Landsburg ch7 micro mod8 competition practice exam questions

(The attached PDF file has better formatting.)

COMPETITIVE INDUSTRY

Firms in a competitive constant-cost industry have marginal costs of 12*q* and fixed costs of 1,350, where *q* is the quantity produced by the firm.

The market demand curve for the firms' goods is P = 450 – 30% × Q or Q = 1,500 – 3.3333 × P, where P is the market price and Q is the market quantity.

Question 8.1: Average variable cost

What is the average variable cost for each firm as a function of its quantity *q* ?

Answer 8.1: *Total* variable costs are the integral of *marginal* costs from zero to the quantity produced:

$$= \int_0^q 12x\,dx = 6q^2.$$

Intuition: This is the area of a right triangle with base *q* and height 12*q*; area = ½ × *q* × 12*q* = $6q^2$.

Average variables costs are $6q^2 / q = 6q$.

Intuition: The marginal cost varies linearly from 0 to 12q, so the average variable cost = ½ × (0 + 12q) = 6q.

Question 8.2: Average fixed cost

What is the average fixed cost for each firm as a function of its quantity *q* ?

Answer 8.2: Fixed costs are 1,350, so average fixed costs are 1,350 / *q*.

Question 8.3: Average total cost

What is the average total cost for each firm as a function of its quantity *q* ?

Answer 8.3: Average total costs are 6q + 1,350 / *q*.

Question 8.5: Competitive industry equilibrium long-run quantity

What is the long-run equilibrium quantity for each firm?

Answer 8.5: In the long run, each firm produces at its minimum average cost.

At this minimum average cost, the slope of the average total cost curve is zero: $6 = 1{,}350 / q^2 \Rightarrow q = 15$.

Question 8.4: Long-run price

What is the long-run equilibrium price for the firms' goods?

Answer 8.4: The market price is equal to this minimum average cost, at which the firm earns zero economic profit. It earns the appropriate return on capital, but no economic rent. If it produced any other quantity, it would have higher costs and negative economic profit.

At q = 15, average total costs are 6 × 15 + 1,350 / 15 = 180, which is the long-run equilibrium price.

Question 8.4: Competitive industry equilibrium long-run market quantity

At the long-run market price, what is the total quantity demanded by consumers? That is, what is the long-run equilibrium quantity for the market as a whole?

Answer 8.4: We derive the equilibrium quantity for the market as a whole from the market demand curve and the long-run equilibrium price: 180 = 450 – 30% × Q ⇛ Q = 900.

Question 8.5: Competitive industry equilibrium number of firms

In the long-run equilibrium, how many firms operate in this industry?

Answer 8.5: Each firm produces 15 units. For a market quantity of 900, there are 900 / 15 = 60 firms.

Question 8.6: Competitive industry consumers' surplus

In long-run equilibrium, what is consumers' surplus?

Answer 8.6: Consumers' surplus is the area under the demand curve, down to the equilibrium price, and out to the equilibrium quantity. Since the demand curve is linear, consumers' surplus is a right triangle with three vertices (quantity is on the horizontal axis; price is on the vertical axis):

- When Q = 0, P = 450 (from the demand curve).
- The equilibrium price is 180.
- The equilibrium quantity 900 units.

The vertices (Q,P) of the right triangle are (0, 450), (0, 180), (900, 180).
Consumers' surplus is ½ × 900 × (450 – 180) = 121,500.

Question 8.7: Competitive industry producers' surplus

What is producers' surplus? (Producers' surplus uses the short-run supply curve.)

Answer 8.7: Producers' surplus is the area above the short-run supply curve, up to the equilibrium price, and out to the equilibrium quantity. The supply curve is linear, so producers' surplus is a right triangle with three vertices

- When Q = 0, marginal cost = 0 (from the supply curve).
- The equilibrium price is 180.
- The equilibrium quantity is 900 units.

The vertices (Q,P) of the right triangle are (0, 0), (0, 180), (900, 180).
Producers' surplus is ½ × 900 × (180 – 0) = 81,000.

[For the next two questions, suppose the government imposes a sales tax of 9 per unit. The equilibrium price and quantity and the number of firms adjust until the industry is again in long-run equilibrium. The rest of this scenario is the same as for the previous questions.]

Question 8.8: Competitive industry sales tax and price change

What is the change in the equilibrium price caused by the sales tax? This is *the price received by the firms*, not the price paid by consumers.

Answer 8.8: The sales tax does not change the supply curve. The equilibrium price is the minimum average cost, which remains 180, so the change is zero.

Question 8.9: Competitive industry sales tax and equilibrium quantity

What is the change in the equilibrium market quantity caused by the sales tax?

Answer 8.9: The sales tax changes the demand curve to (P + tax) = 450 – 30% × Q or Q = 1,500 – 3.33333 × (P + tax). *Intuition:* Consumers pay the price plus the tax, so the effective price = P + sales tax. The equilibrium quantity with the sales tax is Q = 1,500 – 3.33333 × (180 + 15) = 850. The change in the quantity is 900 – 850 = –50. (The change is –3.33333 × 15 = –50.)