

ECON 310  
Nazarov  
Homework 4

You must enter your answers into Blackboard before the due date in order to receive credit for this assignment. The due date is April 1st, 8:00am. It is your responsibility to verify that your homework grade is correctly recorded in the gradebook.

*Questions 1-4*

Sarah's Pretzel plant has the following short-run cost function:

$$C(q, K) = \frac{wq^3}{1000K^{3/2}} + 50K$$

where  $q$  is Sarah's output level,  $w$  is the cost of a labor hour, and  $K$  is the number of pretzel machines Sarah leases.

Sarah's short-run marginal cost curve is

$$MC(q, K) = \frac{3wq^2}{1000K^{3/2}}$$

At the moment, Sarah leases 10 pretzel machines, the cost of a labor hour is \$6.85, and she can sell all the output she produces at \$35 per unit.

1. What is the Sarah's optimal level of output
2. What is the Sarah's profit?  
If the cost per labor hour rises to \$7.50,
3. What is the Sarah's new optimal level of output
4. What is the Sarah's new profit?

*Questions 5-7*

The manufacturing of paper products causes damage to a local river when the manufacturing plant produces more than 1,000 units in a period. To discourage the plant from producing more than 1,000 units, the local community is considering placing a tax on the plant. The long-run cost curve for the paper producing firm is:

$$C(q, t) = \frac{q^2}{1500} + tq$$

where  $q$  is the number of units of paper produced and  $t$  is the per unit tax on paper production. The relevant marginal cost curve is:

$$MC(q, t) = \frac{q}{750} + t$$

5. If the manufacturing plant can sell all of its output for \$2, what is the firm's optimal output if the tax is set at zero?

6. What is the minimum tax rate necessary to ensure that the firm produces no more than 1,000 units?
7. How much are the firm's profits reduced by the presence of a tax?

*Question 8-9*

Arnold's plant has the following short-run cost function:

$$C(q, K) = \frac{wq^2}{K} + rK$$

where  $q$  is Arnold's output level,  $w$  is the cost of a labor hour, and  $K$  is the number of machines Arnold leases. The number of machines that Arnold leases is fixed in the short run and the total cost of leasing  $K$  is \$5000 per period. Arnold's short-run marginal cost curve is:

$$MC = \frac{2wq}{K}$$

At the moment, the cost of a labor hour is \$5 and Arnold can sell as many units of output as he wants at \$10 per unit. Arnold's profits are currently \$7,500.

8. What is the lease rent for machine per unit?
9. How many units is the Arnold's plant producing?

*Question 10-12*

The total and marginal cost functions for a typical soft coal producer are:

$$TC = 75,000 + 0.1Q^2$$

$$MC = 0.2Q$$

where  $Q$  is measured in railroad cars per year. The industry consists of  $n$  identical producers. The market demand curve is:

$$Q_D = 140,000 - 425P$$

where  $P$  is the price per carload. The market can be regarded as competitive.

10. Find the long-run equilibrium price level.
11. Find the long-run production level for each producer.
12. Find the number of producers in the long-run equilibrium.