

Past-paper walk-through

Price Discrimination ■ 4.3

eXercise

Questions in this set

- 2024 Set 2 Q1
- 2014 Q1

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 1

2024 Set 2 ■ Q1

Arzeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.

- (a)** Draw a correctly labeled graph for Arzeye Pharma and show each of the following.
- (i) The profit-maximizing quantity of eye treatments, labeled Q^*
 - (ii) The profit-maximizing price, labeled P^*
 - (iii) The average total cost curve consistent with positive economic profit, labeled ATC
 - (iv) The area representing consumer surplus, shaded completely

Question 1

2024 Set 2 ■ Q1

Arzeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.

(b)(i) Suppose Arzeye Pharma wants to charge a price that maximizes its total revenue rather than its profit. On your graph in part (a), show the revenue-maximizing quantity, labeled Q_R .

(b)(ii) At quantity Q_R identified in part (b)(i), is the demand for eye treatments elastic, inelastic, or unit elastic?

Question 1

2024 Set 2 ■ Q1

Arzeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.

(c)(i) Suppose now that Arzeye Pharma engages in perfect price discrimination. On your graph in part (a), show the lowest price that Arzeye Pharma would charge, labeled P_2 .

(c)(ii) What would happen to consumer surplus? Explain.

Question 1

2024 Set 2 ■ Q1

Arzeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.

(d) Suppose instead that Arzeye Pharma's patent expires. Will the demand for Arzeye Pharma's treatment become more elastic, become less elastic, or not change? Explain.

Solution 1

(a) Mark scheme

- Graph of Arzeye Pharma (a profit-maximizing firm with market power) showing, in order: (1) a downward-sloping demand (D) curve and a downward-sloping marginal revenue (MR) curve lying below D; (2) a rising, U-shaped marginal cost (MC) curve intersecting MR at the profit-maximizing quantity, labeled Q^* , where $MR = MC$; (3) the profit-maximizing price P^* , found by going up from Q^* to the demand curve; (4) the average total cost (ATC) curve drawn below P^* at Q^* (so $P^* > ATC$, i.e. positive economic profit), with the MC curve passing through the minimum point of the ATC curve; (5) the consumer surplus area — the triangle between the demand curve and the price P^* , from the price axis out to Q^* — shaded completely. 5 points total: 1 point each for (i) D & MR correctly drawn

Solution 1

with MR below D, (ii) MC rising and Q^* located at $MR=MC$, (iii) P^* read off D at Q^* , (iv) ATC below P^* at Q^* with MC through ATC's minimum, (v) consumer surplus fully shaded.

Solution 1

(b)(i)

Mark scheme

- On the same graph, the revenue-maximizing quantity Q_R is marked where the MR curve crosses the horizontal (quantity) axis, i.e. where $MR = 0$. Because total revenue is maximized when marginal revenue is zero, Q_R lies to the right of Q^* (a larger quantity than the profit-maximizing quantity, since profit maximization requires $MR = MC > 0$).

Solution 1

(b)(ii)

Mark scheme

- At quantity Q_R , demand for eye treatments is unit elastic. Total revenue is maximized exactly where marginal revenue equals zero, and that point on the demand curve corresponds to $|E_d| = 1$ (unit elastic demand).

Solution 1

(c)(i)

Mark scheme

- Under perfect price discrimination, Arzeye continues selling additional units as long as a consumer's willingness to pay (given by the demand curve) is at least as high as the marginal cost of producing that unit, so it sells down to the quantity where $D = MC$. The lowest price it charges, labeled P_2 , is therefore found at the intersection of the demand (D) curve and the marginal cost (MC) curve — this price is below both P^* and the price at Q_R .

Solution 1

(c)(ii)

Mark scheme

- Consumer surplus would decrease to \$0. Explanation: under perfect price discrimination Arzeye charges each consumer the maximum price that consumer is willing to pay for each unit, so it captures the entire area that was previously consumer surplus as additional producer surplus/profit, leaving consumers with none.

Solution 1

(d)

Mark scheme

- Arzeye Pharma's demand will become more elastic. Explanation: once the patent expires, other firms are free to enter the market and offer substitute (e.g. generic) eye treatments. With more substitutes available, consumers can more easily switch away from Arzeye's treatment in response to a price increase, making demand more responsive to price changes (more elastic).

Question 1

2014 ■ Q1

The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.

[Graph with y-axis "PRICE" showing dashed gridlines at 10, 20, 30, 35, 40, 50, 60, and x-axis "QUANTITY" showing gridlines at 0, 2, 4, 5, 6, 8, 10, 12. A downward-sloping demand curve (D) runs from (0, 60) to (12, 0). A steeper downward-sloping marginal revenue curve (MR) runs from (0, 60) to about (6, 0). A horizontal line at 20 is labeled "MC = ATC = LRATC" and extends across the graph. Dashed reference lines connect the curves to the axis values at quantities 2, 4, 5, 6, 8, 10, and prices 10, 20, 30, 35, 40, 50, \$60.]

(a)(i) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.

Question 1

The quantity produced

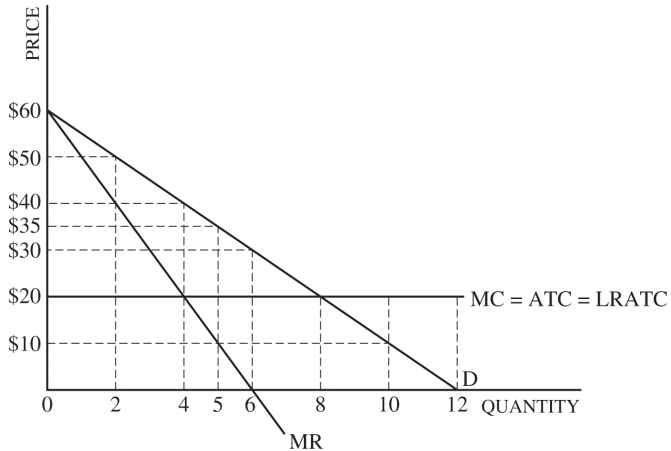
(a)(ii) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.

The price

(a)(iii) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.

The allocatively efficient quantity

Question 1



Question 1

2014 ■ Q1

The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.

[Graph with y-axis "PRICE" showing dashed gridlines at 10,20, 30,35, 40,50, 60, and x – axis "QUANTITY" showing gridlines at 0, 2, 4, 5, 6, 8, 10, 12. A downward – sloping demand curve (D) runs from (0,60) to (12, 0). A steep downward – sloping marginal revenue curve (MR) runs from (0,60) to about (6, 0). A horizontal line at 20 is labeled "MC = ATC = LRATC" and extends across the graph. Dashed reference lines connect the curves to the axis values at quantities 2, 4, 5, 6, 8, 10, and prices 10,20, 30,35, 40,50, \$60.]

(b) At the profit-maximizing quantity from part (a)(i), is the monopolist experiencing economies of scale? Explain.

Question 1

2014 ■ Q1

The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.

[Graph with y-axis "PRICE" showing dashed gridlines at 10,20, 30,35, 40,50, 60, and x – axis "QUANTITY" showing gridlines at 0, 2, 4, 5, 6, 8, 10, 12. A downward – sloping demand curve (D) runs from (0,60) to (12, 0). A steep downward – sloping marginal revenue curve (MR) runs from (0,60) to about (6, 0). A horizontal line at 20 is labeled "MC = ATC = LRATC" and extends across the graph. Dashed reference lines connect the curves to the axis values at quantities 2, 4, 5, 6, 8, 10, and prices 10,20, 30,35, 40,50, \$60.]

(c)(i) Now assume that the monopolist produces 10 units. Using the numbers given in the graph, calculate each of the following. Show your work.

Question 1

The monopolist's economic profit

(c)(ii) Now assume that the monopolist produces 10 units. Using the numbers given in the graph, calculate each of the following. Show your work.

The consumer surplus

(c)(iii) Now assume that the monopolist produces 10 units. Using the numbers given in the graph, calculate each of the following. Show your work.

The deadweight loss

Question 1

2014 ■ Q1

The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.

[Graph with y-axis "PRICE" showing dashed gridlines at 10, 20, 30, 35, 40, 50, 60, and x-axis "QUANTITY" showing gridlines at 0, 2, 4, 5, 6, 8, 10, 12. A downward-sloping demand curve (D) runs from (0, 60) to (12, 0). A steeper downward-sloping marginal revenue curve (MR) runs from (0, 60) to about (6, 0). A horizontal line at 20 is labeled "MC = ATC = LRATC" and extends across the graph. Dashed reference lines connect the curves to the axis values at quantities 2, 4, 5, 6, 8, 10, and prices 10, 20, 30, 35, 40, 50, \$60.]

(d) At what quantity is demand unit elastic?

Question 1

2014 ■ Q1

The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.

[Graph with y-axis "PRICE" showing dashed gridlines at 10,20, 30,35, 40,50, 60, and x – axis "QUANTITY" showing gridlines at 0, 2, 4, 5, 6, 8, 10, 12. A downward – sloping demand curve (D) runs from (0,60) to (12, 0). A steep downward – sloping marginal revenue curve (MR) runs from (0,60) to about (6, 0). A horizontal line at 20 is labeled "MC = ATC = LRATC" and extends across the graph. Dashed reference lines connect the curves to the axis values at quantities 2, 4, 5, 6, 8, 10, and prices 10,20, 30,35, 40,50, \$60.]

(e)(i) Suppose the monopolist perfectly price discriminates and chooses the quantity that maximizes profit. Determine the dollar value of each of the following.

Question 1

The monopolist's profit

(e)(ii) Suppose the monopolist perfectly price discriminates and chooses the quantity that maximizes profit. Determine the dollar value of each of the following.

The consumer surplus

Solution 1

(a)(i)

Mark scheme

- The profit-maximizing quantity is $Q = 4$, found where $MR = MC$ (\$20) on the graph.

(a)(ii)

Mark scheme

- The profit-maximizing price is $P = \$40$, read off the demand curve (D) at $Q = 4$.

Solution 1

(a)(iii)

Mark scheme

- The allocatively efficient quantity is $Q = 8$, where price equals marginal cost (the demand curve intersects $MC = ATC = LRATC = \$20$).

Solution 1

(b)

Mark scheme

- No, the monopolist is not experiencing economies of scale. LRATC is not downward sloping as output increases — it is constant (flat) at \$20 ($MC = ATC = LRATC$), so average cost does not fall as output rises.

Solution 1

(c)(i)

Mark scheme

- Economic profit = $(P - ATC) \times Q = (10 - 20) \times 10 = -100$, *i.e. a loss of 100*. (Price at $Q = 10$ is read off demand as 10; $ATC = 20$.) Other correct calculations showing this work are acceptable.

(c)(ii)

Mark scheme

- Consumer surplus = $\frac{1}{2} \times (\text{choke price} - \text{price}) \times Q = \frac{1}{2} \times (\$60 - \$10) \times 10 = \250 . Other correct calculations are acceptable.

Solution 1

(c)(iii)

Mark scheme

- Deadweight loss = $\frac{1}{2} \times (MC - P) \times (Q - Q_{\text{efficient}}) = \frac{1}{2} \times (\$20 - \$10) \times (10 - 8) = \10 — from overproducing 2 units (10 vs. the allocatively efficient 8) where MC exceeds price. Other correct calculations are acceptable.

Solution 1

(d)

Mark scheme

- Demand is unit elastic at $Q = 6$, the quantity where marginal revenue equals zero (equivalently, where total revenue is maximized).

Solution 1

(e)(i)

Mark scheme

- A perfectly price-discriminating monopolist produces where $D = MC$, i.e., $Q = 8$ (same as the allocatively efficient quantity), and captures the full area between demand and MC as profit: Profit = $\frac{1}{2} \times (\$60 - \$20) \times 8 = \$160$.

Solution 1

(e)(ii)

Mark scheme

- Consumer surplus = \$0. A perfectly price-discriminating monopolist charges every consumer exactly their maximum willingness to pay, so it captures the entire consumer surplus as profit, leaving none for consumers.