

1. In the production function: $Q = 5KL^2$, capital is fixed: $K = 2$, fill in all missing blanks in the table below:

Workers	Output	Average product of labor	Marginal product of labor
0		–	–
1			
2			
3			

2. Complete the following table for the short-run cost curves for the production function: $Q = 3KL$ where K is fixed at 3 units in the short run, with the rental price of capital = \$2 and the wage rate = \$3

Workers	Output	TC	VC	FC	ATC	AVC	AFC	MC
0					--	--	--	--
1								
2								

3. Fill in all of the blanks in the table below:

Q	Fixed Cost	Variable Cost	Total Cost	Marginal Cost	Average Fixed Cost	Average Variable Cost	Average Total Cost
0			24	--	--	--	--
1				16			
2		50					
3			108				
4						34	

4.

East Lake		West Lake	
# of Boats	Total Fish	# of Boats	Average # of Fish
1	100	1	120
2	195	2	115
3	285	3	110
4	370	4	105
5	450	5	100
6	525	6	95
7	595	7	90
8	660	8	85
9	720	9	80
10	775	10	75

a. Using the above chart, suppose Madison has 10 fishing boats. What is the optimal allocation of ten fishing boats for these two lakes? Show your work.

b. How many fish will be caught using the ten fishing boats? Show your work.

5. A firm has access to two production processes with the following marginal cost and average cost curves:

$$MC_1 = 0.4Q_1, ATC_1 = 0.2Q_1$$

$$MC_2 = 2 + 0.2Q_2, ATC_2 = 2 + 0.1Q_2$$

where the subscripts denote plant 1 & 2, respectively (5 points each).

a. What is the least costly way of producing 8 units of output?

b. What is the total cost of producing 8 units of output using the allocation you propose in (a)?

Extra Credit

a. Does the production function $Q = 4K^{1/2}L^{1/2}$ exhibit increasing, decreasing, or constant returns to scale? (+2 points)

b. Does the production function $Q = 2K^2 + 4L^2$ exhibit increasing, decreasing, or constant returns to scale? (+2 points)

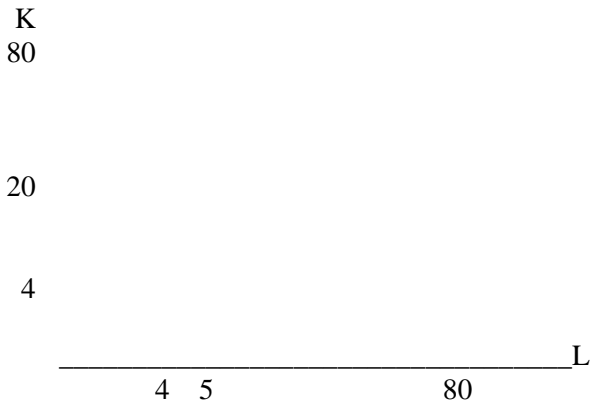
Multiple Choice Section: Use the following table to answer the next three questions:

Labor	Output	Marginal Product
0	0	--
1	10	
2		15
3	37	
4	47	
5		8
6	60	
7		2
8	63	
9		-1

1. Diminishing returns start to occur when which worker is hired?
A) Diminishing returns never occur
B) 2
C) 9
D) 8
E) 3
2. How many workers should be hired if the goal is to maximize output?
A) 2
B) 7
C) 9
D) 8
E) 5
3. How many workers should be hired if the goal is to maximize marginal productivity?
A) 1
B) 2
C) 3
D) 4
E) 8
4. If a firm doubles all inputs and output increases from 100 to 150 then the production function exhibits:
A) decreasing returns to scale.
B) increasing returns to scale.
C) constant returns to scale.
D) returns to scale cannot be determined.
5. True or False: If marginal product is at its maximum then marginal cost is at its minimum.
A) True.
B) False.
6. True or False: If marginal cost is above average variable cost then average variable cost must be rising.
A) True.
B) False.
7. If fixed cost = \$100 at $Q = 10$, then which of the following is true:
A) fixed cost = \$0 at $Q = 0$.
B) fixed cost < \$100 at $Q = 0$.
C) fixed cost = \$200 at $Q = 20$.
D) fixed cost = \$100 at $Q = 20$.

8. Average product reaches a maximum where (hint: draw a graph)
- marginal product is maximized.
 - total product is maximized.
 - marginal product is zero.
 - total product is zero.
 - average product equals marginal product.
9. When economists refer to the “long-run” this is:
- approximately one week.
 - approximately one month.
 - approximately one year.
 - a period of time that is too short to change a firm’s variable inputs.
 - a period of time that is long enough to change a firm’s fixed and variable inputs.
10. Minimum efficient scale is
- the point where diminishing returns begin.
 - the point where increasing returns to scale begin.
 - the additional output from the last dollar spent on an input.
 - the minimum point on the long-run average cost curve.
 - the minimum point on the marginal cost curve.

Use the following information to answer the next two questions: EZ-Cleaning can hire workers to pressure wash houses for \$80 per day and can rent pressure-washing machines for \$20 per day. Currently EZ-Cleaning spends \$400 hiring 4 workers and renting 4 machines. The marginal product of workers = 40 and the marginal product of machines=20.



11. Which of the following curves above reflects EZ-Cleaning’s current isocost curve (i.e., spending \$400)?
- Curve A
 - Curve B.
 - Curve C.
 - Curve D.
12. What recommendation would you give EZ-Cleaning?
- Rent more machines and fire workers.
 - Rent fewer machines and hire workers.
 - Don’t change anything, since EZ-Cleaning is already optimally using its inputs.

Use the following to answer questions 13-15:

Output for a simple production process is given by $Q = 2KL$, where K denotes capital, and L denotes labor. The rental price of capital is \$20 per unit and capital is fixed at 2 units in the short run. The wage rate of labor is \$10 per worker.

13. What is the total cost of producing 40 units of output?
- A) \$40
 - B) \$100
 - C) \$140
 - D) \$220
 - E) none of the above
14. How much is the variable cost of producing 40 units of output?
- A) \$10
 - B) \$20
 - C) \$30
 - D) \$40
 - E) none of the above
15. How much is the fixed cost of producing 40 units of output?
- A) \$10
 - B) \$20
 - C) \$30
 - D) \$40
 - E) none of the above
16. If the law of diminishing returns has occurred, then the slope of the marginal cost curve is
- A) positive.
 - B) negative.
 - C) zero.
 - D) infinity.
17. A graph of the average fixed cost (AFC) with cost on the vertical axis and output on the horizontal axis will show
- A) AFC reaches a minimum where $AFC = MC$.
 - B) AFC is a horizontal line.
 - C) AFC rises as output increases.
 - D) AFC decreases as output increases.
18. Let the total cost curve be given by the equation: $TC = 10 + Q$. The ATC curve equals
- A) 10
 - B) $10Q + Q^2$
 - C) $10/Q$
 - D) $(1/Q) + 10$
 - E) $(10/Q) + 1$
19. Natural monopolies occur when
- A) scarce resources exist.
 - B) long-run average cost fall as output increases.
 - C) marginal cost curves intersect average variable cost curves.
 - D) marginal cost curves intersect average total cost curves.
20. The recent increase in the number of mergers in the oil industry (i.e., Exxon-Mobil, Chevron-Texaco; Conoco-Phillips; Amoco-BP) indicates that oil companies think that “bigger-is-better”. Therefore, the oil production function likely exhibits what kind of returns to scale?
- A) Constant returns to scale.
 - B) Decreasing returns to scale.
 - C) Increasing returns to scale.