

9 COST

OVERVIEW

1. Total fixed cost is the cost which does not vary with output. Total variable cost changes as output changes. Total cost is the sum of total fixed cost and total variable cost.
2. Explicit costs are the money payments made during the production of the good. Implicit costs are the opportunity costs of owner-owned resources. Total cost is the sum of explicit and implicit costs.
3. Average fixed cost is total fixed cost per unit of output. Average fixed cost declines as output increases, but never becomes zero. Average variable cost is the total variable cost per unit of output. Average total cost is the total cost per unit of output. Average total cost also equals the sum of average fixed cost and average variable cost.
4. Marginal cost is the change in total cost due to a change in output. Since total fixed cost does not change as output changes, the change in total cost is the change in total variable cost. Thus marginal cost is also the change in total variable cost due to a change in output.
5. The marginal cost is hook shaped. The shape is due to the law of diminishing returns.
6. The average-marginal relation states that if the marginal is greater than the average, the average will rise. If the marginal is less than the average, the average will fall. This relation together with the hook shape of the marginal cost means that the marginal cost cuts the average total cost at the lowest point on the average total curve.

MATCHING

- | | | | | |
|-------|-----|---------------------------|----|--|
| _____ | 1. | total fixed cost | a. | the total cost per unit of output |
| _____ | 2. | total variable cost | b. | the money costs the firm must pay during production of the product |
| _____ | 3. | total cost | c. | the opportunity costs of owner owned resources |
| _____ | 4. | explicit cost | d. | the added total cost due to an added unit of output |
| _____ | 5. | implicit cost | e. | the total fixed cost per unit of output |
| _____ | 6. | average fixed cost | f. | the average rises when the marginal is above the average |
| _____ | 7. | average variable cost | g. | the total variable cost per unit of output |
| _____ | 8. | average total cost | h. | the cost that does not change with the level of output |
| _____ | 9. | marginal cost | i. | the sum of total variable cost and total fixed cost |
| _____ | 10. | average-marginal relation | j. | the variable cost at each output level |

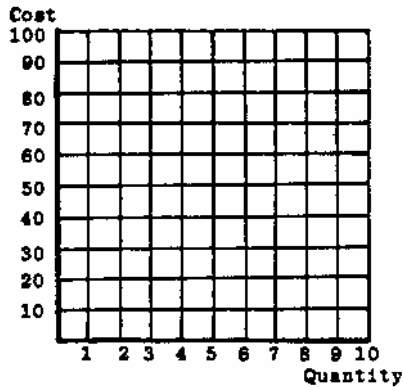
TRUE-FALSE

- _____ 1. If the marginal cost is falling, then the total cost must also fall.
- _____ 2. The marginal cost can cut the average total cost at any point.
- _____ 3. When the marginal cost is below the average cost, the average cost falls.
- _____ 4. The average total cost and the average variable cost are always the same distance apart.
- _____ 5. The marginal cost cuts the average variable cost at minimum of the average variable cost.

PROBLEMS

1. Answer the following questions to complete this table and graph.

Output	TFC	AFC	TVC	AVC	TC	ATC	MC
1	24		27				--
2	24		52				
3	24		72				
4	24		96				
5	24		126				
6	24		174				
7	24		235				
8	24		312				
9	24		399				



2. a. To find AFC, divide TFC by output. The AFC of the first unit is $24/1 = 24$. Continue finding the AFC for each level of output.
 b. Graph the AFC. What shape does it have? _____
3. a. To find the AVC, divide TVC by output. The AVC of the first unit is $27/1 = 27$. Continue finding AVC for each level of output.
 b. Graph AVC. What shape does it have? _____
 c. To find TC, add TFC and TVC. The TC of the first unit is $24 + 27 = 51$. Continue finding TC for each level of output.
4. a. To find the ATC, divide TC by output. The ATC of the first unit is $51/1 = 51$. Continue finding ATC for each level of output.
 b. Graph ATC. What shape does it have? _____
 c. Which curve is higher, ATC or AVC? Why? _____
 d. Add the AFC to the AVC at each level of output. Do you get the ATC? Why?

5. a. To find MC, find the change in total cost per added unit of output. As output goes from 1 unit to 2, total cost goes from 51 to 76. The change in total cost is 25 so the MC of unit 2 is 25. Continue finding MC for each level of output.
 b. Graph MC. What shape does it have? _____

6. Using the graph, when the marginal cost is less than the average total cost, does the average total fall? Why? _____ When the marginal cost is greater than the average total cost does the average total rise? Why?

7. Calculate the MC by finding the change in total variable cost per change in output. As output goes from 1 unit to 2, total variable cost goes from 27 to 52. The change in total variable cost is 25 so the MC of unit 2 is 25. Continue finding MC for each level of output. Do you get the same MC as recorded on the table from question 5 by using total cost? _____ Why? _____

IN THE NEWS

1. The students and their parents considering colleges are in for a shock. College has gotten expensive. Students pay tuition based on the number of classes they take. There is also a room and board fee for dormitory students. On top off that, there are books and incidental living expenses. All of these costs have increased.
- a. Which costs to the student vary with the number of classes? Do not vary?

 - b. If a student decides to take another class, what is the marginal cost?

2. Farming has changed. It used to be that a farmer needed money to buy seed, fertilizer, and fuel. Farmers also had some hired help. Now, the bulk of the farmer's money is tied up in machinery. These machinery costs must be paid even if the farmer does not plow a row.
- a. What costs are fixed? Variable? _____
 - b. If the farmer buys a new tractor, what happens to the marginal cost of plowing another row?

3. The glass industry is very sensitive to the cost of energy. Extremely high temperatures are required to process raw material into glass. Once the temperatures needed to process glass are reached, the furnaces are kept on until they are scheduled for maintenance. The ovens operate regardless of the amount of glass produced.
- a. As the price of energy rises, what will happen to the marginal cost of the glass producer?
 - b. If a new glass blowing machine is invented, what would you expect to happen to the marginal cost of glass?
4. *Gypsy* recently came back to Broadway. The play was much more expensive to produce this time. The cost to rent the hall, the cost of the performers, the cost of musicians, and the cost of the stage crew have all gone up.
- a. For a Broadway show, what costs are fixed? _____

 - b. How much would it cost to do one more performance? _____

PRACTICE TEST

Circle the correct answer.

- Ma and Pa converted the downstairs of their house into a grocery store. They gave up \$3600 a year rent to do this. Pa also gave up a job paying \$15,000 a year at the supermarket. They have labor costs of \$12,000 a year for carry-out help and energy costs of \$6,000. Their total implicit cost is:
 - \$3,600
 - \$15,000
 - \$18,600
 - \$24,600
- When the total variable cost of producing 3 units is \$10, and the total fixed cost of producing 1 unit is \$5, the total cost of producing 3 units is:
 - \$15.
 - \$25.
 - \$30
 - \$45
- Average fixed cost:
 - is U shaped.
 - is hump shaped.
 - always increases.
 - always decreases.
- The total cost of producing 1 unit is \$3, 2 units, \$6, and 3 units, \$10. What is the marginal cost of the second and third units?
 - \$3, \$6
 - \$6, \$10
 - \$3, \$12
 - \$3, \$4
- Marginal cost is the change in:
 - total cost.
 - total variable cost.
 - total fixed cost.
 - both a and b.

ANSWERS

Answers – Cost

Matching

- h
- j
- i

4. b
5. c
6. e
7. g
8. a
9. d
10. f

True-False

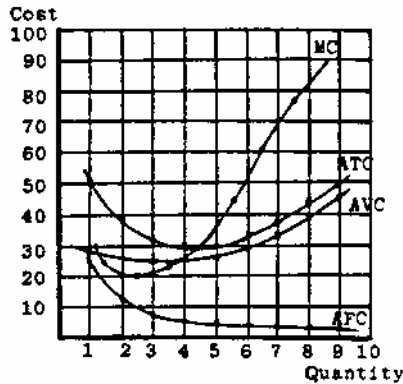
1. F
2. F
3. T
4. F
5. T

Problems

1.

Output	TFC	AFC	TVC	AVC	TC	ATC	MC
1	24	24	27	27	51	51	--
2	24	12	52	26	76	38	25
3	24	8	72	24	96	32	20
4	24	6	96	24	120	30	24
5	24	4.8	126	25.2	150	30	30
6	24	4	174	29	198	33	48
7	24	3.4	235	33.6	259	37	61
8	24	3	312	39	336	42	77
9	24	2.7	399	44.3	423	47	87

2. b. The AFC decreases as output rises.
3. b. The AVC is U shaped.
4. b. The ATC is also U shaped.
 - c. The ATC is higher than the AVC because the ATC also includes the AFC.
 - d. The ATC equals the AFC plus the AVC.
5. b. The marginal cost is hook shaped.
6. The average-marginal relation says that when the marginal is less than the average, the average will fall, and when the marginal is greater than the average, the average will rise.
7. Yes, the marginal cost will be the same using either calculation. Marginal cost measures the change in total cost. Fixed cost does not change as output changes, so the change in total cost is the change in total variable cost.



In the News

1. a. The tuition and books are variable. The room and board and incidental costs are fixed.
 b. The marginal cost is the change in the variable cost, which is the tuition cost and the book cost. Thus the extra class will cost the student the additional tuition and the price of the additional books.
2. a. The machine costs are fixed. The labor, seed, fertilizer, and fuel costs are all variable.
 b. If there is no change in fuel use, then the marginal cost will not change. It is true that the cost to the farmer has gone up, but the machine costs are fixed costs so that the marginal cost does not change. If the new tractor uses less fuel, then the marginal cost will fall.
3. a. The use of energy to run the furnace will continue regardless of the rate of production. The energy is a fixed cost and so does not affect the marginal cost. Thus the marginal cost of producing another piece of glass is not affected by the increase in the cost of energy.
 b. The new machine is likely to be a fixed factor, and thus the cost of the machine is a fixed cost. That means that the addition of the new machine will not affect the marginal cost. However, if the new machine requires less labor or less of some other variable input, then the marginal cost may fall.
- 4.a. To correctly answer the question, we must decide which factors are fixed. Once the hall is hired, the stage ready, the performers hired, the musicians hired, the factors are all fixed. These people must be paid whether or not there is an audience. So as long as all the inputs are under contract for the run of the play, all costs are fixed.
 b. The cost of putting on another performance will depend on the contracts of the various workers. If the extra performance is not already in the contract, the cost may be very great. If the performance is already in the contract, the marginal cost is zero.

Practice Test

1.c., 2.a., 3.d., 4.d., 5.d.