

*Landsburg Mod 12 Ch10 third degree price discrimination practice exam questions*

A monopolist sells to two sets of consumers, Group Y and Group Z.

- The demand curve *per person* for Group Y is  $Q = 18.7 - 2.34 \times P$ .
- The demand curve *per person* for Group Z is  $Q = 24.4 - 4.74 \times P$ .

The quantity  $Q$  and the price  $P$  may be any positive real numbers, not just integers.

The marginal cost is  $MC = 0$ . Group Y has 158 persons and Group Z has 242 persons.

Question 12.1: Combined demand curve intercept

If the price is zero, what is the total quantity demanded? This is the  $\alpha$  parameter of the combined demand curve.

Answer 12.1: The quantity demanded by Group Y is  $Q = 18.7 \times 158$  and the quantity demanded by Group Z is  $Q = 24.4 \times 242$ , so the total quantity demanded is  $Q = 18.7 \times 158 + 24.4 \times 242 = 8,859.4$

Question 12.2: Combined demand curve slope

If the price increases by one, what is the decrease in the total quantity demanded? This is the  $\beta$  parameter of the combined demand curve.

Answer 12.2: If the price increases by one unit, the quantity demanded by Group Y decreases by  $Q = 2.34 \times 158$  and the quantity demanded by Group Z decreases by  $Q = 4.74 \times 242$ , so the total quantity demanded decreases by  $Q = 2.34 \times 158 + 4.74 \times 242 = 1,516.8$ .

Question 12.3: marginal revenue

If price discrimination is not allowed (all persons are charged the same price), what is the marginal revenue curve?

Answer 12.3: For a linear demand curve ( $Q = \alpha - \beta \times P$ ), the marginal revenue curve has the same intercept as the demand curve and is twice as steep (twice the slope), or  $MR = \alpha - 2\beta \times P =$

$$MR = 8,859.4 - 2 \times 1,516.8 \times P$$

Question 12.4: Equilibrium price

If price discrimination is not allowed (all persons are charged the same price), what is the price charged? (This is a monopoly, not a competitive market; assume the monopoly price is charged.)

Answer 12.4: The monopoly price is where marginal revenue equals marginal cost. For simplicity, marginal cost equals zero in this problem, so the monopoly price is where marginal revenue equals zero, or

$$\begin{aligned} MR &= 8,859.4 - 2 \times 1,516.8 \times P = 0 \Rightarrow \\ P &= 8,859.4 / (2 \times 1,516.8) = 2.92 \end{aligned}$$

Question 12.5: Equilibrium quantity Group Y

If price discrimination is not allowed (all persons are charged the same price), what is the quantity bought by Group Y?

Answer 12.5: The price charged is 2.92, so the quantity bought by Group Y is

$$158 \text{ persons} \times (18.7 - 2.34 \times P) \text{ per person} = 158 \times (18.7 - 2.34 \times 2.92) = 1,875.02$$

Question 12.6: Equilibrium quantity Group Z

If price discrimination is not allowed (all persons are charged the same price), what is the quantity bought by Group Z?

Answer 12.6: The price charged is 2.92, so the quantity bought by Group Z is

$$242 \text{ persons} \times (24.4 - 4.74 \times P) \text{ per person} = 242 \times (24.4 - 4.74 \times 2.92) = 2,555.33$$

Question 12.7: Consumers' surplus

If price discrimination is not allowed (all persons are charged the same price), what is consumers' surplus for Groups Y and Z?

Answer 12.7: 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):

The demand curve *per person* for Group Y is  $Q = 18.7 - 2.34 \times P$ .

- When  $Q = 0$ ,  $P = 18.7 / 2.34 = 7.99$  (from the demand curve).
- The equilibrium price is 2.92.
- The equilibrium quantity 1,875.02 units for Group Y.

The vertices (Q,P) of the right triangle are (0, 7.99), (0, 2.92), (1,875.02, 2.92).  
Consumers' surplus is  $\frac{1}{2} \times 1,875.02 \times (7.99 - 2.92) = 4,753.18$ .

The demand curve *per person* for Group Z is  $Q = 24.4 - 4.74 \times P$ .

- When  $Q = 0$ ,  $P = 24.4 / 4.74 = 5.15$  (from the demand curve).
- The equilibrium price is 2.92.
- The equilibrium quantity 2,555.33 units for Group Z.

The vertices (Q,P) of the right triangle are (0, 5.15), (0, 2.92), (2,555.33, 2.92).  
Consumers' surplus is  $\frac{1}{2} \times 2,555.33 \times (5.15 - 2.92) = 2,849.19$

### Question 12.8: Producers' surplus

If price discrimination is not allowed (all persons are charged the same price), what is producers' surplus for Groups Y and Z?

Answer 12.8: Producers' surplus is the area above the short-run supply curve, up to the equilibrium price, and out to the equilibrium quantity. The short-run supply curve for a monopolist is the marginal cost curve, which is flat at zero in this problem, so producers' surplus is a rectangle with

- height = The equilibrium price of 2.92
- base = The equilibrium quantity of 1,875.02 units

for an area of  $2.92 \times 1,875.02 = 5,475.06$  = producers' surplus for Group Y, and

- height = The equilibrium price of 2.92
- base = The equilibrium quantity of 2,555.33 units

for an area of  $2.92 \times 2,555.33 = 7,461.56$  = producers' surplus for Group Z

### Question 12.9: Price discrimination price and quantity

If the monopolist sells at different prices to Groups Y and Z, what is the price charged and the quantity sold to each group?

Answer 12.9: The monopoly price is where marginal revenue equals marginal cost. For simplicity, marginal cost equals zero in this problem, so the monopoly price is where marginal revenue equals zero, or

$$\begin{aligned} \text{Group Y:} \quad & \text{MR} = 18.7 - 2 \times 2.34 \times P = 0 \Rightarrow \\ & P = 18.7 / (2 \times 2.34) = 4.00 \\ \text{Group Z:} \quad & \text{MR} = 24.4 - 2 \times 4.74 \times P = 0 \Rightarrow \\ & P = 24.4 / (2 \times 4.74) = 2.57 \end{aligned}$$

The quantity bought by each Group is derived from its demand curve and its size:

$$\begin{aligned} \text{Group Y:} \quad & 158 \text{ persons} \times (18.7 - 2.34 \times P) \text{ per person} = 158 \times (18.7 - 2.34 \times 4.00) = 1,475.72 \\ \text{Group Z:} \quad & 242 \text{ persons} \times (24.4 - 4.74 \times P) \text{ per person} = 242 \times (24.4 - 4.74 \times 2.57) = 2,956.80 \end{aligned}$$

### Question 12.10: Price discrimination consumers' surplus

If the monopolist sells at different prices, what is consumers' surplus for Group Y?

Answer 12.10: 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):

The demand curve *per person* for Group Y is  $Q = 18.7 - 2.34 \times P$ .

- When  $Q = 0$ ,  $P = 18.7 / 2.34 = 7.99$  (from the demand curve).
- The equilibrium price is 4.00.
- The equilibrium quantity is 1,475.72 units for Group Y.

The vertices (Q,P) of the right triangle are (0, 7.99), (0, 4.00), (1,475.72, 4.00).  
Consumers' surplus is  $\frac{1}{2} \times 1,475.72 \times (7.99 - 4.00) = 2,944.06$

Question 12.11: Price discrimination consumers' surplus

If the monopolist sells at different prices, what is consumers' surplus for Group Z?

Answer 12.11: 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):

The demand curve *per person* for Group Z is  $Q = 24.4 - 4.74 \times P$ .

- When  $Q = 0$ ,  $P = 24.4 / 4.74 = 5.15$  (from the demand curve).
- The equilibrium price is 2.57
- The equilibrium quantity 2,956.80 units for Group Z.

The vertices (Q,P) of the right triangle are (0, 5.15), (0, 2.57), (2,956.80, 2.57).  
Consumers' surplus is  $\frac{1}{2} \times 2,956.80 \times (5.15 - 2.57) = 3,814.27$

Question 12.12: Price discrimination producers' surplus

If the monopolist sells at different prices, what is producers' surplus for Groups Y and Z?

Answer 12.12: Producers' surplus is the area above the short-run supply curve, up to the equilibrium price, and out to the equilibrium quantity. The short-run supply curve for a monopolist is the marginal cost curve, which is flat at zero in this problem, so producers' surplus is a rectangle with

- height = The equilibrium price of 4.00
- base = The equilibrium quantity of 1,475.72 units

for an area of  $4.00 \times 1,475.72 = 5,902.88 =$  producers' surplus for Group Y, and

- height = The equilibrium price of 2.57
- base = The equilibrium quantity of 2,956.80 units

for an area of  $2.57 \times 2,956.80 = 7,598.98 =$  producers' surplus for Group Z