Past-paper walk-through

The Effects of Government Intervention in Different Market Structures ▪ 6.4

eXercise

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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)

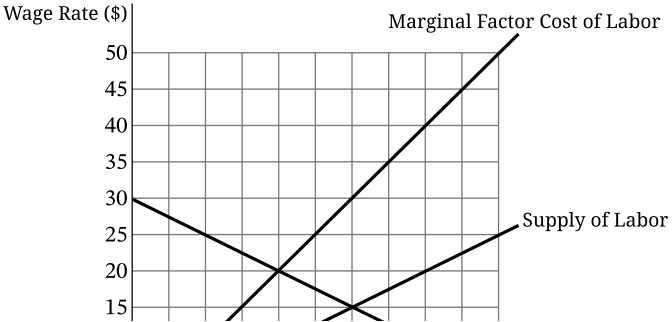
Mark scheme

- 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.

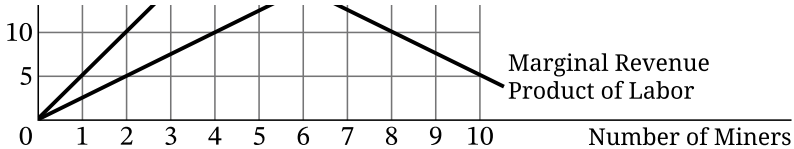
Question 2

2025 Set 2 ▪ Q2

2. Quartz Excavations is a profit-maximizing firm and the only employer of miners of quartz in a small town. The graph provided shows the labor market for miners.



Question 2



A. Identify Quartz Excavations' profit-maximizing number of miners to hire.

B. Will Quartz Excavations pay its profit-maximizing number of miners a wage rate that is equal to $15, greater than $15, or less than $15? Explain using numbers.

C. Suppose the government sets a minimum wage (a price floor on wages) at $25. Calculate the total wage bill for Quartz Excavations at the resulting profit-maximizing number of miners. Show your work.

D. Suppose that instead of a minimum wage, there is now an increase in the demand for quartz.

i. Will the marginal revenue product of miners increase, decrease, or remain the same? Explain.

Question 2

ii. After the demand for quartz increases, Quartz Excavations hires the new profit-maximizing number of miners. Will the marginal factor cost of the last miner hired be greater than, less than, or equal to the marginal factor cost of the last miner hired before the demand for quartz increased?

Solution 2

(a)

Mark scheme

- The profit-maximizing number of miners is 4 — the quantity of labor at which the marginal revenue product (MRP) of labor equals the marginal factor cost (MFC) of labor.

Solution 2

(b)

Mark scheme

- Quartz Excavations will pay its profit-maximizing number of miners a wage rate that is LESS than \$15. As a monopsonist (the sole buyer of labor), the wage rate it pays is determined by the labor supply curve at the quantity of labor hired, not by the (higher) marginal factor cost curve used to find the hiring quantity. The wage rate associated with hiring 4 miners, read off the labor supply curve, is \$10.

Solution 2

(c)

Mark scheme

- With a binding minimum wage (price floor on wages) of \$25, the labor supply curve becomes horizontal at \$25 up to the point where it meets the original supply curve, and the firm hires labor where MRP equals this new (horizontal) MFC of \$25, which occurs at 2 miners. Total Wage Bill = \$25 \times 2 = \$50. Show the multiplication as work.

Solution 2

(d)(i)

Mark scheme

- The marginal revenue product (MRP) of miners will INCREASE. An increase in the demand for quartz raises the price (and marginal revenue) of quartz; since MRP = marginal product of labor $\times$ marginal revenue (price) of quartz, a higher quartz price raises MRP at every quantity of labor.

Solution 2

(d)(ii)

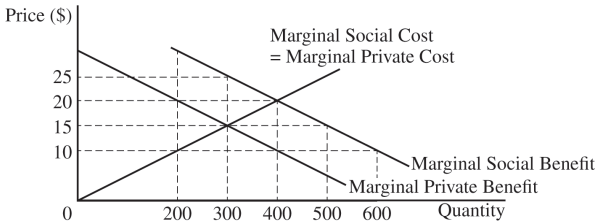
Mark scheme

- The marginal factor cost (MFC) of the last miner hired after the demand increase will be GREATER THAN the MFC of the last miner hired before the demand increase. Because MRP increased, the monopsonist's profit-maximizing hiring quantity increases; moving further up the upward-sloping labor supply curve, the firm must pay a higher wage to attract more workers, and since MFC lies above (and rises faster than) the supply curve for a monopsonist, MFC at the new (larger) quantity of miners is higher than MFC at the original quantity.

Question 2

2024 Set 1 ▪ Q2

2. Good X is produced and sold in a perfectly competitive market. The provided graph shows the market for Good X.



(a) Identify the market equilibrium price and quantity.

(b) Calculate the deadweight loss at the market equilibrium. Show your work.

Question 2

(c) Suppose the government wants to eliminate the deadweight loss in the market for Good X.

(i) Which of the following will achieve the government's objective: a per-unit tax on consumers or a per-unit subsidy to consumers? Explain.

(ii) What is the dollar value of the per-unit tax or per-unit subsidy identified in part (c)(i) ?

(d) Suppose instead the government imposes a price ceiling of $10. Will the price ceiling achieve the socially optimal quantity of Good X? Explain.

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 2

(a)

Mark scheme

- The market equilibrium price is \$15, and the market equilibrium quantity is 300 units (read directly off the given supply-and-demand graph/data as the point where quantity supplied equals quantity demanded).

Solution 2

(b)

Mark scheme

- Deadweight loss = \$500. Work: \$DWL = \tfrac{1}{2} \times (\$25 - \$15) \times (400 - 300) = \tfrac{1}{2} \times \$10 \times 100 = \$500\$. This is the triangle between the demand and supply curves from the market quantity (300) to the socially optimal quantity (400), using the demand price (\$25) and supply price (\$15) at the margin.

Solution 2

(c)(i) Mark scheme

- The government should grant a per-unit subsidy to consumers (not a per-unit tax) to eliminate the deadweight loss and achieve the socially optimal quantity of Good X. Explanation (any one is sufficient): a per-unit subsidy to consumers internalizes the external benefit and increases consumers' incentive/ability to buy, raising quantity to the socially optimal level (400); a subsidy equal to the marginal external benefit lowers the effective price paid by consumers, increasing consumption to 400; a subsidy equal to the gap between marginal social benefit and marginal private benefit increases the quantity exchanged to the socially optimal quantity (400). (This implies Good X generates a positive externality, so a tax would move the market further from the optimum, not closer.)

Solution 2

(c)(ii)

Mark scheme

- The dollar value of the per-unit subsidy is \$10 — equal to the vertical gap between the marginal social benefit (demand) curve and the marginal private benefit at the socially optimal quantity of 400 units.

Solution 2

(d)

Mark scheme

- No, the price ceiling of \$10 will not achieve the socially optimal quantity of Good X. Explanation: a binding price ceiling causes the quantity actually exchanged in the market to be limited by the (lower) quantity supplied at that price, which is 200 units — less than the socially optimal quantity of 400 units. So the price ceiling creates a shortage and under-provides the good relative to the social optimum.

Question 1

2023 Set 1 ▪ Q1

1. RKB is a profit-maximizing monopoly that produces a new, patented electronic device. RKB is earning positive economic profit.

   (a) Draw a correctly labeled graph for RKB, and show each of the following.

   (i) The profit-maximizing quantity, labeled Q_M
   (ii) The profit-maximizing price, labeled P_M
   (iii) The average total cost curve consistent with RKB earning positive economic profit
   (iv) The area representing the deadweight loss, shaded completely

   (b) The government wants RKB to produce the allocatively efficient quantity. Would the government impose a binding price ceiling, a binding price floor, a per-unit tax, or a lump-sum tax?

   (c) Suppose that the government does not impose the policy you identified in part (b). Consumers now become aware of research that confirms the use of this new device harms users' vision. Given widespread consumer awareness of this research, what will happen to RKB's profit-maximizing quantity in the short run? Explain.

Question 1

(d) Assume that RKB hires workers in a perfectly competitive labor market.

(i) Draw a correctly labeled graph for the labor market, showing the equilibrium wage and quantity of labor, labeled W_E and Q_E, respectively.

(ii) Suppose immigration increases the number of workers in this labor market. On your graph in part (d)(i), show the new equilibrium wage and quantity of labor, labeled W_2 and Q_2, respectively.

(iii) RKB uses the optimal combination of capital and labor in its production process. The firm rents capital at \$500 per unit, and the last unit of capital rented has a marginal product of 2,500 units. If the marginal product of the last unit of labor hired is 1,000 units, calculate the wage rate. Show your work.

Question 1

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 one correctly labeled monopoly graph (axes: Price/Cost vertical, Quantity horizontal) showing all five required elements, 1 point each: (1) a downward-sloping Demand (D) curve and a downward-sloping Marginal Revenue (MR) curve, with MR below D; (2) an upward-sloping Marginal Cost (MC) curve and the profit-maximizing quantity, labeled Q_M, where MR = MC; (3) the profit-maximizing price, labeled P_M, found on the D curve directly above Q_M; (4) an Average Total Cost (ATC) curve drawn below P_M at Q_M (so the firm earns positive economic profit), with the MC curve passing through the minimum point of the ATC curve; (5) the deadweight loss area — bounded by the D curve, the

Solution 1

MC curve, and the vertical line at Q_M, out to the allocatively efficient quantity where D = MC — shaded completely.

Solution 1

(b)

Mark scheme

- The government would impose a binding price ceiling, set at the price where D = MC (the allocatively efficient price/quantity), to induce RKB to produce the allocatively efficient quantity.

Solution 1

(c)

Mark scheme

- The profit-maximizing quantity will decrease. Explanation: widespread consumer awareness that the device harms vision reduces demand for RKB's device, so the D curve shifts left; this causes the MR curve to shift left as well, so the new MR intersects the (unchanged) MC curve at a lower quantity than before.

Solution 1

(d)(i)

Mark scheme

- Draw a correctly labeled graph of a perfectly competitive labor market: Wage on the vertical axis, Quantity of Labor on the horizontal axis, a downward-sloping labor demand curve (D_L) and an upward-sloping labor supply curve (S_L), intersecting at the equilibrium wage, labeled W_E, and equilibrium quantity of labor, labeled Q_E.

Solution 1

(d)(ii)

Mark scheme

- On the graph from part (d)(i), shift the labor supply curve rightward (to S'_L) to represent immigration increasing the number of workers. Show the new equilibrium at a lower wage, labeled W_2, and a higher quantity of labor, labeled Q_2, at the intersection of D_L and S'_L (with $W_2 < W_E$ and $Q_2 > Q_E$).

Solution 1

(d)(iii) Mark scheme

- Use the optimal (cost-minimizing) input combination rule: $\frac{\text{Marginal Product of Capital}}{\text{Rental Price}} = \frac{\text{Marginal Product of Labor}}{\text{Wage Rate}}$. Substitute: $\frac{2{,}500}{\$500} = \frac{1{,}000}{\text{Wage Rate}}$, so $5 = \frac{1{,}000}{\text{Wage Rate}}$, giving Wage Rate $= \$200$.

Question 1

2023 Set 2 ▪ Q1

Anderson Company is a typical firm that manufactures Good G in a constant-cost, perfectly competitive market. Anderson Company is currently earning positive economic profit.

(a) What must be true about the relationship between accounting profit and economic profit if Anderson Company currently incurs both explicit and implicit costs in production?

Question 1

2023 Set 2 ▪ Q1

Anderson Company is a typical firm that manufactures Good G in a constant-cost, perfectly competitive market. Anderson Company is currently earning positive economic profit.

(b) Draw correctly labeled side-by-side graphs for the market and Anderson Company and show each of the following.

(i) The market equilibrium price and quantity, labeled P_M and Q_M, respectively (ii) The profit-maximizing price and quantity for Anderson Company, labeled P_F and Q_F, respectively (iii) The area representing Anderson Company's positive economic profit, shaded completely

Question 1

2023 Set 2 ▪ Q1

Anderson Company is a typical firm that manufactures Good G in a constant-cost, perfectly competitive market. Anderson Company is currently earning positive economic profit.

(c) On your graphs in part (b), show what will happen to each of the following if the market for Good G adjusts to long-run equilibrium.

(i) The market equilibrium price and quantity, labeled P_2 and Q_2, respectively (ii) Anderson Company's profit-maximizing price and quantity, labeled $P*$ and $Q*$, respectively

Question 1

2023 Set 2 ▪ Q1

Anderson Company is a typical firm that manufactures Good G in a constant-cost, perfectly competitive market. Anderson Company is currently earning positive economic profit.

(d)(i) Assume the production of Good G creates benefits for third parties. Given this situation, will the market equilibrium quantity be greater than, less than, or equal to the allocatively efficient quantity? Explain.

(d)(ii) The government takes an action that corrects the externality in the market for Good G. As a result of the government's action, does total economic surplus increase, decrease, or stay the same? Explain.

Solution 1

(a)

Mark scheme

- Anderson Company's accounting profit must be greater than its economic profit. Accounting profit = total revenue − explicit costs, while economic profit = total revenue − (explicit costs + implicit costs). Because implicit costs are positive, subtracting them further reduces the total, so economic profit is lower than accounting profit.

Solution 1

(b) Mark scheme

- Draw correctly labeled side-by-side graphs for the market and for Anderson Company. Market graph: downward-sloping demand (D) and upward-sloping supply (S), with their intersection labeled market equilibrium price P_M and quantity Q_M [1 point]. Firm graph: a horizontal demand/marginal-revenue curve (d = MR) extended from P_M, with the firm's price labeled P_F ($= P_M$) [1 point]. Add a rising marginal cost (MC) curve intersecting d = MR at the profit-maximizing quantity, labeled Q_F, where MR = MC [1 point]. Add an average total cost (ATC) curve that sits below the d = MR curve at Q_F, with the MC curve passing through the minimum point of ATC [1 point]. Shade completely the rectangle bounded above by P_F (d = MR) and below by ATC at

Solution 1

Q_F to represent Anderson Company's positive economic profit [1 point]. Total: 5 points for the five required graph elements.

Solution 1

(c) Mark scheme

- On the graphs from part (b), show the long-run adjustment: (i) On the market graph, draw a rightward shift of the supply curve (S to S_2), producing a lower market equilibrium price, labeled P_2, and a greater market equilibrium quantity, labeled Q_2 [1 point]. (ii) On the firm's graph, show the new lower price P^* extended from the new market equilibrium price P_2 (giving the firm a new demand/MR curve $d_2 = MR_2$), and a lower profit-maximizing quantity, labeled Q^*, at the new equilibrium where $P^* = MR_2 = MC =$ minimum ATC (zero economic profit in the long run) [1 point]. Total: 2 points.

Solution 1

(d)(i)

Mark scheme

- The market equilibrium quantity will be less than the allocatively efficient quantity. Because production of Good G creates benefits for third parties (a positive production externality), the marginal social cost (MSC) is less than the marginal private cost (MPC) at the market equilibrium. Since the market only reflects MPC (not MSC), it under-produces relative to the allocatively efficient output level where price equals MSC.

Solution 1

(d)(ii)

Mark scheme

- Total economic surplus will increase. Accept an explanation using ONE of the following: the quantity produced will increase toward the allocatively efficient quantity; the deadweight loss will decrease to $0; the marginal private cost will rise to equal the marginal social cost, internalizing the externality (e.g., via a per-unit subsidy).

Question 3

2023 Set 2 ▪ Q3

The graph shows the cost and revenue curves for an unregulated, profit-maximizing monopoly.

[Graph of Price, Cost (vertical axis) vs. Quantity (horizontal axis) for a monopoly. Four downward-sloping curves are drawn from a common region on the left: a steep straight-line "Demand" curve, a steeper straight-line "Marginal Revenue" curve below it, a curved "Average Total Cost" curve, and a curved "Marginal Cost" curve that dips down and then rises, crossing the other curves. Horizontal dashed price levels from top to bottom: P_7 (the vertical-axis intercept of Demand), P_6, P_5, P_4, P_3, P_2 (just below P_3), and P_1 (drawn as a solid horizontal line). Vertical dashed quantity levels from left to right: Q_1, Q_2, Q_3, Q_4. Labeled points on the curves: point *a* at (Q_1, P_6) on the Demand curve; point *b* at (Q_2, P_5) on the Demand curve; point *e* at (Q_2, P_4) on the Average Total Cost curve; point *h* at (Q_2, P_3) on the Marginal Cost curve; point *f* at

Question 3

(Q_2, P_1) on the Marginal Revenue curve; point *c* at $(Q_3, P_3–P_2$ region$)$ where Demand, Average Total Cost, and Marginal Cost curves appear to intersect; point *d* at (Q_4, P_2) on the Average Total Cost curve; point *j* at (Q_3, P_1) on the Marginal Revenue curve; point *g* at (Q_4, P_1) on the Marginal Cost curve. Curves are labeled directly on the graph: "Average Total Cost", "Marginal Cost", "Demand", "Marginal Revenue".]

(a) Is the firm shown in this graph a natural monopoly? Explain.

(b) Using the labeling from the graph, identify the area representing the deadweight loss for this profit-maximizing monopoly.

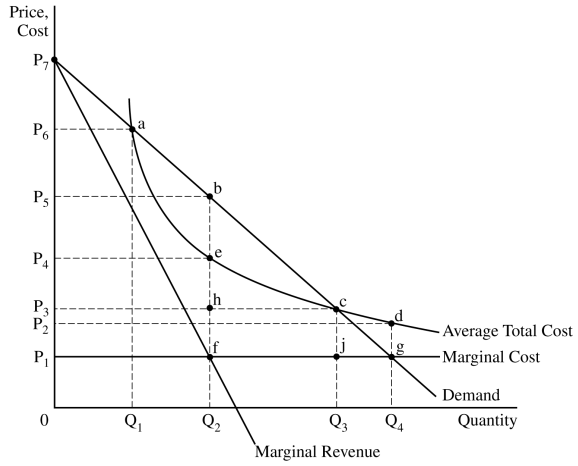
(c)(i) In order to improve resource allocation, the government sets a price that results in the firm earning zero economic profit. Using the labeling from the graph, identify the price and resulting quantity the firm would produce.

(c)(ii) Will this government policy eliminate the deadweight loss? Explain using labeling from the graph.

Question 3

(d) Instead, the government decides to set a price that results in the socially optimal quantity of output. Will the firm earn positive, negative, or zero economic profit? Explain using labeling from the graph.

Question 3


Price,
Cost
P7
P6
P5
P4
P3
P2
P1
0
Q1
Q2
Q3
Q4
Quantity
a
b
c
d
e
f
g
h
j
Average Total Cost
Marginal Cost
Demand
Marginal Revenue

Solution 3

(a)

Mark scheme

- Yes, this firm is a natural monopoly, because it experiences decreasing (falling) average total cost over the entire effective range of demand for its product — average total cost is still declining at the quantity the firm would produce, so a single firm can supply the whole market at lower average cost than multiple firms could.

Solution 3

(b)

Mark scheme

- The area of deadweight loss is triangle bfg, equal to $\frac{1}{2} \times (P_5 - P_1) \times (Q_4 - Q_2)$ — one-half times the vertical distance between the profit-maximizing monopoly price and the efficient (marginal-cost) price, times the horizontal distance between the efficient quantity and the profit-maximizing monopoly quantity.

Solution 3

(c)(i)

Mark scheme

- The regulated (marginal-cost) price is P_3 and the resulting regulated quantity is Q_3.

Solution 3

(c)(ii)

Mark scheme

- No, this policy will not eliminate the deadweight loss completely. Accept an explanation using ONE of: area cjg remains as deadweight loss; the deadweight loss is only reduced by area bfjc, not eliminated entirely; P_3 is still greater than (or not equal to) marginal cost at Q_3; Q_3 is still less than (or not equal to) the socially optimal quantity Q_4.

Solution 3

(d)

Mark scheme

- The firm will earn negative economic profit at the socially optimal (allocatively efficient) quantity Q_4. Accept an explanation using ONE of: at Q_4, average total cost (P_2) is greater than price (P_1); the area of negative economic profit at Q_4 is rectangle P_1P_2dg; the area of negative economic profit equals $(P_2 - P_1) \times Q_4$.

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 1

2022 Set 2 ▪ Q1

Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.

(a) Assume Frank Sugar Co. is earning zero economic profit. Draw correctly labeled side-by-side graphs for the sugar market and Frank Sugar Co. and show each of the following.

(i) The market equilibrium price and quantity, labeled P_M and Q_M, respectively (ii) The profit-maximizing price and quantity for Frank Sugar Co., labeled P_F and Q_F, respectively

Question 1

2022 Set 2 ▪ Q1

Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.

(b)(i) Assume the demand for sugar increases and sugar is produced in a constant-cost industry.

On your graph in part (a), show the short-run effect of the increased demand for sugar on the market price, labeled P_2, and the quantity sold by Frank Sugar Co., labeled Q_N.

(b)(ii) Compared to the equilibrium identified in part (a)(ii), what will happen to the short-run profit earned by Frank Sugar Co. as a result of the increased demand for sugar?

(b)(iii) When the market adjusts to long-run equilibrium, how will the market price of sugar in the long run compare to P_2 ? Explain.

Question 1

2022 Set 2 ▪ Q1

Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.

(c) Instead, assume sugar consumption has a negative impact on public health over time and the negative impact of sugar on health is underestimated by consumers. Draw a correctly labeled graph of the market, with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.
(i) The market equilibrium quantity, labeled Q_M (ii) The socially optimal quantity, labeled Q_S

Question 1

2022 Set 2 ▪ Q1

Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.

(d) Assume the government decides to intervene in the market to affect consumers' incentives and to address the negative impact of sugar consumption on public health. Which of the following policies would best achieve that objective in the short run: a lump-sum tax, a per-unit tax, a lump-sum subsidy, or a per-unit subsidy? Explain.

Solution 1

(a) Mark scheme

- Draw two side-by-side graphs. Market graph: upward-sloping supply (S) and downward-sloping demand (D) curves crossing at the equilibrium price P_M and quantity Q_M (1 pt — correctly labeled axes/curves/P_M/Q_M). Firm graph: a horizontal line at $P_F = P_M$ labeled d = MR, representing the price-taking firm's demand/marginal-revenue curve (1 pt). An upward-sloping MC curve crossing d = MR at quantity Q_F, the profit-maximizing output where MR = MC (1 pt). A U-shaped ATC curve drawn tangent to (just touching) the d = MR line at Q_F, with the MC curve passing through ATC's minimum point — this shows P_F = ATC, i.e. the firm earns zero economic profit (1 pt).

Solution 1

(b)(i)

Mark scheme

- On the market graph, shift the demand curve rightward from D to D , raising the equilibrium price from P_M to a higher price labeled P_2 (equilibrium quantity rises from Q_M to Q_2). On the firm's graph, shift the horizontal d = MR line upward to the new price P_2 (labeled d = MR); the firm's profit-maximizing quantity, where MR = MC, rises from Q_F to a higher quantity labeled Q_N.

Solution 1

(b)(ii)

Mark scheme

- The short-run profit earned by Frank Sugar Co. will increase. At the new price P_2, price exceeds ATC at Q_N (whereas at P_F price equaled ATC, i.e. zero economic profit), so the firm now earns positive economic profit.

Solution 1

(b)(iii)

Mark scheme

- The long-run market price will be lower than P_2 (it will fall back to P_M). Explanation: the positive economic profit earned at P_2 attracts new firms to enter the sugar market; entry increases market supply, shifting the supply curve rightward and driving the market price back down until it reaches P_M, where firms again earn zero economic profit.

Solution 1

(c)

Mark scheme

- Draw a graph with an upward-sloping marginal private cost curve (MPC) and a downward-sloping marginal private benefit curve (MPB); their intersection gives the market equilibrium quantity Q_M (1 pt). Add a marginal social benefit curve (MSB) drawn below/to the left of MPB (since consumers underestimate sugar's harm to health, so MSB $<$ MPB at each quantity), label the upward-sloping cost curve MPC $=$ MSC (no production externality), and mark the socially optimal quantity Q_S at the intersection of MSB and MSC, with $Q_S < Q_M$ (1 pt).

Solution 1

(d)

Mark scheme

- A per-unit tax would best achieve the objective in the short run. Explanation: a per-unit tax raises the effective price consumers pay per unit of sugar, directly changing consumers' marginal incentives and reducing the quantity consumed toward the socially optimal quantity Q_S — unlike a lump-sum tax (which does not change the per-unit price/marginal incentive) or a subsidy (which would increase, not decrease, consumption).

Question 3

2022 Set 2 ▪ Q3

The graph provided shows the demand (D), long-run average total cost (LRATC), marginal cost (MC), and marginal revenue (MR) curves for a natural monopoly.
[Graph titled "Price, Cost
()"$onthey-axis(valuesmarkedat6, 10, 13, 15, 23, 40)and"Quantity"onthex-axis(valuesmarkedat34, 50, 60).Adownward-slopingdemandcurve(D)startsat(0, 40)andslopesdowntotheright, passingthroughapproximately($
$slopingmarginalrevenuecurve(MR)startsat(0, 40)andfallsmoresteeply, crossingthequantityaxisne$
$34.Thelong-runaveragetotalcostcurve(LRATC)isU-$
shaped, *startinghighontheleft*, *decliningtoaminimumofabout*6 near Q = 34, then rising gently through about (50, 10) toward (60, 13) and beyond. The marginal cost curve (MC) is upward-sloping, starting below LRATC, crossing LRATC at its minimum point (about Q = 34, price $6), and rising to intersect MR at Q = 34 and to intersect the

Question 3

demand curve (D) at approximately (60, 15). Dashed reference lines connect price levels 23, 15, 13, 10, 6 on the y-axis to quantities 34, 50, 60 on the x-axis, marking the curve intersections.]

(a) Over the output range of 0 to 60 units, is this firm experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain.

(b) Using numbers from the graph, identify the price and quantity produced at which the monopolist earns zero economic profit.

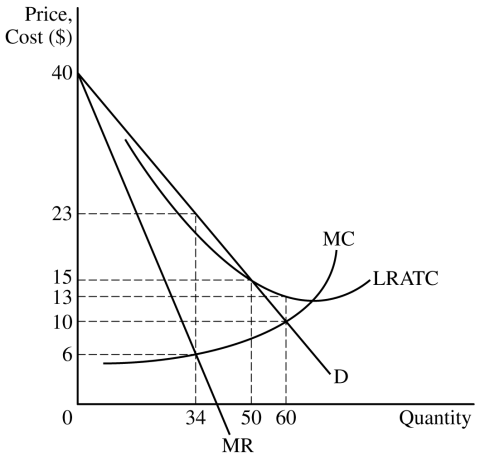
(c)(i) Assume that regulators impose a price ceiling that results in the firm producing the socially optimal quantity in the short run.

Calculate the total revenue at the price ceiling. Show your work.

(c)(ii) Explain why the firm requires a subsidy to continue producing in the long run.

(c)(iii) Calculate the lump-sum subsidy that would be required for the monopolist to produce the socially optimal quantity in the long run. Show your work.

Question 3



Solution 3

(a)

Mark scheme

- The firm is experiencing economies of scale over the range of 0 to 60 units. Explanation: the long-run average total cost (LRATC) curve is downward sloping over that output range, meaning average cost falls as output increases.

Solution 3

(b)

Mark scheme

- Price = \$15 and quantity = 50 units — read off the graph as the price and quantity where the monopolist's demand curve intersects the LRATC curve (price = average total cost, so economic profit is zero).

Solution 3

(c)(i)

Mark scheme

- Total Revenue = Price $\times$ Quantity = \$10 $\times$ 60 = \$600, using the price-ceiling price (\$10, the price at which the firm produces the socially optimal quantity, i.e. where P = MC) and the socially optimal quantity (60 units).

Solution 3

(c)(ii)

Mark scheme

- At the socially optimal quantity (60 units) under the price ceiling, the firm earns negative economic profit in the short run because price (10) *is less than average total cost* $(LRATC = 13)$ at that quantity. Sustained losses mean the firm cannot continue producing at that price/quantity in the long run without a subsidy.

Solution 3

(c)(iii)

Mark scheme

- Lump-sum Subsidy = (LRATC − Price) × Quantity = ($13 − $10) × 60 = $180.

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 2

2021 Set 2 ▪ Q2

Copper is produced in a perfectly competitive market with an upward-sloping supply curve and a downward-sloping demand curve. Assume the production of copper results in liquid waste, which seeps into local rivers. The contaminated river water causes human illnesses and crop failures downstream. The marginal external cost from producing copper is constant across all quantities of copper produced.

(a)(i) Draw a correctly labeled graph of the copper market with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.

The market equilibrium quantity, labeled Q_M

(a)(ii) Draw a correctly labeled graph of the copper market with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.

Question 2

The socially efficient quantity, labeled Q_S

Question 2

2021 Set 2 ▪ Q2

Copper is produced in a perfectly competitive market with an upward-sloping supply curve and a downward-sloping demand curve. Assume the production of copper results in liquid waste, which seeps into local rivers. The contaminated river water causes human illnesses and crop failures downstream. The marginal external cost from producing copper is constant across all quantities of copper produced.

(b) Suppose the demand for copper decreases. On your graph in part (a), show the deadweight loss at the new market equilibrium, shaded completely.

Question 2

2021 Set 2 ▪ Q2

Copper is produced in a perfectly competitive market with an upward-sloping supply curve and a downward-sloping demand curve. Assume the production of copper results in liquid waste, which seeps into local rivers. The contaminated river water causes human illnesses and crop failures downstream. The marginal external cost from producing copper is constant across all quantities of copper produced.

(c)(i) Suppose the government is considering levying a tax on copper.
What per-unit tax level would achieve the socially optimal quantity?

(c)(ii) Explain why a lump-sum tax on producers will not achieve the socially optimal quantity in the short run.

Solution 2

(a)(i)

Mark scheme

- Draw an upward-sloping marginal private cost (MPC) curve and a downward-sloping marginal private benefit (MPB) curve. Label the market equilibrium quantity, where MPC = MPB, as Q_M on the horizontal axis.

Solution 2

(a)(ii)

Mark scheme

- Add a marginal social cost (MSC) curve drawn above the MPC curve at every output level (reflecting a negative production externality, e.g. pollution from copper mining/production). Label the socially efficient quantity Q_S, where MSC = MPB (= MSB), lying to the left of Q_M (i.e., $Q_S < Q_M$).

Solution 2

(b)

Mark scheme

- Shift the demand curve (MPB = MSB) leftward to MPB' = MSB'. The new market equilibrium quantity Q'_M (where MPC = MPB') and the new socially efficient quantity Q'_S (where MSC = MPB') both fall, with $Q'_S < Q'_M$. Shade the deadweight loss as the fully-enclosed triangle bounded by the MSC curve and the MPB' (=MSB') curve over the output range between Q'_S and Q'_M.

Solution 2

(c)(i)

Mark scheme

- The per-unit tax that achieves the socially optimal quantity equals the marginal external cost at that quantity: tax = MSC − MPC (the vertical gap between MSC and MPC, evaluated at the socially efficient quantity Q_S).

Solution 2

(c)(ii)

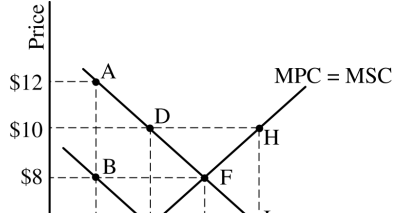
Mark scheme

- A lump-sum tax on producers will not achieve the socially optimal quantity in the short run because a lump-sum tax is a fixed cost — it raises total cost and average cost but does not change marginal cost. Since a firm's output decision depends on marginal cost (producing where MPC = MPB), quantity stays at Q_M rather than falling to Q_S.

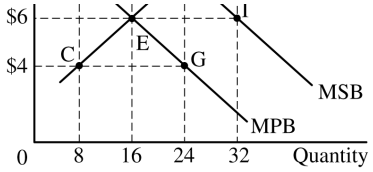
Question 2

2018 ▪ Q2

2. Modern-day word processing software gives consumers the ability to create and save documents in different file formats that can then be accessed by multiple computer operating systems. The graph below depicts a perfectly competitive market for word processing software. In the graph, MSB is the marginal social benefit, MPB is the marginal private benefit, MPC is the marginal private cost, and MSC is the marginal social cost.



Question 2



(a) Identify the type of market failure illustrated by the graph. Explain.

(b) Using the numbers on the graph, identify the market equilibrium price and quantity.

(c) Using the labeling on the graph, identify the area representing the deadweight loss at the quantity identified in part (b).

(d) Suppose the government is considering granting a subsidy to correct the market failure. What is the dollar value of the per-unit subsidy that would achieve the socially optimal quantity?

(e) Suppose the government does not grant the subsidy and instead imposes a price floor at $8.

(i) How many units will consumers and producers exchange at the price floor?

Question 2

(ii) Does the price floor correct the market failure? Explain.

Solution 2

(a)

Mark scheme

- The graph illustrates a positive externality (in production or consumption). Explanation: marginal social benefit is greater than marginal private benefit (MSB $>$ MPB) — equivalently, the market equilibrium quantity is less than the socially optimal quantity.

Solution 2

(b)

Mark scheme

- Market equilibrium price = \$6; market equilibrium quantity = 16 units.

Solution 2

(c)

Mark scheme

- The deadweight loss at the market quantity of 16 units is the triangular area labeled DEF on the graph — the region between the MSB and MSC (supply) curves, spanning from the market quantity (16 units) out to the socially optimal quantity.

Solution 2

(d)

Mark scheme

- The per-unit subsidy needed to achieve the socially optimal quantity is $4.

Solution 2

(e)(i)

Mark scheme

- At a price floor of 8, $consumersandproducerswillexchange8units(thequantitydemandedatthe8$ price floor, which is below the quantity supplied, so the shorter side of the market — quantity demanded — determines the amount actually exchanged).

Solution 2

(e)(ii)

Mark scheme

- No, the $8 price floor does not correct the market failure. Explanation (any one of): the quantity exchanged in the market (8 units) is still less than the socially optimal quantity; marginal social benefit is greater than marginal social cost (MSB $>$ MSC) at a quantity of 8 units; or the deadweight loss increased after the price floor was imposed compared to the unregulated market outcome.