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Economics 201
Spring 2026

Homework #3 (due by 9:00pm on Monday, March 2)

*Please submit your answers to this homework through the Assignment link at Blackboard. **No credit will be given for answers submitted in class or emailed to the professor, regardless of the excuse.** This includes unique excuses like my dog ate my homework, but also more traditional excuses like “I lost my Internet”. Please note that all submissions are final, again – regardless of the excuse (which includes “I accidentally hit the submit button”). You will get whatever score is assigned to you by Blackboard. If you are unfamiliar with Blackboard, then it would be a good idea to visit the class page at Blackboard and check out the homework assignments as they are posted.*

Please note that when Blackboard grades answers to the fill-in-the-blank questions – your answer must match exactly with the answer that Blackboard is looking for or your answer will be considered incorrect. You’ll always be given formatting instructions and you must follow those instructions. Below, you’ll find some instructions on how to properly format your answers to these type of questions. A more complete discussion of these rules is provided at Blackboard. Reading that section is strongly recommended.

As stated above, given that answers to the fill-in-the-blank questions must not only be correct, but formatted properly, correct formatting is part of the process. A wrongly formatted answer is still a wrong answer. I.e., you will not have points added to your homework score if you got answers wrong due to formatting mistakes. However, this is still something you will want to bring to Professor Haworth’s attention. *In addition, if you are unsure how to round an answer (e.g. whether 3.25 rounds to 3.2 or 3.3), then please contact Professor Haworth.*

Homework #3 formatting instructions:

*(a) **Questions #1a and 1b:** express your answer as a decimal rounded to the nearest tenth and not as a fraction. E.g., if your answer is $10/20$, then express that answer as 0.5, and not 0.50 or $1/2$.*

*(b) **Questions #5-10:** please express your answer in terms of dollars, not dollars and cents, or simply a whole number (i.e. with or without the dollar sign, and with or without the comma when your answer is 1000 or more). Please round your answer to the nearest whole number. E.g., if you calculate an answer like \$152.10, then please express your answer as \$152 or 152, and not \$152.10 or 152.10.*

*(c) **Questions #6c, 6d, 7-8 and 10:** if you get a negative answer for profit, then include the negative sign before the dollar sign (or directly in front of your answer if you don’t include the dollar sign). Do not include a space between the negative sign and your number (or the \$). E.g., a loss of \$55 should be written as -\$55 or -55 and not - \$55, \$-55 or - 55.*

Homework #3 Questions

1. Firm A is a relatively small distribution firm that transports the goods produced by different manufacturers to various retail locations in the Greater Louisville area. The firm has its own capital, secretarial staff and managers, but hires all other laborers (dock workers and drivers) on a daily basis from a temporary services company. We'll assume that labor (dock workers and drivers) is a variable factor and that capital (e.g. warehouse, office space, forklifts and trucks) is a fixed factor.

We also assume that firm A's output is characterized by this production function: $Q = 3\sqrt{2L}$

a. If this firm hires 8 units of labor, then the average product of labor for this firm would be equal to _____

(round your answer to the nearest tenth – e.g. 31.421 would be 31.4)

b. If this firm increases the quantity of labor hired from 8 units to 9 units, then the marginal product of labor for this firm would be equal to _____

(round your answer to the nearest tenth – e.g. 31.421 would be 31.4).

*To answer Questions #2-3, you must access the **DMR.pdf** article posted in the Homework #3 folder within Blackboard (i.e. the folder that also contains a link to where you submit HW 3). This article discusses the Law of Diminishing Returns in the average, everyday life of individuals and applies this law to the real world.*

2. If you consider the examples presented in the article and relate them to a graph of one's production function, how might someone avoid the inevitable effects of diminishing returns:

- by focusing on the quality of your effort, rather than the quantity of effort
- by engaging in other activities which effectively shift your production function upward
- by attempting to increase your productivity of input by taking more breaks
- (only) answers a and c are correct
- answers a, b and c are correct

3. According to the article, the law of diminishing marginal returns is a principle that states which of the following:

- after a certain point, each additional unit of input results in less output
- after a certain point, each additional unit of input results in lower costs
- after a certain point, each additional unit of input results in greater profit
- after a certain point, each additional unit of input results in a smaller increase in output
- answers a and d are correct

4. **The Hiring Decision:** let's assume that you run a company that hires variable amounts of labor to work with fixed amounts of land. Assume further that you have a production function equation (see below) which tells you how much output can be produced by the different amounts of labor.

Lastly, the information below can also be used to answer the question below.

- Price (paid by consumers for each unit they buy): $P = \$25$
- Wage (paid to each unit of labor hired): $w = \$80$
- The production function equation: $Q = 10\sqrt{2L}$

Lastly, we will assume that this firm must engage in the hiring decision, that is, the firm must decide how many units of labor to hire by comparing the marginal benefit and marginal cost associated with hiring each additional unit of labor. You will want to approach this question in the same manner that we approached it in class.

Based upon your analysis, how much labor should this firm hire?

- | | |
|---------------------|----------------------|
| a. 1 unit of labor | f. 6 units of labor |
| b. 2 units of labor | g. 7 units of labor |
| c. 3 units of labor | h. 8 units of labor |
| d. 4 units of labor | i. 9 units of labor |
| e. 5 units of labor | j. none of the above |

To answer this question, you may use the table below. The different options of labor are provided in the table, as are the different levels of output produced in each row. After the output column, you have additional columns to use as you choose to use them in order to answer the question.

Labor	Output					
0	0					
1	14.142					
2	20.000					
3	24.495					
4	28.284					
5	31.623					
6	34.641					
7	37.417					
8	40.000					
9	42.426					

5. A firm has the following costs (q = output, TC = total costs, MC = marginal costs):

$$\begin{array}{ll} TC = \$200 & \text{if } q = 0 \\ TC = 3q^2 + 10q + 300 & \text{if } q > 0 \\ MC = 6q + 10 & \text{if } q > 0 \end{array}$$

Based on the equations above, please calculate the various types of cost below and remember to follow the formatting instructions for this question.

- If this firm produces 10 units of output, then the firm's average cost is _____
- If this firm produces 10 units of output, then the firm's average variable cost is _____
- If this firm produces 10 units of output, then the firm's average fixed cost is _____
- If this firm produces 10 units of output, then the firm's sunk cost is _____
- If this firm produces 10 units of output, then the firm's recoverable fixed cost is _____

6. Assume that a firm has the following costs (q = output, TC = total costs, MC = marginal costs):

$$\begin{array}{ll} TC = \$200 & \text{if } q = 0 \\ TC = 2q^2 + 10q + 500 & \text{if } q > 0 \\ MC = 4q + 10 & \text{if } q > 0 \end{array}$$

Assume that the firm discussed in this question always operates under the profit maximizing principles discussed in class, and then, based on the equations above, please calculate the various types of cost below. Remember to follow the formatting instructions for this question.

- If we the market price is \$90, then the firm's average cost (AC) is equal to _____
- If the market price is \$90, then the firm's average variable cost (AVC) is equal to _____
- If the market price is \$90, then the firm's greatest possible profit is equal to _____
- Assume that our firm faces a new market price, and that this new price is not \$90. If the new market price leads this firm to produce 25 units of output (i.e. $q = 25$), then the greatest possible profit for this firm would be equal to _____

Remember to follow the formatting instructions with your answers to Questions #7-9. Note that each of these questions is independent of one another (i.e. information from Question 7 does not apply to Question 8 or Question 9).

7. Assume that a profit-maximizing, perfectly competitive firm is producing at the breakeven point. The firm is facing a market price of \$300 and has total cost of \$2500. Assume that this includes \$500 in recoverable fixed costs and \$200 in sunk cost.

Given this information, the firm's current profit is equal to _____

8. Assume that a profit-maximizing, perfectly competitive firm is currently producing 10 units of output at the shut down point. In addition, the firm has \$100 in recoverable fixed costs and total fixed cost of \$500.

Given this information, the firm's current profit is equal to _____

9. Assume that a profit-maximizing, perfectly competitive firm (not the firm in the previous question) is producing at the breakeven point. The firm's output is 10 units and the market price is \$160. The firm has \$400 in sunk cost and total fixed cost of \$600.

Given this information, the average variable cost of this firm is equal to _____

Question #10 requires the use of the Output-Cost table on the last page of this homework.

10. Assume that the information in this table illustrates the output and costs of a perfectly competitive firm, and that this firm follows the profit maximizing principles discussed in class.

Remember to follow the formatting instructions on this question, and to calculate profit using the profit equation: $\pi = (P \times q) - TC$

a. Assume that this perfectly competitive firm is operating as a profit maximizer when producing 12 units of output. If so, then this firm's current profits are equal to _____

Assume that the market price is set at \$33.00 (i.e. $P = 33.00$)

b. The greatest possible profit that the firm can earn in this situation is equal to _____

Assume industry demand increases, causing the market price to become \$41.00 (i.e. $P = 41.00$)

c. The greatest possible profit that the firm can earn in this situation is equal to _____

Industry demand increases again, causing the market price to become \$65.00 (i.e. $P = 65.00$)

d. The greatest possible profit that the firm can earn in this situation is equal to _____

Firm A's Output and Costs:

q	TC	MC	AC	AVC	AFC
0	100.00	—	—	—	—
1	207.00	9.00	207.00	7.00	200.00
2	218.00	13.00	109.00	9.00	100.00
3	233.00	17.00	77.67	11.00	66.67
4	252.00	21.00	63.00	13.00	50.00
5	275.00	25.00	55.00	15.00	40.00
6	302.00	29.00	50.33	17.00	33.33
7	333.00	33.00	47.57	19.00	28.57
8	368.00	37.00	46.00	21.00	25.00
9	407.00	41.00	45.22	23.00	22.22
10	450.00	45.00	45.00	25.00	20.00
11	497.00	49.00	45.18	27.00	18.18
12	548.00	53.00	45.67	29.00	16.67
13	603.00	57.00	46.38	31.00	15.38
14	662.00	61.00	47.29	33.00	14.29
15	725.00	65.00	48.33	35.00	13.33
16	792.00	69.00	49.50	37.00	12.50
17	863.00	73.00	50.76	39.00	11.76
18	938.00	77.00	52.11	41.00	11.11
19	1017.00	81.00	53.53	43.00	10.53
20	1100.00	85.00	55.00	45.00	10.00
21	1187.00	89.00	56.52	47.00	9.52
22	1278.00	93.00	58.09	49.00	9.09
23	1373.00	97.00	59.70	51.00	8.70
24	1472.00	101.00	61.33	53.00	8.33
25	1575.00	105.00	63.00	55.00	8.00

Note that q = output, TC = total cost, MC = marginal cost, AC = average cost, AVC = average variable cost, AFC = average fixed cost