefore, it is possible for average total cost to be falling even as average variable cost is rising.

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Learning Objective: 6.4

29. Assume a firm has fixed costs of \$80 and variable costs as indicated in the table below. Complete the cost table.

<u>Total product</u>	<u>Total variable cost</u>	<u>Total cost</u>	<u>AFC</u>	<u>AVC</u>	<u>ATC</u>	<u>MC</u>
0	\$0	\$80	—	—	—	—
1	110	190	\$ _____	\$ _____	\$ _____	\$ _____
2	150	230	_____	_____	_____	_____
3	180	260	_____	_____	_____	_____
4	220	300	_____	_____	_____	_____
5	270	350	_____	_____	_____	_____
6	340	420	_____	_____	_____	_____
7	440	520	_____	_____	_____	_____
8	580	660	_____	_____	_____	_____

Ans:

<u>Total product</u>	<u>Total variable cost</u>	<u>Total cost</u>	<u>AFC</u>	<u>AVC</u>	<u>ATC</u>	<u>MC</u>
0	\$0	\$80	—	—	—	—
1	110	190	\$80	\$110	\$190	\$110
2	150	230	40	75	115	40
3	180	260	26.67	60	86.67	30
4	220	300	20	55	75	40
5	270	350	16	54	70	50
6	340	420	13.33	56.67	70	70
7	440	520	11.43	62.86	74.29	100
8	580	660	10	72.50	82.50	140

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Learning Objective: 6.4

30. Complete the following short-run cost table using the information provided.

Total product	<u>TFC</u>	<u>AFC</u>	<u>TVC</u>	<u>AVC</u>	<u>TC</u>	<u>MC</u>
0	\$ _____	_____	\$ _____	_____	\$ _____	_____
1	_____	\$ _____	_____	\$12	_____	\$ _____
2	_____	12	_____	10	_____	_____
3	_____	_____	_____	12	_____	_____
4	_____	_____	_____	14	_____	_____

Ans:

Total product	<u>TFC</u>	<u>AFC</u>	<u>TVC</u>	<u>AVC</u>	<u>TC</u>	<u>MC</u>
0	\$24	_____	\$0	_____	\$24	_____
1	24	\$24	12	\$12	36	\$12
2	24	12	20	10	44	8
3	24	8	36	12	60	16
4	24	6	56	14	80	20

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Learning Objective: 6.4

31. In the table below you will find a schedule of a firm's fixed cost and variable cost. Complete the table by computing total cost, average fixed cost, average variable cost, average total cost, and marginal cost.

<u>Total product</u>	<u>total fixed cost</u>	<u>Total variable cost</u>	<u>Total cost</u>	<u>Average fixed cost</u>	<u>Average variable cost</u>	<u>Average total cost</u>	<u>Marginal cost</u>
0	\$100	\$0	\$ _____	_____	_____	_____	_____
1	100	100	_____	\$ _____	\$ _____	\$ _____	\$ _____
2	100	180	_____	_____	_____	_____	_____
3	100	240	_____	_____	_____	_____	_____
4	100	320	_____	_____	_____	_____	_____
5	100	440	_____	_____	_____	_____	_____
6	100	600	_____	_____	_____	_____	_____
7	100	800	_____	_____	_____	_____	_____
8	100	1040	_____	_____	_____	_____	_____
9	100	1340	_____	_____	_____	_____	_____
10	100	1800	_____	_____	_____	_____	_____

Ans:

<u>Total product</u>	<u>Total fixed cost</u>	<u>Total variable cost</u>	<u>Total cost</u>	<u>Average fixed cost</u>	<u>Average variable cost</u>	<u>Average total cost</u>	<u>Marginal cost</u>
0	\$100	\$0	\$100	_____	_____	_____	_____
1	100	100	200	\$100.00	\$100.00	\$200.00	\$100
2	100	180	280	50.00	90.00	140.00	80
3	100	240	340	33.33	80.00	113.33	60
4	100	320	420	25.00	80.00	105.00	80
5	100	440	540	20.00	88.00	108.00	120
6	100	600	700	16.66	100.00	116.67	160
7	100	800	900	14.29	114.29	128.57	200
8	100	1040	1140	12.50	130.00	142.50	240
9	100	1340	1440	11.11	148.89	160.00	300
10	100	1800	1900	10.00	180.00	190.00	460

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Learning Objective: 6.4

32. Complete the following short-run cost table using the information provided.

<u>Q</u>	<u>TC</u>	<u>TFC</u>	<u>TVC</u>	<u>AVC</u>	<u>ATC</u>	<u>MC</u>
0	\$4	\$ _____	\$ _____	_____	_____	_____
1	7	_____	_____	\$ _____	\$ _____	\$ _____
2	9	_____	_____	_____	_____	_____
3	10	_____	_____	_____	_____	_____
4	11	_____	_____	_____	_____	_____
5	13	_____	_____	_____	_____	_____
6	17	_____	_____	_____	_____	_____
7	22	_____	_____	_____	_____	_____

Ans:

<u>Q</u>	<u>TC</u>	<u>TFC</u>	<u>TVC</u>	<u>AVC</u>	<u>ATC</u>	<u>MC</u>
0	\$4	\$4	\$0	_____	_____	_____
1	7	4	3	\$3.00	\$7.00	\$3
2	9	4	5	2.50	4.50	2
3	10	4	6	2.00	3.33	1
4	11	4	7	1.75	2.75	1
5	13	4	9	1.80	2.60	2
6	17	4	13	2.17	2.83	4
7	22	4	18	2.57	3.14	5

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Learning Objective: 6.4

33. What is the relationship between marginal cost and marginal product?

Ans: Marginal cost is the change in total cost divided by the change in output. Marginal product is the change in output divided by the change in input. Assume that each additional unit of a resource is hired at a constant price, or that the change in total cost from hiring another unit of resource is constant. If input changes by 1 unit, then marginal product is simply the change in output. Thus, marginal cost is simply a constant change in total cost divided by marginal product. As marginal product increases, marginal costs decline. As marginal product decreases, marginal costs increase. This increasing and decreasing relationship for marginal product is suggested by the law of diminishing returns.

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Learning Objective: 6.4

34. Why does the short-run marginal cost curve eventually increase for the typical firm?

Ans: The shape of the firm's marginal cost curve is a result of the law of diminishing returns. If all units of a variable resource are hired at the same price, the marginal cost of each additional unit of output will fall as long as the marginal product of each additional resource is rising. Marginal cost is equal to the marginal product of each additional unit of resource divided by the constant cost of each additional unit. As diminishing returns set in, the marginal product of each additional resource falls and when divided by the constant price for each unit of resource, the marginal cost will now rise.

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35. Assume that a firm has a plant of fixed size and that it can vary its output only by varying the amount of labour it employs. The table below shows the relationships between the amount of labour employed, the output of the firm, the marginal product of labour, and the average product of labour.

(a) Assume each unit of labour costs the firm \$20. Compute the total cost of labour for each quantity of labour the firm might employ, and enter these figures in the table.

(b) Now determine the marginal cost of the firm's product as the firm increases its output. Enter these figures in the table.

(c) If labour is the only variable input, the total labour cost and total variable cost are equal. Find the average variable cost of the firm's product. Enter these figures in the table.

(d) Describe the relationship between the marginal product of labour and the marginal cost of the firm's product.

(e) Describe the relationship between the average product of labour and the average variable cost.

Quantity of labour employed	Total output	Marginal product of labour	Average product of labour	Total variable cost	Marginal cost	Average variable cost
0	0	—	—	—	—	—
1	10	10	10.00	\$ _____	\$ _____	\$ _____
2	22	12	11.00	_____	_____	_____
3	36	14	12.00	_____	_____	_____
4	48	12	12.00	_____	_____	_____
5	58	10	11.60	_____	_____	_____
6	66	8	11.00	_____	_____	_____
7	72	6	10.28	_____	_____	_____
8	76	4	9.50	_____	_____	_____
9	78	2	8.66	_____	_____	_____
10	78	0	7.80	_____	_____	_____

Ans:

Quantity of labour employed	Total output	Marginal product of labour	Average product of labour	Total variable cost	Marginal cost	Average variable cost
0	0	—	—	—	—	—
1	10	10	10.00	\$ 20	\$2.00	\$2.00
2	22	12	11.00	40	1.67	1.82
3	36	14	12.00	60	1.43	1.67
4	48	12	12.00	80	1.67	1.67
5	58	10	11.60	100	2.00	1.72

6	66	8	11.00	120	2.50	1.82
7	72	6	10.28	140	3.33	1.94
8	76	4	9.50	160	5.00	2.10
9	78	2	8.66	180	10.00	2.31
10	78	0	7.80	200	—	2.56

(a) *See table above.*

(b) Divide the *increase* in total labour cost by the *increase* in total output to get marginal cost.

(c) Divide total labour cost by total output to get average variable cost.

(d) As marginal product rises to a maximum, marginal cost falls to its minimum. As marginal product falls from its maximum, marginal cost rises from its minimum.

(e) As average product rises to its maximum, average variable cost falls to its minimum. As average product falls from its maximum, average variable cost rises from its minimum. [**Note to instructors:** Output increases by more than one unit in this problem, which differs from text example on p.144.]

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Learning Objective: 6.4

36. You are given the following short-run information for an individual firm. Labour (L) is the only variable input. The price of labour is \$200/week. Fixed costs are \$100/week. Complete the rest of the table. Describe the relationship between the MP and MC. At which output level does the law of diminishing returns set in?

Labour	Total product					
<u>L</u>	<u>Q</u>	<u>MP</u>	<u>TVC</u>	<u>TFC</u>	<u>TC</u>	<u>MC</u>
0	0	_____	\$_____	\$_____	\$_____	_____
1	20	_____	_____	_____	_____	\$_____
2	55	_____	_____	_____	_____	_____
3	100	_____	_____	_____	_____	_____
4	150	_____	_____	_____	_____	_____
5	200	_____	_____	_____	_____	_____
6	230	_____	_____	_____	_____	_____
7	250	_____	_____	_____	_____	_____
8	263	_____	_____	_____	_____	_____
9	270	_____	_____	_____	_____	_____
10	275	_____	_____	_____	_____	_____
11	278	_____	_____	_____	_____	_____
12	280	_____	_____	_____	_____	_____

Ans:

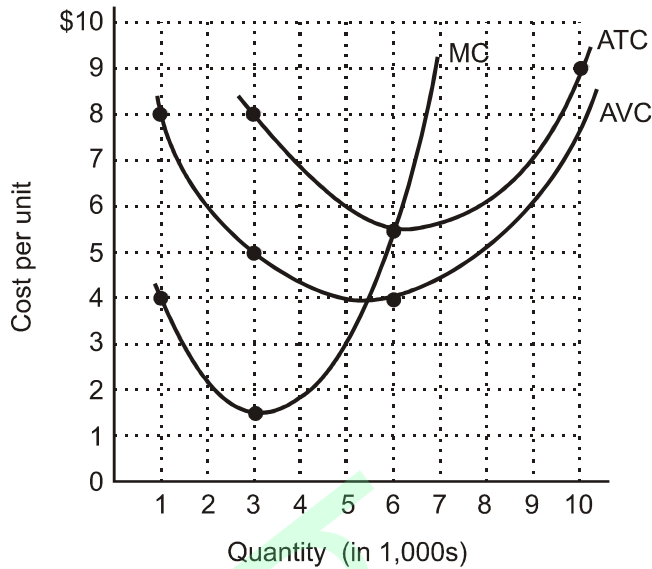
Labour	Total product					
<u>L</u>	<u>Q</u>	<u>MP</u>	<u>TVC</u>	<u>TFC</u>	<u>TC</u>	<u>MC</u>
0	0	_____	\$0	\$100	\$100	_____
1	20	20	200	100	300	\$10.00
2	55	35	400	100	500	5.71
3	100	45	600	100	700	4.41
4	150	50	800	100	900	4.00
5	200	50	1,000	100	1,100	4.00
6	230	30	1,200	100	1,300	6.66
7	250	20	1,400	100	1,500	10.00
8	263	13	1,600	100	1,700	15.38
9	270	7	1,800	100	1,900	28.57
10	275	5	2,000	100	2,100	40.00
11	278	3	2,200	100	2,300	66.66
12	280	2	2,400	100	2,500	100.00

As marginal product rises from 0 to 50, marginal cost falls from \$10 to \$4. Then marginal product falls from 50 to 2, as marginal cost increases from \$4 to \$100. Diminishing marginal returns set in beyond output level 200. [*Note to instructors:* output increases by more than one unit, which differs from text example on p.144.]

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Learning Objective: 6.3, 6.4

37. Answer the questions below on the basis of the diagram.



(a) How can you tell if these cost curves are for the short run or the long run?

(b) What does the graph indicate about:

- (1) AVC at 6,000 units of output?
- (2) ATC at 6,000 units of output?
- (3) AFC at 6,000 units of output?
- (4) TVC at 6,000 units of output?
- (5) TFC at all levels of output?
- (6) TC at 10,000 units of output?
- (7) When does diminishing marginal returns set in?

Ans: (a) The ATC, AVC, and MC curves are for one size of plant. In the short run, there are fixed costs and variable costs. In the long run, all costs are variable.

- (b) (1) AVC at 6,000 units is \$4.00.
- (2) ATC at 6,000 units is \$5.50.
- (3) AFC at 6,000 units is \$1.50.
- (4) TVC at 6,000 units is \$24,000 (\$4.00 x 6,000).
- (5) TFC at all levels of output is \$9,000.
- (6) TC at 10,000 units is \$90,000.
- (7) Diminishing marginal returns set in at 3,000 units.

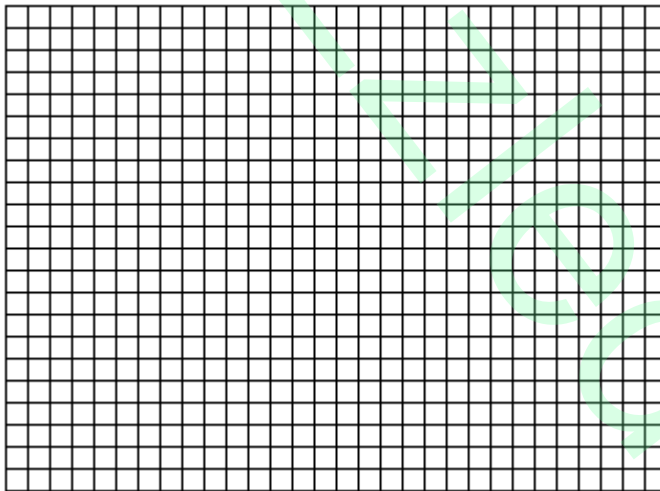
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Learning Objective: 6.4

38. In the table below are data from a book company that prints and binds special-order books. The data show various quantities that can be produced by the firm in an hour and the unit costs of each quantity.

(1) Quantity of books	(2) Unit cost A of books	(3) Unit cost B of books
100	\$70	\$ _____
200	60	_____
300	50	_____
400	40	_____
500	35	_____
600	30	_____
700	35	_____
800	45	_____
900	60	_____
1,000	80	_____

- (a) In the graph below, label the axes and plot the average cost curve for this firm using the data in columns 1 and 2 of the table above.



- (b) The firm then decides to subcontract the binding work to another company that specializes in the binding of books. As a consequence, the unit costs of the firm are decreased by \$20 at each output level. Fill in column 3 of the table, and then graph the new long-run average cost curve B for the firm on the graph.

- (c) What will be the minimum cost with unit cost A? With unit cost B?

- (d) If the firm produces 400 books, what will be the cost with curve A? With curve B?

Ans:

(1) Quantity	(2) Unit cost A	(3) Unit cost B
-------------------------------	----------------------------------	----------------------------------

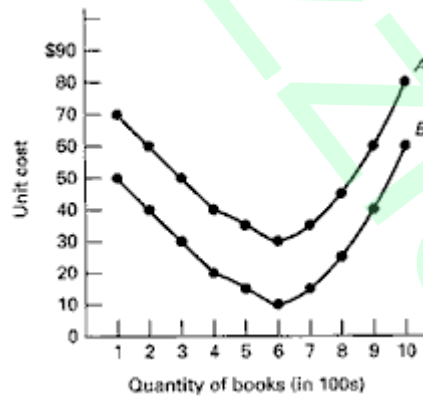
<u>of books</u>	<u>of books</u>	<u>of books</u>
100	\$70	\$50
200	60	40
300	50	30
400	40	20
500	35	15
600	30	10
700	35	15
800	45	25
900	60	30
1,000	80	40

(a) See graph below.

(b) See table above and graph below.

(c) The minimum cost with A will be \$30 at 600 units. The minimum cost with B will be \$10 with 600 units.

(d) When the firm produces 400 books, the unit cost will be \$40 with curve A and \$20 with curve B.



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Learning Objective: 6.4

39. Explain what happens to AFC, AVC, ATC, and MC curves in these two situations: (a) fixed cost increase; (b) variable cost increase.

Ans: (a) If fixed costs increase, then the AFC curve would shift upward. The ATC curve would shift upward because AFC is a component of ATC. The AVC and MC curves will not change because a variable cost has not changed.

(b) If variable costs increase, then AVC will shift upward. The ATC curve will shift upward because AVC is a component of ATC. The MC curve will shift upward because a change in variable cost affects marginal cost. The AFC curve would not change.

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Learning Objective: 6.4

40. What effect would each of the following have on the short-run average and marginal costs of an auto dealership: (a) auto mechanics receive a 10% wage increase; (b) property taxes decrease; (c) auto dealers institute a one-time only promotional campaign?

Ans: (a) The increase in wages raises variable costs. AVC, ATC, and MC will rise.

(b) Property taxes are viewed as fixed costs that must be paid irrespective of output level. AFC and ATC will fall.

(c) Advertising campaigns are a one-time expense considered to be fixed costs. AFC and ATC rise.

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Learning Objective: 6.4

41. The following are three short-run average total cost schedules for the only three possible plant sizes, 1, 2, and 3. Find the long-run average cost schedule and show the result in the second table.

<u>Size 1</u>		<u>Size 2</u>		<u>Size 3</u>	
<u>Q</u>	<u>ATC</u>	<u>Q</u>	<u>ATC</u>	<u>Q</u>	<u>ATC</u>
10	\$1.00	20	\$.95	40	\$1.00
20	.90	30	.80	50	.87
30	.85	40	.76	60	.84
40	.88	50	.79	70	.80
50	.93	60	.83	80	.95
60	1.05	70	.90	90	1.05

Long-Run

<u>Q</u>	<u>AC</u>
10	\$ _____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
90	_____

Ans:

Long-Run

<u>Q</u>	<u>AC</u>
10	\$1.00
20	.90
30	.80
40	.76
50	.79
60	.83
70	.80
80	.95
90	1.05

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Learning Objective: 6.5

42. What factors explain economies of scale?

Ans: First, as plant size increases, there can be greater specialization of labour that permits increased productivity and lower average costs. Second, managerial specialization can occur as plant size increases and contributes to increased productivity and lower costs. Third, larger-scale firms are usually able to make use of more efficient (technologically superior) capital equipment that may only be suitable for use if there is a large quantity of production. Fourth, some enterprises require large start-up costs that can be reduced as output increases.

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Learning Objective: 6.5

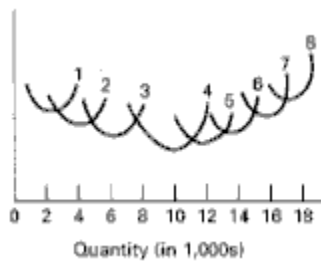
43. Explain the circumstances under which a firm might encounter a rather extended range of output over which long-run average costs are relatively constant.

Ans: This would happen under circumstances where the firm is operating in resource markets where the firm's demand has no impact on resource prices, so that long-run expansion will not drive up the price of resources. It would also mean that the firm is already operating at a level of minimum-efficient scale. In other words, expanding the plant size does not change long-run average costs.

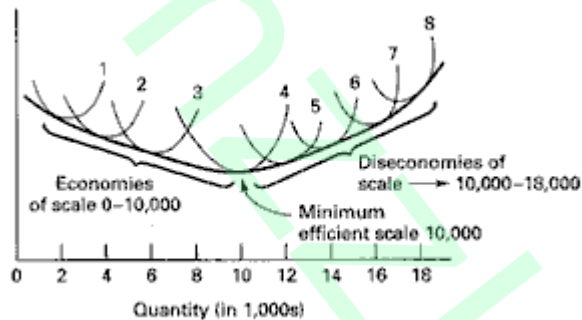
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Learning Objective: 6.5

44. Consider the diagram below. Curves 1–8 are the short-run curves that occur with different plant sizes. Answer the next two questions.



- (a) On the graph show the range of outputs for: (1) economies of scale; (2) diseconomies of scale: Indicate (3) minimum efficient scale.
- (b) In the long run, what plant size should the firm build if it wants to produce: (1) 6000 units; (2) 14,000 units?



Ans:

- (a) Answers given in graph below.
- (b) (1) Plant size 3 would be used to produce 6,000 units; (2) plant size 6 would be used to produce 14,000 units.

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Learning Objective: 6.5

45. Below are the short-run average-total-cost schedules for three plants of different size that a firm might build to produce its product. Assume that these are the only possible sizes of plants that the firm might build.

(a) What is the *long-run* average-cost schedule for the firm? Show it in the second table below.

<u>Plant size X</u>		<u>Plant size Y</u>		<u>Plant size Z</u>	
<u>Output</u>	<u>ATC</u>	<u>Output</u>	<u>ATC</u>	<u>Output</u>	<u>ATC</u>
5	\$10	5	\$13	5	\$72
10	9	10	12	10	65
15	8	15	11	15	52
20	7	20	10	20	41
25	6	25	8	25	33
30	9	30	7	30	20
35	12	35	9	35	15
40	18	40	12	40	14
45	20	45	17	45	12
50	23	50	19	50	14
55	29	55	25	55	20
60	31	60	33	60	30

<u>Output</u>	<u>Average cost</u>
5	\$ _____
10	_____
15	_____
20	_____
25	_____
30	_____
35	_____
40	_____
45	_____
50	_____
55	_____
60	_____

(b) For what output levels should the firm build plant X, plant Y, and plant Z?

(c) What is the firm's minimum efficient scale?

Ans:

<u>Output</u>	<u>Average cost</u>
5	\$10
10	9
15	8
20	7
25	6

30	7
35	9
40	12
45	12
50	14
55	20
60	30

(a) *See table above.*

(b) The firm should build plant X for output levels 5 to 25, plant Y for output levels 30 to 40, and plant Z for output levels 45 to 60.

(c) The firm's minimum efficient scale is 25 units of output.

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Learning Objective: 6.5

46. Evaluate. Diminishing returns explains why the ATC curve is U-shaped in the short run. Therefore, diminishing returns also explains why ATC curve is U-shaped in the long run.

Ans: Diminishing returns is a short run phenomenon that explains the shape of the ATC curve in the short run. It does not however, explain the shape of the ATC curve in the long run. The U-shaped long run ATC curve results from economies and diseconomies of scale. When firms initially expand in the long run, they can take advantage of labour and managerial specialization and more efficient capital. Economies of scale – a long run phenomenon – leads to lower long run average total costs. Eventually further expansion results in diseconomies of scale. Firms face control and coordination problems that result in higher long run average total costs.

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Learning Objective: 6.3, 6.5

47. Why do diseconomies of scale occur?

Ans: Diseconomies of scale occur in the long run because as firms become larger, they encounter greater difficulties in controlling and coordinating their operations. Firms with larger operations have more layers of management that make communication and cooperation more difficult. As well, they involve more bureaucratic red tape. Decisions are not coordinated and are slow to react to changing market conditions. Furthermore, workers are alienated in larger firms and become less motivated. As a result, firms face difficulties with efficiency and encounter higher average total costs.

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Learning Objective: 6.5

48. What is minimum efficient scale? What insights would it give about the size of firms in an industry?

Ans: Minimum efficient scale is the lowest level of output at which a firm can minimize long-run average costs. If a firm has an extended range of constant returns to scale, then minimum efficient scale would be the output level at which constant returns to scale begin. In this case, economies of scale can be achieved over a wide range of output, so efficient firms will be of various sizes. In industries where there are economies of scale throughout most of the range of production, minimum efficient scale will be achieved only after a sizeable level of output for each firm. This result suggests that there will be a few dominant producers in industries with such long-run ATC curves. In industries where diseconomies of scale set in at a low level of output, there will be many small-sized firms that are producers. In short, the shape of the long-run ATC curve will determine the characteristics of the firms in an industry.

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Learning Objective: 6.5

49. What are sunk costs and what are their implications for economic decision-making?

Ans: Sunk costs are expenditures that have already been made and cannot be recovered, so one should ignore those costs and recognize that they are irrelevant to current decision-making and should be forgotten. They should not affect your current decision-making. The reason for this view is that economic analysis says that you should take actions for which the marginal benefits are greater than the marginal costs. Sunk costs, however, are past costs that should be ignored and not added to marginal cost when making a current decision. Suppose you purchased an expensive ticket to a football game and you are sick the day of the game. The price of the ticket is a sunk cost paid when the ticket decision was made and should not enter into your attendance decision. In general, a prior decision and its cost should not dictate or influence a second decision. If a cost has been incurred and cannot be partly or fully recouped by some other choice, a rational consumer or producer should ignore it.

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Learning Objective: Last Word