Past-paper walk-through

Price Elasticity of Demand ▪ 2.3

eXercise

Questions in this set

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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

2025 Set 1 ▪ Q1

Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

(a)(i) Draw a correctly labeled graph for Voda Reservoir and show each of the following. The profit-maximizing quantity, labeled Q_M.

(a)(ii) The profit-maximizing price, labeled P_M.

(a)(iii) The average total cost curve consistent with Voda Reservoir earning negative economic profit, labeled ATC.

(a)(iv) The area of deadweight loss, shaded completely.

Question 1

2025 Set 1 ▪ Q1

Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

(b) Suppose the government requires Voda Reservoir to produce the socially optimal quantity of bottled water. On your graph in part A, show the socially optimal quantity of bottled water, labeled Q_S.

Question 1

2025 Set 1 ▪ Q1

Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

(c) Suppose instead the government grants a per-unit subsidy to Voda Reservoir. What will happen to Voda Reservoir's profit-maximizing quantity of bottled water? Explain.

Question 1

2025 Set 1 ▪ Q1

Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

(d) Suppose new producers have entered the bottled-water market and Voda Reservoir continues to operate in the bottled-water market. Will the demand for Voda Reservoir's bottled water become more elastic, become less elastic, or stay the same as new producers enter the market?

Question 1

2025 Set 1 ▪ Q1

Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.

(e)(i) Voda Reservoir hires workers in a perfectly competitive labor market. If the demand for bottled water increases, what will happen to Voda Reservoir's demand for labor? Explain.

(e)(ii) The government implements a new regulation that increases the minimum age required for a worker to be employed in a bottled-water factory. What will happen to the market wage in the short run? Explain.

Solution 1

(a)(i)

Mark scheme

- Draw a correctly labeled graph for Voda Reservoir (a monopolist) with Price/Cost on the vertical axis and Quantity on the horizontal axis. Show a downward-sloping demand curve (D) and a downward-sloping marginal revenue curve (MR) lying below D, plus a rising marginal cost curve (MC). Label the profit-maximizing quantity Q_M at the intersection of MR and MC (where MR = MC). Points: 1 point for the correctly drawn D and MR curves (D downward-sloping, MR downward-sloping and below D); 1 point for the rising MC curve and Q_M correctly labeled where MR = MC.

Solution 1

(a)(ii)

Mark scheme

- From Q_M, draw a vertical line up to the demand curve D; the corresponding price on the vertical axis is the profit-maximizing price, labeled P_M. The graph must show P_M read off the D curve directly above Q_M.

Solution 1

(a)(iii)

Mark scheme

- Draw the average total cost (ATC) curve so that it lies ABOVE the demand curve D at Q_M (i.e., $ATC > P_M$ at Q_M), which is consistent with Voda Reservoir earning negative economic profit (a loss). The MC curve must pass through the minimum point of the ATC curve.

Solution 1

(a)(iv)

Mark scheme

- Shade the deadweight loss completely: the triangular area bounded between the demand curve (D) and the marginal cost curve (MC), from Q_M out to the quantity where D intersects MC (the allocatively efficient quantity). This region represents the value lost to society because the monopolist produces less than the efficient quantity.

Solution 1

(b)

Mark scheme

- On the same graph, label the socially optimal quantity Q_S at the intersection of the demand curve (D) and the marginal cost curve (MC) — the allocatively efficient quantity where price equals marginal cost. Q_S must lie to the right of Q_M.

Solution 1

(c)

Mark scheme

- Voda Reservoir's profit-maximizing quantity of bottled water will INCREASE. Explain with ONE of: (1) the per-unit subsidy decreases the firm's marginal cost, shifting the MC curve to the right (down), so it intersects the MR curve at a greater quantity; OR (2) the per-unit subsidy increases the firm's marginal revenue, shifting the MR curve to the right, so it intersects the MC curve at a greater quantity.

Solution 1

(d)

Mark scheme

- The demand for Voda Reservoir's bottled water will become MORE ELASTIC. As new producers enter the bottled-water market, more substitutes become available for Voda Reservoir's product, making its individual demand more sensitive to price changes (more elastic).

Solution 1

(e)(i)

Mark scheme

- Voda Reservoir's demand for labor will INCREASE. Explanation: the increase in demand for bottled water increases the price and marginal revenue of bottled water, which increases the marginal revenue product of labor (MRP = MR $\times$ MPL), shifting the labor demand curve to the right.

Solution 1

(e)(ii)

Mark scheme

- The market wage will INCREASE in the short run. Explanation: raising the minimum age required to work in a bottled-water factory decreases the supply of workers, shifting the labor supply curve to the left, which raises the equilibrium market wage.

Question 1

2024 Set 1 ▪ Q1

1. Soja Farm is a typical profit-maximizing firm that produces and sells soybeans in a constant-cost, perfectly competitive market that is in long-run equilibrium. The market equilibrium price of soybeans is \$14 per bushel.

   (a) Draw correctly labeled side-by-side graphs for the soybean market and for Soja Farm, and show each of the following.

   (i) The market equilibrium price and quantity, labeled \$14 and Q_M, respectively
   (ii) Soja Farm's profit-maximizing price and quantity, labeled P_F and Q_F, respectively
   (iii) Soja Farm's average total cost curve consistent with a long-run equilibrium, labeled ATC

   (b) If Soja Farm is the only firm in the market that chooses to increase its price of soybeans to \$15 per bushel, will Soja Farm's total revenue increase by \$1, remain the same, or decrease to \$0 ? Explain.

   (c) Soybeans are used as an input in the production of tofu. Tofu now becomes a more popular food option among consumers. On your graphs in part (a), show the short-run effect of the increased popularity of tofu on each of the following.

   (i) The new market equilibrium price and quantity of soybeans, labeled P_2 and Q_2, respectively
   (ii) Soja Farm's new profit-maximizing quantity, labeled Q*

Question 1

(d) Given the increase in popularity of tofu in part (c), what will happen to the number of firms in the soybean market in the long run? Explain.

(e) Suppose a 25% increase in the market price of quinoa causes a 5% decrease in the quantity demanded of quinoa and a 10% increase in the quantity demanded for tofu.

(i) Is the demand for quinoa elastic, inelastic, or unit elastic? Explain using numbers.
(ii) Calculate the cross-price elasticity of demand between quinoa and tofu. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

Solution 1

(a) Mark scheme

- Draw side-by-side graphs (4 points, 1 each): (1) Market graph: downward-sloping demand D_1 and upward-sloping supply S, with the equilibrium labeled at price $14 and quantity Q_M. (2) Firm graph: Soja Farm (a price-taking, perfectly competitive firm) has a horizontal demand/marginal-revenue curve d_1 = MR_1 drawn at the market price, labeled P_F (=14, the height carried over from the market graph). (3) A rising marginal cost (MC) curve is added to the firm graph, crossing $d_1 = MR_1$ at the profit-maximizing quantity Q_F (where $MR = MC$). (4) An average total cost (ATC) curve is added, drawn tangent to the firm's demand curve exactly at Q_F (zero long-run economic profit),

Solution 1

with the MC curve passing through the minimum point of ATC. Each of the four elements earns its own point; grade holistically against these four labeled features.

Solution 1

(b)

Mark scheme

- Soja Farm's total revenue would decrease to $0(notmerelyfallby1)$. Because Soja Farm is one price-taking firm among many in a perfectly competitive market, it faces a perfectly elastic (horizontal) demand curve at the market price of $14.Ifitaloneraisesitspriceto15$, all of its customers would simply buy soybeans from the many other sellers still charging the market price of $14, soSojaFarmwouldsellzerounitsandearn0$ in revenue.

Solution 1

(c)

Mark scheme

- Two points, one per graph: (i) On the market graph, demand shifts rightward from D_1 to D_2 (tofu's rising popularity raises demand for its input, soybeans), producing a new, higher equilibrium price labeled P_2 and a new, higher equilibrium quantity labeled Q_2 (both to the right/above the original 14/Q_M point). (ii) On the firm's graph, the higher market price shifts the firm's horizontal demand/MR curve upward to $d_2 = MR_2$ at P_2, and the new profit-maximizing quantity is labeled Q^*, found where $MR_2 = MC$ (to the right of the original Q_F).

Solution 1

(d)

Mark scheme

- The number of firms in the soybean market will increase in the long run. At the new higher price P_2, existing firms like Soja Farm earn positive (above-normal) economic profits (price exceeds ATC at Q^*). These economic profits attract new firms to enter the soybean market, which is characteristic of long-run adjustment in a perfectly competitive industry.

Solution 1

(e)(i)

Mark scheme

- Demand for quinoa is inelastic. Explanation (either is sufficient): the price elasticity of demand for quinoa has an absolute value of $|\%\Delta Q\_d \ / \ \%\Delta P| = 5\% \ / \ 25\% = 0.2$, which is less than 1, so demand is inelastic; equivalently, the 5% decrease in quantity demanded of quinoa is smaller (proportionally) than the 25% increase in the price of quinoa, meaning quantity demanded responds less than proportionally to the price change.

Solution 1

(e)(ii)

Mark scheme

- Cross-price elasticity of demand between quinoa and tofu = (% change in quantity demanded of tofu) / (% change in price of quinoa) = 10% / 25% = 0.4. (The positive value confirms quinoa and tofu are substitutes.)

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

2022 Set 1 ▪ Q1

A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

(a) Draw a correctly labeled graph for the firm and show each of the following. (i) The quantity of carbon-capture devices produced by the firm, labeled Q_M (ii) The price charged by the firm, labeled P_M (iii) The area representing consumer surplus, shaded completely

Question 1

2022 Set 1 ▪ Q1

A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

(b)(i) The government is considering different options to regulate the firm. Suppose the government is considering taxing the firm. Could using a per-unit tax change the firm's output to the socially optimal quantity? Explain.

(b)(ii) Instead, suppose the government imposes a price ceiling so that the firm produces the socially optimal quantity. On your graph in part (a), label the quantity and price after the price ceiling is imposed as Q_C and P_C.

(b)(iii) At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.

Question 1

2022 Set 1 ▪ Q1

A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

(c)(i) Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.
If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.

(c)(ii) Starting at the total-revenue-maximizing quantity, if the firm reduces the price by 10%, would quantity demanded increase by less than 10%, by more than 10%, or by exactly 10%?

Solution 1

(a) Mark scheme

- Monopoly graph for the firm, 5 points total (1 point each): (1) Correctly labeled downward-sloping demand curve D and marginal-revenue curve MR, with MR below D. (2) Marginal-cost curve MC added, intersecting MR at the profit-maximizing quantity labeled Q_M (where $MR = MC$). (3) Profit-maximizing price P_M read up from Q_M to the demand curve. (4) Average-total-cost curve ATC drawn below the demand curve at Q_M, with the MC curve passing through the minimum point of ATC. (5) Consumer surplus – the area bounded above by D, below by the price P_M, from the price axis out to Q_M – shaded completely.

Solution 1

(b)(i)

Mark scheme

- No. A per-unit tax raises the firm's marginal cost, shifting MC upward. The new MC intersects MR at a LOWER quantity than Q_M, so the tax decreases the firm's profit-maximizing output – it moves output further away from (not toward) the socially optimal quantity, which is higher than Q_M (found where $MC = D$).

Solution 1

(b)(ii)

Mark scheme

- The socially optimal quantity Q_C is where the (original, untaxed) MC curve crosses the demand curve D (i.e. $MC = D$); this lies to the right of Q_M. The corresponding price ceiling P_C is the price on the demand curve at Q_C (equivalently, the height of D and MC where they cross). Both Q_C (on the quantity axis, right of Q_M) and P_C (on the price axis, below P_M) should be labeled on the part (a) graph.

Solution 1

(b)(iii)

Mark scheme

- Yes, the firm earns positive economic profit at Q_C, because $ATC < P_C$ at that quantity – profit per unit is $P_C - ATC > 0$. Scoring note: grade for internal consistency with the student's own graph – accept 'no economic profit' only if their ATC curve is drawn at or above P_C at Q_C; the standard graph has ATC below P_C at Q_C, giving positive profit.

Solution 1

(c)(i)

Mark scheme

- Marginal revenue would be negative. At the total-revenue-maximizing quantity, $MR = 0$ (TR is at its peak). Increasing output by one more unit pushes the firm onto the inelastic portion of the demand curve, where selling more requires a price cut large enough that total revenue falls, i.e. $MR < 0$ for that extra unit.

Solution 1

(c)(ii)

Mark scheme

- Less than 10%. At the revenue-maximizing quantity, demand is unit elastic ($|E_d| = 1$). Cutting price further moves the firm onto the inelastic portion of the demand curve, where $|E_d| < 1$, so the percentage increase in quantity demanded is smaller than the 10% percentage decrease in price.

Question 3

2022 Set 1 ▪ Q3

(a) The local market for Good X has a perfectly elastic supply. Draw a correctly labeled graph for the local market for Good X with a market equilibrium price of $5. Label the equilibrium price as $5, and label the equilibrium quantity for the market with a specific value based on the data provided in the table.

(b) Assume the cost of production increases, which causes the price of Good X to increase from $5 to $7.

(i) Calculate the price elasticity of demand for Good X as the price increases from $5 to $7. Show your work.
(ii) Identify whether the demand for Good X is elastic, inelastic, or unit elastic in that range of prices.

(c) Could Emily's marginal benefit for the second unit of Good X equal $4.50 ? Explain.

Question 3

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- Graph, 2 points (1 point each): (1) A downward-sloping demand curve D and a perfectly elastic (horizontal) supply curve S at price $= \$5$, both correctly labeled. (2) The equilibrium quantity, read from the given demand data at $P = \$5$, labeled as $Q = 8$ units on the quantity axis at the S-D intersection.

Solution 3

(b)(i) Mark scheme

- $E_d = \left| \frac{\%\Delta Q_d}{\%\Delta P} \right| = \frac{\left| \frac{4-8}{8} \times 100 \right|}{\left| \frac{7-5}{5} \times 100 \right|} = \frac{50\%}{40\%} = 1.25$ (magnitude of the price elasticity of demand as price rises from $5 to 7$ and quantity falls from 8 to 4 units).

Solution 3

(b)(ii)

Mark scheme

- Elastic, since $|E_d| = 1.25 > 1$.

Solution 3

(c)

Mark scheme

- No. Emily's marginal benefit for the second unit must be greater than or equal to the price she was willing to pay for it $(7) - -since she purchased it at 7$, her marginal benefit must be at least $7, so 4.50$ is inconsistent with that purchase.

Question 1

2021 Set 1 ▪ Q1

The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.
(a) Draw a correctly labeled graph for SkyRunner, and show each of the following. (i) The profit-maximizing quantity of tickets, labeled Q_M (ii) The profit-maximizing price of a ticket, labeled P_M (iii) The area representing profits, shaded completely
Now the island's tourist bureau asks the government to consider the following two proposals.

- Proposal I: Set a price ceiling on tickets that eliminates all deadweight loss.
- Proposal II: Eliminate SkyRunner's monopoly rights, which will remove all barriers to entry.

Question 1

2021 Set 1 ▪ Q1

The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.

(b) Suppose the government adopts proposal I. On your graph in part (a), indicate the quantity of tickets sold in the short run, labeled Q_C.

Question 1

2021 Set 1 ▪ Q1

The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.

(c)(i) Suppose instead the government adopts proposal II. How will each of the following be affected in the long run compared to the market conditions in part (a)? The quantity of tickets sold by SkyRunner. Explain.

(c)(ii) The price elasticity of demand for SkyRunner's airline service. Explain.

(c)(iii) SkyRunner's profits

(c)(iv) The deadweight loss in the market. Explain.

Solution 1

(a) Mark scheme

- Draw a correctly labeled graph for SkyRunner (a monopolist) with 5 scorable elements, 1 point each: (1) a downward-sloping demand (D) curve with marginal revenue (MR) below it, hitting the quantity axis at half of D's intercept; (2) an upward-sloping marginal cost (MC) curve, with the profit-maximizing quantity Q_M marked where MR = MC; (3) the profit-maximizing price P_M, found by going up from Q_M to the demand curve and across to the price axis; (4) a U-shaped ATC curve lying below the demand curve at Q_M, with the rising portion of MC crossing ATC exactly at ATC's minimum point; (5) the profit rectangle completely and correctly shaded, bounded above by P_M, below by ATC at Q_M, and on the right by Q_M — representing profit = $(P_M - \text{ATC at } Q_M) \times Q_M$.

Solution 1

(b)

Mark scheme

- On the same graph, label Q_C at the quantity where the demand curve intersects the MC curve (i.e., where price = marginal cost). A price ceiling set at this level forces the monopolist to sell where P = MC, the allocatively efficient (competitive-like) output, which eliminates all deadweight loss. Q_C lies to the right of Q_M on the quantity axis.

Solution 1

(c)(i)

Mark scheme

- The quantity of tickets sold by SkyRunner will decrease. Explanation: removing SkyRunner's monopoly rights allows new firms to enter, and the entry of these substitute providers reduces the demand facing SkyRunner specifically (its demand curve shifts left), so SkyRunner sells fewer tickets even though total market output rises.

Solution 1

(c)(ii)

Mark scheme

- The price elasticity of demand for SkyRunner's service will increase (become more elastic). Explanation: entry of new firms increases the number of close substitutes available to consumers, and having more substitutes makes demand for any one firm's service more price-elastic.

Solution 1

(c)(iii)

Mark scheme

- SkyRunner's profit will be zero, or will decrease toward zero. In the long run, free entry drives economic profit to zero as new firms keep entering until no further profit incentive to enter remains.

Solution 1

(c)(iv)

Mark scheme

- The deadweight loss will decrease. Explanation: entry of new firms increases total market output (total services provided), moving output closer to the socially optimal (allocatively efficient) level, which shrinks the deadweight loss.

Question 1

2021 Set 2 ▪ Q1

NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(a)(i) Draw a correctly labeled graph of NCHart making a positive economic profit, and show each of the following.

The profit-maximizing quantity, labeled Q_m

(a)(ii) Draw a correctly labeled graph of NCHart making a positive economic profit, and show each of the following.

The profit-maximizing price, labeled P_m

Question 1

NCHart \ TXDrug	Stay Out	Enter
Q_m	\$10, \$0	\$4, \$1
Q_z	\$0, \$0	–\$2, –\$1

Question 1

2021 Set 2 ▪ Q1

NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(b) At Q_m from part (a)(i), is demand elastic, unit elastic, or inelastic? Explain using information from the graph.

Question 1

2021 Set 2 ▪ Q1

NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(c)(i) Instead of maximizing profit, suppose NCHart considers providing the new drug to as many patients as possible as long as it can generate enough revenue to cover its total costs.

On your graph from part (a), show the quantity that is consistent with this goal, labeled Q_z.

(c)(ii) At Q_z from part (c)(i), is there a deadweight loss? Explain.

Question 1

2021 Set 2 ▪ Q1

NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.

(d)(i) NCHart's patent expires next year, and a new firm, TXDrug, is considering whether to Enter this market or Stay Out. NCHart can either produce Q_m or Q_z. The firms independently and simultaneously choose their actions. The first entry in the payoff matrix represents NCHart's payoff and the second entry represents TXDrug's payoff. Both firms have complete information. Use the payoff matrix below to answer the following questions.

Question 1

[Payoff matrix: rows = NCHart's choice (Q_m or Q_z), columns = TXDrug's choice (Stay Out or Enter). Column header "TXDrug" spans both columns; row header "NCHart" spans both rows.]

NCHart \ TXDrug	**Stay Out**	**Enter**
Q_m	\$10, \$0	\$4, \$1
Q_z	\$0, \$0	-\$2, -\$1

Does TXDrug have a dominant strategy? Explain using strategies and payoffs from the payoff matrix.

Question 1

(d)(ii) Use the payoff matrix from part (d):

NCHart \ TXDrug	**Stay Out**	**Enter**
Q_m	\$10, \$0	\$4, \$1
Q_z	\$0, \$0	-\$2, -\$1

What is the best response for NCHart if TXDrug chooses to Stay Out?

(d)(iii) Use the payoff matrix from part (d):

Question 1

NCHart \ TXDrug	Stay Out	Enter
Q_m	\$10, \$0	\$4, \$1
Q_z	\$0, \$0	-\$2, -\$1

Identify the Nash equilibrium.

Solution 1

(a)(i)

Mark scheme

- Draw a downward-sloping demand (D) curve with a marginal revenue (MR) curve below it everywhere, plus an upward-sloping marginal cost (MC) curve. The profit-maximizing quantity Q_m is where MR = MC (the intersection of MR and MC). Points: 1 for a correctly labeled graph with D and MR (MR below D), 1 for the MC curve intersecting MR at the labeled quantity Q_m.

Solution 1

(a)(ii)

Mark scheme

- From Q_m (where MR = MC), go up to the demand curve to find the profit-maximizing price P_m, labeled above Q_m on the vertical axis. Also add the ATC curve lying below the demand curve at Q_m (so P $>$ ATC, confirming positive economic profit), with the rising MC curve intersecting ATC at its minimum point. Points: 1 for P_m shown correctly above Q_m on the demand curve, 1 for ATC below D at Q_m with MC crossing ATC at its minimum.

Solution 1

(b)

Mark scheme

- Demand is elastic at Q_m. Explanation: at the profit-maximizing quantity, marginal revenue is positive (MR > 0 at Q_m), and demand is elastic wherever MR is positive. Equivalently, Q_m is less than the quantity at which MR $= 0$ (the midpoint of the demand curve).

Solution 1

(c)(i)

Mark scheme

- Q_z is the quantity at which price (the demand curve) equals ATC — i.e., where D = ATC — so total revenue just covers total cost (zero economic profit, enough revenue to cover total costs). On the graph, Q_z is shown to the right of Q_m, at the intersection of the demand curve and the ATC curve.

Solution 1

(c)(ii)

Mark scheme

- Yes, there is a deadweight loss at Q_z (true whenever the demand curve is drawn so the D=ATC quantity is less than the D=MC quantity). Explanation: at Q_z, price/demand is less than marginal cost (P or D $<$ MC), meaning units are produced whose marginal cost exceeds the value consumers place on them, creating a deadweight loss. (Note: if D=ATC and D=MC occur at the same quantity, so P = MC there, no deadweight loss exists at Q_z.)

Solution 1

(d)(i)

Mark scheme

- No, TXDrug does not have a dominant strategy. Explanation: if NCHart chooses Q_m, TXDrug's best response is to Enter, because $1 > 0$. But if NCHart chooses Q_z, TXDrug's best response is to Stay Out, because $0 > -1$. Since TXDrug's best action changes depending on NCHart's choice, it has no single dominant strategy.

Solution 1

(d)(ii)

Mark scheme

- NCHart's best response if TXDrug chooses to Stay Out is to produce Q_m, since NCHart earns $10 at Q\_m versus 0$ at Q_z, and $10 > 0$.

Solution 1

(d)(iii)

Mark scheme

- The Nash equilibrium is: NCHart produces Q_m and TXDrug chooses to Enter (payoffs 4,1). Neither firm can improve its payoff by unilaterally deviating: given TXDrug Enters, NCHart's best response is Q_m ($4 > -2$); given NCHart chooses Q_m, TXDrug's best response is Enter ($1 > 0$).

Question 2

2019 Set 2 ▪ Q2

[Graph titled with y-axis "Price" and x-axis "Quantity". Three upward/downward lines are shown: a downward-sloping "Demand" curve, an upward-sloping "Supply" curve, and a steeper upward-sloping "Supply + Tax" curve (parallel-shifted up-left from Supply). Dashed horizontal gridlines at price levels P_4 (highest), P_3, P_2, P_1 (lowest), and dashed vertical gridlines at quantity levels Q_1, Q_2, Q_3, Q_4, Q_5 (left to right). Labeled points on the diagram: R at (Q_2, P_4) on the Supply + Tax curve; S at (Q_2, P_3) at the intersection of Demand and Supply; X at (Q_3, P_4) on the Supply + Tax curve; Y at (Q_4, P_3) on the Supply curve; T at (Q_2, P_2), unlabeled curve position (interior point); W at (Q_3, P_2) at the intersection of Supply and Supply + Tax; Z at (Q_2, P_1) on the Supply curve; V at (Q_4, P_1) on the Demand curve. The Demand curve slopes downward from upper-left to lower-right through S and V (and further points);

Question 2

the Supply curve slopes upward from lower-left through Z, S(no), W, Y; the Supply + Tax curve slopes upward from lower-left, parallel to Supply, through R, X.]

Hats are produced in a perfectly competitive industry, and the government imposes a per-unit sales tax on hats.

(a)(i) Using the labeling from the graph, identify each of the following. The after-tax price paid by consumers and the after-tax quantity

(a)(ii) The area representing the total tax revenue received by the government

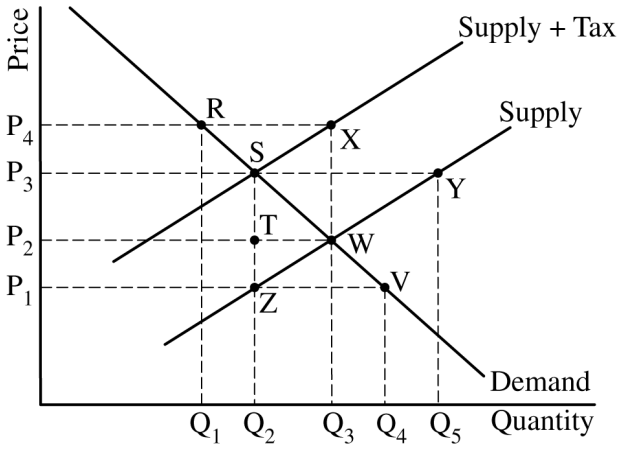
(b)(i) Now assume instead that the demand for hats is perfectly inelastic at Q_3, while the supply and the per-unit tax remain unchanged. Will the after-tax price paid by consumers be higher, lower, or the same compared to the price in your answer to part (a)(i)?

(b)(ii) Will the total tax revenue received by the government be higher, lower, or the same compared to the tax revenue in your answer to part (a)(ii)? Explain.

Question 2

(c) If the demand for hats remains perfectly inelastic at Q_3 and the per-unit sales tax is reduced, will producer surplus increase, decrease, or stay the same? Explain.

Question 2


Price
Supply + Tax
Supply
Demand
Quantity
R
S
T
W
X
Y
V
Z
P_4
P_3
P_2
P_1
Q_1
Q_2
Q_3
Q_4
Q_5

Solution 2

(a)(i)

Mark scheme

- The after-tax price paid by consumers is P_3, and the after-tax quantity is Q_2 (using the graph's labeling, where the per-unit tax drives a wedge between the price consumers pay and the price sellers receive, and reduces the equilibrium quantity from Q_3 to Q_2).

Solution 2

(a)(ii)

Mark scheme

- The area representing the total tax revenue received by the government is the rectangle P_1P_3SZ, equivalently $(P_3 \times Q_2) - (P_1 \times Q_2)$, or $(P_3 - P_1) \times Q_2$ — where P_1 is the price received by sellers after the tax, P_3 is the price paid by consumers, and $(P_3 - P_1)$ is the per-unit tax, multiplied by the after-tax quantity Q_2.

Solution 2

(b)(i)

Mark scheme

- The after-tax price paid by consumers will be higher than in part (a)(i). When demand for hats is perfectly inelastic at Q_3, sellers can pass the entire per-unit tax on to consumers, so the price rises by the full amount of the tax (more than when demand was downward-sloping).

Solution 2

(b)(ii)

Mark scheme

- The total tax revenue received by the government will be higher than in part (a)(ii). This is because the tax does not reduce the quantity purchased when demand is perfectly inelastic (quantity stays at Q_3), whereas quantity falls (to Q_2) when demand is downward-sloping — since $Q_3 > Q_2$, tax revenue (tax per unit $\times$ quantity) is larger under perfectly inelastic demand.

Solution 2

(c)

Mark scheme

- Producer surplus will stay the same. Because demand is perfectly inelastic at Q_3, both the price received by sellers (P_2) and the quantity sold (Q_3) do not change when the per-unit sales tax is reduced, so producer surplus (which depends only on price received and quantity) is unaffected. (Equivalently: producer surplus stays the same because the consumer bears the full burden of any change in the tax.)

Question 1

2018 ▪ Q1

In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.

(a)(i) Draw a correctly labeled graph for Single Cinema, and show the following: The profit-maximizing price and quantity of tickets, labeled as P_m and Q_m, respectively.

(a)(ii) Draw a correctly labeled graph for Single Cinema, and show the following: The area representing the negative economic profit, shaded completely.

Question 1

2018 ▪ Q1

In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.

(b) Explain why Single Cinema continues to operate in the short run despite earning negative economic profit in the short run.

Question 1

2018 ▪ Q1

In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.

(c) Would Single Cinema's total revenue increase, decrease, or stay the same if it decides to sell one fewer ticket than Q_m? Explain.

Question 1

2018 ▪ Q1

In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.

(d)(i) Single Cinema hires workers in a perfectly competitive labor market with a downward-sloping demand curve. Suppose the number of workers available in the market decreases. What will happen to the wage rate? Explain.

(d)(ii) Single Cinema hires workers in a perfectly competitive labor market with a downward-sloping demand curve. Suppose the number of workers available in the market decreases. What will happen to the marginal revenue product of the last worker hired? Explain.

Solution 1

(a)(i)

Mark scheme

- Draw a correctly labeled monopoly graph for Single Cinema. Points earned: (1) a correctly labeled graph with a downward-sloping demand (D) curve and a marginal revenue (MR) curve drawn below/steeper than D; (2) a rising marginal cost (MC) curve that passes through the minimum point of the average total cost (ATC) curve; (3) the profit-maximizing quantity Qm shown where MR = MC (MC crosses MR); (4) the profit-maximizing price Pm read off the demand curve directly above Qm (go up from Qm to D, then across to the price axis).

Solution 1

(a)(ii)

Mark scheme

- On the same monopoly graph, completely shade the rectangle representing negative economic profit: it lies between the ATC curve and price Pm, at quantity Qm, with the ATC curve drawn above the demand curve (and thus above Pm) at Qm — since ATC $>$ Pm at Qm, the firm is making a loss. The shaded loss area = (ATC - Pm) x Qm.

Solution 1

(b)

Mark scheme

- Single Cinema keeps operating in the short run because price is greater than average variable cost (P $>$ AVC) — equivalently, total revenue exceeds total variable cost (TR $>$ TVC), or the firm's current economic loss is smaller than its fixed cost, which is what its loss would be if it shut down. Since operating produces a smaller loss than shutting down, the firm continues to operate despite the negative economic profit.

Solution 1

(c)

Mark scheme

- Total revenue will decrease if Single Cinema sells one fewer ticket than Qm. Explanation (any one of): the monopolist is operating on the elastic portion of the demand curve at Qm; the quantity effect of losing a ticket sale is greater than the price effect of the higher price; the percentage change in quantity demanded is greater than the percentage change in price; or MR is positive at Qm (since Qm is where $MR = MC > 0$), meaning revenue is still rising with quantity, so cutting quantity lowers revenue.

Solution 1

(d)(i)

Mark scheme

- The wage rate will increase. Because the number of workers available in the perfectly competitive labor market decreases, the market labor supply curve S shifts left to S'. With labor demand D unchanged, the new market equilibrium wage W' is higher than the original wage W (quantity of labor falls from Q to Q').

Solution 1

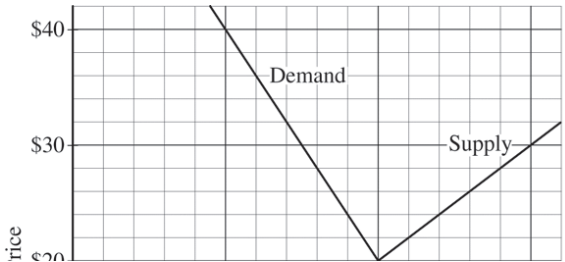
(d)(ii) Mark scheme

- The marginal revenue product (MRP) of the last worker hired will increase. Explanation (any one of): the firm now hires fewer workers, so the marginal product of the last worker hired is higher (diminishing marginal product means fewer workers implies a higher marginal product); the market wage (marginal factor cost, MFC) increased, and a profit-maximizing firm hires where MRP = MFC, so at the new higher wage MRP must also be higher; or graphically, there is an upward movement along the firm's downward-sloping MRP curve as the wage/MFC rises from W to W' (quantity of labor hired falls from q to q').

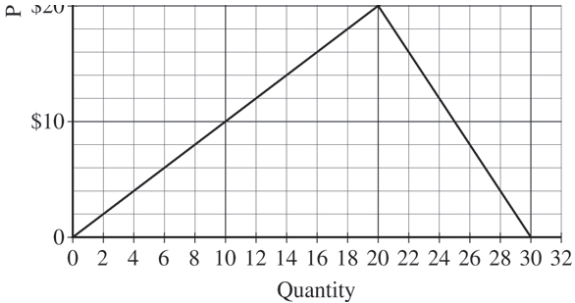
Question 3

2015 ▪ Q3

3. The graph below shows the market for widgets. The government is considering intervening in this market.



Question 3



Question 3

(a) Calculate the total producer surplus at the market equilibrium price and quantity. Show your work.

(b) If the government imposes a price floor at $16, is there a shortage, a surplus, or neither? Explain.

(c) If instead the government imposes a price ceiling at $12, is there a shortage, a surplus, or neither? Explain.

(d) If instead the government restricts the market output to 10 units, calculate the deadweight loss. Show your work.

(e) Assume the price decreases from $20 to $12.
   (i) Calculate the price elasticity of demand. Show your work.
   (ii) In this price range, is demand perfectly elastic, relatively elastic, unit elastic, relatively inelastic, or perfectly inelastic?

Question 3

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- Producer surplus is the area of the triangle between the supply curve and the market price, from output 0 to the equilibrium quantity. $PS = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 20 \times 20 = \$200$.

Solution 3

(b)

Mark scheme

- Neither a shortage nor a surplus results. The equilibrium price is $20, so a price floor set at $16 is BELOW equilibrium — it is not binding (the market still clears at the higher equilibrium price), so quantity supplied still equals quantity demanded.

Solution 3

(c)

Mark scheme

- A shortage results. The equilibrium price is \$20, so a price ceiling at \$12 is BELOW equilibrium — it is binding: at \$12 the quantity demanded exceeds the quantity supplied, creating a shortage.

Solution 3

(d) Mark scheme

- Restricting output to 10 units (below the equilibrium quantity of 20) creates a deadweight loss of \$150, found as the area of the triangle between the demand and supply curves from Q=10 to Q=20: $DWL = \frac{1}{2} \times 30 \times 10$, equivalently split into two triangles $\left(\frac{1}{2} \times 10 \times 10\right) + \left(\frac{1}{2} \times 20 \times 10\right) = \$50 + \$100 = \$150$.

Solution 3

(e)(i)

Mark scheme

- Using the reference quantity of 20 rising to 24 as price falls from \$20 to \$12: $E_d = \dfrac{(24-20)/20}{(12-20)/20} = \dfrac{0.20}{-0.40} = -0.5$ (equivalently, using the midpoint/arc-elasticity formula).

Solution 3

(e)(ii)

Mark scheme

- Since $|E_d| = 0.5 < 1$, demand is relatively inelastic over this price range.

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, $and x - axis"QUANTITY"showinggridlinesat 0, 2, 4, 5, 6, 8, 10, 12.Adownward - slopingdemandcurve(D)runsfrom(0$,60) to (12, $0).Asteeperdownward - slopingmarginalrevenuecurve(MR)runsfrom(0$,60) to about (6, $0).Ahorizontallineat$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

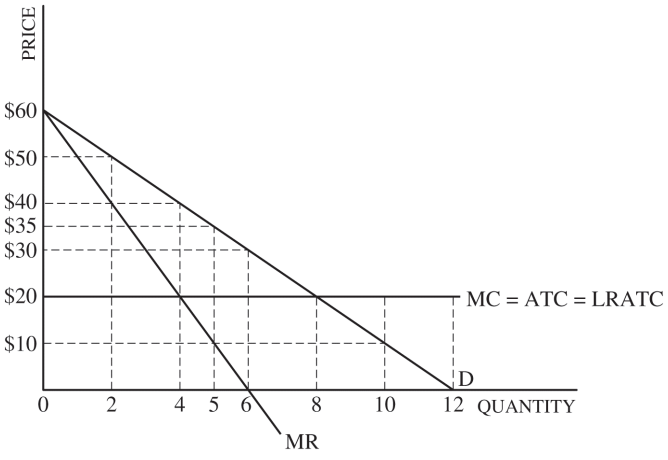
(a)(ii) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.

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


PRICE
$60
$50
$40
$35
$30
$20
$10
MC = ATC = LRATC
D
0
2
4
5
6
8
10
12
QUANTITY
MR

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.]

(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, $and x - axis"QUANTITY"showinggridlinesat0, 2, 4, 5, 6, 8, 10, 12.Adownward -$ $slopingdemandcurve(D)runsfrom(0,60)$ to (12, $0).Asteeperdownward - slopingmarginalrevenuecurve(MR)runsfrom(0,60)$ to about (6, $0).Ahorizontallineat20$ 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 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.]

(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) × 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 = ½ × (choke price − price) × Q = ½ × ($60 − $10) × 10 = $250. Other correct calculations are acceptable.

Solution 1

(c)(iii)

Mark scheme

- Deadweight loss = ½ × (MC − P) × (Q − Q_efficient) = ½ × ($20 − $10) × (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 = ½ × ($60 − $20) × 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.

Question 3

2014 ▪ Q3

3. Assume that gasoline is sold in a competitive market in which demand is relatively inelastic and supply is relatively elastic.

   (a) Draw a correctly labeled graph of the gasoline market. On your graph show the equilibrium price and quantity of gasoline, labeled P_E and Q_E.

   (b) Suppose the government imposes a $2 per unit tax on the producers of gasoline. On your graph from part (a), show each of the following after the tax is imposed.

      (i) The price paid by buyers, labeled P_B

      (ii) The after-tax price received by sellers, labeled P_S

      (iii) The quantity, labeled Q_T

   (c) Using the labeling on your graph, explain how to calculate the total tax revenue collected by the government.

Question 3

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- Draw a correctly labeled supply-and-demand graph of the gasoline market — downward-sloping demand (D), upward-sloping supply (S) — with their intersection labeled as the equilibrium price P_E and quantity Q_E.

Solution 3

(b)(i)

Mark scheme

- After the $2 per-unit tax on producers shifts the supply curve up/left to S + Tax, show the new price paid by buyers, P_B, above P_E — read off the original demand curve (D) at the new quantity Q_T.

(b)(ii)

Mark scheme

- Show the after-tax price received by sellers, P_S, below P_E — read off the original supply curve (S) at the new quantity Q_T (equivalently, $P_S = P_B - \$2$, the size of the tax).

Solution 3

(b)(iii)

Mark scheme

- Show the new (post-tax) equilibrium quantity, Q_T, at the intersection of S + Tax and demand (D); Q_T is less than the original equilibrium quantity Q_E, since the tax raises the buyer price and reduces quantity transacted. (Drawing the S + Tax curve is not required — a 'tax wedge' approach between the demand and supply curves at Q_T is also acceptable.)

Solution 3

(c)

Mark scheme

- Total tax revenue = tax per unit × after-tax quantity = $(P_B - P_S) \times Q_T = 2 \times Q_T$ (equivalently written as $(P_B \times Q_T) - (P_S \times Q_T)$, or Tax × Q_T), using the buyer price, seller price, and post-tax quantity labeled on the graph.

Solution 3

(d)

Mark scheme

- The tax burden falls more on buyers and less on sellers, because demand is more inelastic (steeper/less price-responsive) than supply — the side of the market with the less elastic response bears the larger share of a per-unit tax, and here buyers reduce their quantity demanded less than sellers reduce quantity supplied.