

Economics 101: Basic Economic Principles

Problem Set #4 Solutions

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Part I: Multiple Choice

Problem 1

Problem: Price is constant or “given” to the individual firm selling in a purely competitive market because:

- (A) The firm’s demand curve is downward-sloping.
- (B) There are no good substitutes for the firm’s product.
- (C) Product differentiation is reinforced by extensive advertising.
- (D) Each seller supplies a negligible fraction of total supply.

Solution: In a purely competitive market each firm is a price taker because its output is too small relative to the entire market to affect the market price. Thus, the correct answer is **(D)**.

Problem 2

Problem: Consider the table below. At what point would a purely competitive firm cover all of its costs and earn only normal profits (i.e., zero economic profits)?

Price	Quantity	TFC	TVC
\$5	5	\$25	\$10
\$5	10	\$25	\$20
\$5	15	\$25	\$50
\$5	20	\$25	\$60

At output level:

- (A) 15.
- (B) 10.

(C) 20.

(D) 5.

Solution: At an output of 15, total revenue is $\$5 \times 15 = \75 and total cost is $TFC + TVC = \$25 + \$50 = \$75$. This means the firm earns zero economic profit. Therefore, the answer is (A).

Part II: Perfect Competition in the Short Run (Problem #4)

This problem (with parts a–f) is taken from the textbook. The firm's cost data are given in the table below. In the table the columns represent:

- **AFC:** Average Fixed Cost,
- **AVC:** Average Variable Cost,
- **ATC:** Average Total Cost, and
- **MC:** Marginal Cost.

The fixed cost is \$60 for all output levels.

Q	AFC	AVC	ATC	MC
1	60.00	45.00	105.00	45
2	30.00	42.50	72.50	40
3	20.00	40.00	60.00	35
4	15.00	37.50	52.50	30
5	12.00	37.00	49.00	35
6	10.00	37.50	47.50	40
7	8.57	38.57	47.14	45
8	7.50	40.63	48.13	55
9	6.67	43.33	50.00	65
10	6.00	46.50	52.50	75

(a) Analysis at Product Price \$56

Question: At a product price of \$56, will the firm produce in the short run? If so, what is the profit-maximizing (or loss-minimizing) output? What is the economic profit per unit?

Solution:

- In perfect competition, the firm produces where $P = MC$ as long as $P \geq AVC$.
- Here, $P = \$56$. Checking the MC schedule, we note that:
 - $MC(8) = 55$ (just below 56) and
 - $MC(9) = 65$ (above 56).
- Thus, the firm produces $Q = 8$ units.
- At $Q = 8$, $ATC = 48.13$; therefore, profit per unit $= 56 - 48.13 \approx 7.87$.
- Total economic profit $\approx 8 \times 7.87 \approx 63$ dollars.

(b) Analysis at Product Price \$41

Question: Answer part (a) assuming product price is \$41.

Solution:

- With $P = \$41$, we compare with the MC schedule. Notice:
 - $MC(6) = 40$ (below 41) and
 - $MC(7) = 45$ (above 41).
- Thus, the profit-maximizing output is $Q = 6$.
- At $Q = 6$, $ATC = 47.50$; the per-unit loss is $41 - 47.50 = -6.50$.
- Total loss = $6 \times (-6.50) = -39$ dollars.
- Since P exceeds AVC (with $AVC(6) = 37.50$), the firm produces despite the loss.

(c) Analysis at Product Price \$32

Question: Answer part (a) assuming product price is \$32.

Solution:

- At $P = \$32$, observe that the lowest AVC in the table is approximately \$37 (at $Q = 5$).
- Since $32 < 37$, $P < AVC$ at every output.
- Therefore, the firm should shut down in the short run and produce $Q = 0$.
- The loss incurred is the fixed cost, which is \$60.

(d) Short-Run Supply Schedule for the Single Firm

We now complete the supply schedule for the firm at various product prices and compute the profit or loss.

Method: Total cost (TC) at any Q is computed by

$$TC = ATC \times Q,$$

knowing that fixed cost (TFC) is \$60. (Alternatively, $TC = TFC + (AVC \times Q)$.)

Using the results from parts (a)–(c) and the following optimal outputs:

Price	Q_{supply}	Profit per Firm
\$26	0	–\$60 (shut down)
\$32	0	–\$60 (shut down)
\$38	5	$5(38) - 245 = 190 - 245 = -\55
\$41	6	$6(41) - 285 = 246 - 285 = -\39
\$46	7	$7(46) - 330 \approx 322 - 330 = -\8
\$56	8	$8(56) - 385 \approx 448 - 385 = +\63
\$66	9	$9(66) - 450 = 594 - 450 = +\144

Thus, the firm's short-run supply schedule is as shown above.

(e) Industry Supply Schedule (1,500 Firms)

If there are 1,500 identical firms, the industry supply is simply 1,500 times the output of the individual firm:

Price	Industry Quantity Supplied
\$26	$1,500 \times 0 = 0$
\$32	0
\$38	$1,500 \times 5 = 7,500$
\$41	$1,500 \times 6 = 9,000$
\$46	$1,500 \times 7 = 10,500$
\$56	$1,500 \times 8 = 12,000$
\$66	$1,500 \times 9 = 13,500$

(f) Determination of Market Equilibrium

The market demand schedule is given by:

Price	Total Quantity Demanded
\$26	17,000
\$32	15,000
\$38	13,500
\$41	12,000
\$46	10,500
\$56	9,500
\$66	8,000

Comparing with the industry supply schedule:

- At \$38: Supply = 7,500; Demand = 13,500 (excess demand).
- At \$41: Supply = 9,000; Demand = 12,000 (excess demand).
- At \$46: Supply = 10,500; Demand = 10,500 (equilibrium).
- At higher prices, supply exceeds demand.

Thus, the equilibrium price is \$46, with total industry output of 10,500 units. Each firm produces 7 units.

At $Q = 7$ for a single firm, the average total cost is approximately \$47.14. Hence, the per-unit profit is:

$$46 - 47.14 \approx -\$1.14,$$

implying a small loss of about \$8 per firm. In the long run, if firms make losses, some will exit, causing the industry supply to contract and the equilibrium price to rise until only normal profits remain.