

Past-paper walk-through

Changes in Factor Demand and Factor Supply ■ 5.2

eXercise

Questions in this set

- 2025 Set 1 Q1
- 2025 Set 2 Q2
- 2023 Set 1 Q1
- 2021 Set 1 Q2
- 2019 Set 2 Q1
- 2018 Q1

Reading the mark scheme

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

Question 1

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)

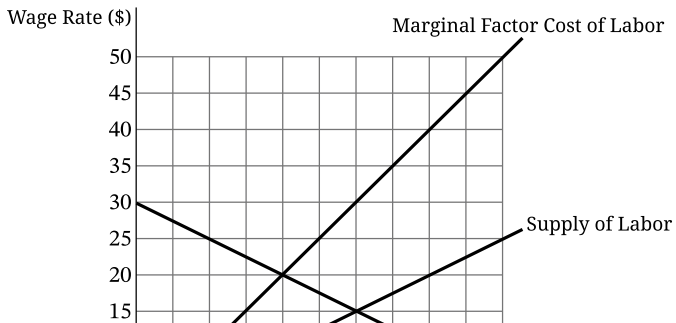
Mark scheme

- 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.

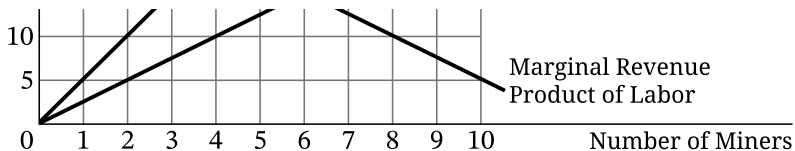
Question 2

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 $\text{MRP} = \text{marginal product of labor} \times \text{marginal revenue (price) of quartz}$, 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 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:

$$\frac{2,500}{\$500} = \frac{1,000}{\text{Wage Rate}}, \text{ so } 5 = \frac{1,000}{\text{Wage Rate}}, \text{ giving Wage Rate} = \$200.$$

Question 2

2021 Set 1 ■ Q2

Assume that Schmitt Inc. provides car parking services in a perfectly competitive output market and hires labor in a perfectly competitive input market. The market price per car parked is 10, the daily market wage per worker is 100, and fixed costs are \$50 per day. The table above shows the number of workers required to park different quantities of cars per day.

Number of Workers	Number of Parked Cars
0	0
1	8
2	20
3	34
4	45
5	54
6	60
7	63

Question 2

- (a)** Calculate the marginal revenue product of the second worker. Show your work.
- (b)** How many workers will Schmitt Inc. hire to maximize profit? Relative to this number of hired workers, explain why Schmitt Inc. will not hire one additional worker. Your answer must use marginal analysis and numbers from the table.
- (c)** Calculate the daily profit for Schmitt Inc. at the profit-maximizing quantity identified in part (b). Show your work.
- (d)(i)** Suppose new legislation requires each worker in the parking industry to purchase an individual insurance policy at the worker's expense in order to legally park cars. Will the market wage paid by a typical firm in this industry increase, decrease, or stay the same in the long run?
- (d)(ii)** For a typical firm in the industry, will the number of workers hired in the short run increase, decrease, or stay the same? Explain.

Solution 2

(a)

Mark scheme

- Marginal Revenue Product (MRP) of the 2nd worker = \$120. Work:

$$MRP = \frac{\Delta TR}{\Delta L} = \frac{(20 - 8)}{(2 - 1)} \times \$10 = 12 \times \$10 = \$120, \text{ equivalently}$$

$$\frac{\$200 - \$80}{2 - 1} = \$120 \text{ (using total output of 8 and 20 units at 1 and 2 workers respectively, and an output price of \$10).}$$

Solution 2

(b)

Mark scheme

- Schmitt Inc. will hire 4 workers. Explanation: a firm hires workers up to the point where $MRP = \text{wage}$ (marginal factor cost), and stops before MRP falls below the wage. Schmitt will not hire a 5th worker because the MRP of the 5th worker is \$90 (computed as $(54 - 45) \times \$10 = \90), which is less than the \$100 wage — hiring the 5th worker would cost \$100 but add only \$90 in revenue, reducing profit.

Solution 2

(c)

Mark scheme

- Daily profit = £0. Work: $\text{Profit} = TR - TC = (£10 \times 45) - (£50 + 4 \times £100) = £450 - (£50 + £400) = £450 - £450 = £0$, using output price £10 times the 45 units of output produced by the 4 hired workers, minus fixed cost £50 plus the wage bill of 4 workers at £100 each.

Solution 2

(d)(i)

Mark scheme

- The market wage will increase. Requiring each worker to purchase an individual insurance policy at their own expense raises the effective cost of working, so the market supply of labor decreases (shifts left/up), which raises the equilibrium market wage in the long run.

Solution 2

(d)(ii)

Mark scheme

- The number of workers hired by a typical firm will decrease. Explanation: the market supply of workers decreases because of the new insurance requirement, which drives up the market wage; a higher wage raises the marginal factor cost (marginal resource cost, MFC) faced by the typical firm, so the firm hires fewer workers at its new profit-maximizing point where $MRP = MFC$.

Question 1

2019 Set 2 ■ Q1

Gigantic Pharmaceutical Corporation has a patent on a prescription drug, making it the only manufacturer of that prescription drug. Gigantic is currently earning a positive economic profit.

- (a)** Draw a correctly labeled graph for Gigantic and show each of the following.
- (i) The profit-maximizing quantity, labeled Q_G
 - (ii) The profit-maximizing price, labeled P_G
 - (iii) The average total cost curve, labeled ATC
 - (iv) The area representing the consumer surplus, shaded completely

Question 1

2019 Set 2 ■ Q1

Gigantic Pharmaceutical Corporation has a patent on a prescription drug, making it the only manufacturer of that prescription drug. Gigantic is currently earning a positive economic profit.

(b)(i) Suppose the demand for the prescription drug increases, and Gigantic hires its warehouse workers in a perfectly competitive labor market. What will happen to Gigantic's demand for warehouse workers? Explain.

(b)(ii) What will happen to the wage rate Gigantic pays its warehouse workers and the number of warehouse workers it hires?

Question 1

2019 Set 2 ■ Q1

Gigantic Pharmaceutical Corporation has a patent on a prescription drug, making it the only manufacturer of that prescription drug. Gigantic is currently earning a positive economic profit.

(c)(i) After Gigantic's patent expires, another firm enters the prescription drug market and produces an identical drug that sells for a lower price. What will happen to Gigantic's producer surplus?

(c)(ii) What will happen to the consumer surplus in this prescription drug market? Explain.

Solution 1

(a) Mark scheme

- Correctly labeled monopoly graph for Gigantic, earning 1 point each for: (1) downward-sloping demand (D) and marginal revenue (MR) curves, with MR below D; (2) the profit-maximizing quantity Q_G shown where $MR = MC$; (3) the profit-maximizing price P_G shown from the demand curve at Q_G , positioned above the average total cost (ATC) curve at that quantity; (4) a rising marginal cost (MC) curve that passes through the minimum point of the ATC curve; (5) the consumer surplus completely shaded as the triangular area bounded above by the demand curve D, below by the price P_G , and to the right by the vertical line at Q_G (from the price axis to where D meets that vertical line).

Solution 1

(b)(i)

Mark scheme

- Gigantic's demand for warehouse workers will increase. Because Gigantic hires labor in a perfectly competitive labor market, the increase in demand for the prescription drug raises the product's price, which raises the marginal revenue product of labor ($MRP = MPL \times \text{price}$), shifting Gigantic's labor demand curve to the right.

Solution 1

(b)(ii)

Mark scheme

- The wage rate Gigantic pays its warehouse workers will not change (Gigantic is a wage-taker in a perfectly competitive labor market, facing a horizontal/perfectly elastic labor supply curve), while the number of warehouse workers it hires will increase, since the rightward shift in labor demand is met along that fixed wage.

Solution 1

(c)(i)

Mark scheme

- Gigantic's producer surplus will decrease. Once the patent expires and a rival firm sells an identical drug at a lower price, Gigantic loses its monopoly pricing power, so its producer surplus falls.

Solution 1

(c)(ii)

Mark scheme

- Consumer surplus in the prescription drug market will increase. The new entrant increases competition, which decreases the price and increases the quantity sold in the market, both of which enlarge the area of consumer surplus.

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 Q_m shown where $MR = MC$ (MC crosses MR); (4) the profit-maximizing price P_m read off the demand curve directly above Q_m (go up from Q_m 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 P_m , at quantity Q_m , with the ATC curve drawn above the demand curve (and thus above P_m) at Q_m — since $ATC > P_m$ at Q_m , the firm is making a loss. The shaded loss area = $(ATC - P_m) \times Q_m$.

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 Q_m .
Explanation (any one of): the monopolist is operating on the elastic portion of the demand curve at Q_m ; 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 Q_m (since Q_m 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').