
# *UNIVERSITY OF THE PEOPLE*

## *ECON 1580-01-INTRODUCTION TO ECONOMICS-AY2024-T3*

### *WRITTEN ASSIGNMENT UNIT 4*

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A monopoly firm faces a demand curve given by the following equation: P = $500 − 10Q, where Q equals quantity sold per day. Its marginal cost curve is MC = $100 per unit. Assume that the firm faces no fixed cost. You may wish to arrive at the answers mathematically, or by using a graph (the graph is not required to be presented), either way, please provide a brief description of how you arrived at your results.

a) How much will the firm produce?

To maximize profit, the firm will produce where marginal cost (MC) equals marginal revenue (MR). Given that the marginal cost is $100 per unit and the demand curve is P = $500 - 10Q, we need to find the marginal revenue.

The marginal revenue (MR) for a monopoly is the derivative of the total revenue (TR) with respect to quantity (Q). So, MR = TR/Q

Total revenue (TR) is price (P) multiplied by quantity (Q), so TR = P * Q.

Differentiating TR with respect to Q, we get MR = P * Q/Q

Substitute the demand curve equation P = $500 - 10Q into TR equation: TR = (500 - 10Q) * Q.

Differentiate TR with respect to Q: MR = (500 – 10Q) * Q/Q

Solving for MR: MR = 500 - 20Q.

Now, equate MR to MC to find the profit-maximizing quantity:

MR = MC

500 - 20Q = 100

20Q = 400

Q = 20

So, the firm will produce 20 units per day.

b) How much will it charge?

To find the price, substitute the quantity into the demand curve:

P = 500 - 10 X 20

P = 500 - 200

P = $300

Therefore, the firm will charge $300 per unit.

c) Can you determine its profit per day? (Hint: you can; state how much it is?

Profit per day can be calculated as total revenue (TR) minus total cost (TC):

TR = P X Q

TR = 300 X 20

TR = $6000

TC = MC X Q

TC = 100 X 20

TC = $2000

Profit = TR - TC = $6000 - $2000 = $4000

So, the profit per day is $4000.

d) Suppose a tax of $1,000 per day is imposed on the firm. How will this affect its price?

With a fixed cost per day of $1,000 imposed, the profit maximizing price and quantity will not change. Only the total profit is affected.

e) How would the $1,000 per day tax its output per day?

The tax will not directly affect the firm's output per day. The quantity produced will still be 20 units per day.

f) How would the $1,000 per day tax affect its profit per day?

The tax will affect the firm's profit per day by reducing it. To calculate the new profit, subtract the tax from the previous profit: Profit' = $4000 - $1000

The profit will decrease = $3000.

g) Now suppose a tax of $100 per unit is imposed. How will this affect the firm's price?

With a tax of $100 per unit imposed, the firm's marginal cost curve will shift by $100. This means the new marginal cost curve will be MC' = $100 + $100 = $200.

MR = MC

500 – 20Q = 200

-20Q = 200 – 500

Q = -300/-20

Q = 15

Quantity sold is reduced by the tax.

P = 500-10(15)

The new price will be $350

h) How would a $100 per unit tax affect the firm's profit maximizing output per day?

To find the profit-maximizing output per day with the $100 per unit tax, equate the new marginal cost MC' to the original marginal revenue MR:

MR = MC'

500 - 20Q = 200

20Q = 300

Q = 15

So, the firm's profit-maximizing output per day with the $100 per unit tax is 15 units.

i) How would the $100 per unit tax affect the firms profit per day?

To find the profit per day with the $100 per unit tax, calculate the total revenue and total cost with the new quantity:

TR' = P' x Q

TR' = 350 x 15

TR' = $5250

TC' = MC' x Q

TC' = 200 x 15

TC' = $3000

Profit = TR' - TC' = $5250 - $3000 = $2250

So, the profit per day with the $100 per unit tax is $2250.