

Principles of Economics and Management I

Ciências ULisboa · MMAEG · 2026/2027

Problem Set 4 · Production, Costs and Market Structures

Session 4 · LN04

Exercise level: [Easy] routine / warm-up [Medium] typical test level [Hard] challenge (above test level, to consolidate mastery)

1. (2 points) **[Easy] Cost structure.** A firm has total cost $C(q) = 100 + 2q + 0.5q^2$.
 - (a) (1 point) Identify the fixed cost and the variable cost, and write $AC(q)$ and $AVC(q)$.
 - (b) (1 point) Obtain $MC(q)$ and the output level that minimizes average cost.
2. (2 points) **[Easy] The decision under perfect competition.** The same firm is a price taker and the market price is €12.
 - (a) (1 point) Find the profit maximizing quantity.
 - (b) (1 point) Compute the profit. Should the firm produce in the short run?
3. (3 points) **[Medium] Monopoly.** A monopolist faces the inverse demand $P = 100 - 2q$ and has cost $C(q) = 20q$.
 - (a) (1 point) Obtain marginal revenue and explain why it differs from price.
 - (b) (1 point) Compute q^M , P^M and the profit.
 - (c) (1 point) Compare with perfect competition and compute the deadweight loss.
4. (3 points) **[Medium] Producer surplus against profit.** A competitive firm has $TC(q) = 40 + 2q^2$ and faces a price of €20.
 - (a) (1 point) Find the profit maximizing quantity.
 - (b) (1 point) Compute producer surplus and profit, and state the difference between them.
 - (c) (1 point) The landlord raises the rent, so the fixed cost goes from 40 to €60. What happens to the quantity produced, to producer surplus, and to profit?
5. (5 points) **[Hard] Markup and elasticity.**
 - (a) (1 point) Derive the markup rule (Lerner index) $\frac{P - MC}{P} = \frac{1}{|\varepsilon|}$.
 - (b) (1 point) Verify it at the optimum of the previous exercise.
 - (c) (1 point) What markup follows from $|\varepsilon| = 5$? And from $|\varepsilon| \rightarrow \infty$?
6. (5 points) **[Hard] Shutdown, exit, and the long run price.** A competitive firm has $TC(q) = 27 + 3q + q^2$, so that $FC = 27$ and $VC(q) = 3q + q^2$.
 - (a) (1 point) Write MC , AVC and AC .
 - (b) (1 point) Find the price below which the firm shuts down in the short run.
 - (c) (2 points) Find the price below which it exits in the long run, and the quantity it produces there.
 - (d) (1 point) At $P = €12$, is the firm making a profit? Should it produce?