

Past-paper walk-through

Short-Run Production Costs ■ 3.2

eXercise

Questions in this set

- 2026 Q2
- 2024 Set 2 Q2
- 2023 Set 1 Q3
- 2017 Q2

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 2

2026 ■ Q2

The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Question 2

Protecto produces and sells as many helmets as it wants at a market price of 60 each, and Protecto's fixed cost is 80.

- (a) Identify the market structure in which Protecto sells helmets.
- (b) Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.
- (c) Calculate Protecto's economic profit when it sells 5 helmets. Show your work.
- (d) Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.
- (e) Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

Question 2

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Question 2

2024 Set 2 ■ Q2

2. The table provided shows the short-run production function for Lowen Feline, a profit-maximizing firm that produces cat food.

Number of Workers	Total Quantity of Cat Food (bags)
0	0
1	5
2	12
3	18
4	23
5	27
6	30
7	32

Question 2

8	33
9	32

Lowen Feline sells as many bags of cat food as it wants at a market price of \$10 per bag and hires as many workers as it wants at a market wage of \$18.

- (a) Lowen Feline's fixed cost is \$90. Calculate the average fixed cost if Lowen Feline hires 6 workers. Show your work.
- (b) Assume labor is the only variable input to Lowen Feline. Calculate the marginal cost if Lowen Feline increases output from 27 to 30 units. Show your work.
- (c) With the hiring of which worker do diminishing marginal returns begin? Explain using numbers.
- (d) Determine the profit-maximizing number of workers Lowen Feline will hire. Explain using marginal analysis.

Question 2

(e) In the long run, a rival company, Gato Food, increases its production from 40 to 50 units, and its total cost increases from \$600 to \$900. Over the output range of 40 to 50 units, is Gato Food experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain using numbers.

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

- Average Fixed Cost = Total Fixed Cost / Quantity of Output = $90/30 = 3$. (6 workers correspond to 30 units of output on Lowen Feline's production schedule.)

Solution 2

(b)

Mark scheme

- Marginal Cost = Change in Total Variable Cost / Change in Output = $(108 - 90) / (30 - 27) = 18/3 = 6$. (Equivalently, Marginal Cost = Change in Total Cost / Change in Output = $(198 - 180) / (30 - 27) = 18/3 = 6$.)

Solution 2

(c)

Mark scheme

- Diminishing marginal returns to labor begin with the hiring of the 3rd worker. Explanation using numbers: the marginal product of the 1st worker is 5 bags, the marginal product of the 2nd worker increases to 7 bags, and the marginal product of the 3rd worker decreases to 6 bags — since marginal product starts falling with the 3rd worker, that is where diminishing marginal returns begin.

Solution 2

(d)

Mark scheme

- The profit-maximizing number of workers is 7. Explanation using marginal analysis: a firm hires labor up to the point where the marginal revenue product (MRP) of the last worker is at least equal to the marginal factor cost (MFC) of that worker (the wage). The MRP of the 7th worker (20) is greater than the MFC of the 7th worker (wage = 18), so hiring the 7th worker adds to profit; hiring an 8th worker would decrease profit because the MRP of the 8th worker (10) is less than the MFC of the 8th worker (wage = 18). So Lowen Feline stops hiring at 7 workers.

Solution 2

(e)

Mark scheme

- Gato Food is experiencing diseconomies of scale. Explanation using numbers: as output rises from 40 to 50 units, long-run average total cost rises from 15 *per unit* ($600 / 40 = 15$) to 18 per unit ($900 / 50 = 18$). Because long-run average total cost increases as output increases over this range, Gato Food is experiencing diseconomies of scale.

Question 3

2023 Set 1 ■ Q3

The graph provided shows the demand (d), marginal revenue (MR), average total cost (ATC), average variable cost (AVC), and marginal cost (MC) curves for Hansel Hangout, a typical profit-maximizing firm in a perfectly competitive market producing Good X.

[Graph with y-axis "Price, Cost (\$) showing gridline values 8, 9, 11, 14, 20, 21, 26 and x-axis "Quantity" showing gridline values 4, 6, 8, 10. Curves shown, labeled left to right along the right side: MC (rising marginal cost curve), ATC (average total cost curve, U-shaped, intersecting MC at approximately quantity 8, price 20 – 21), AVC (average variable cost curve, U-shaped, lying below ATC, with its minimum near quantity 4 – 6 around price 8 – 9), and a horizontal line = MR drawn at price 14. Dashed guidelines connect: price 26 up to the MC curve near quantity 10; price 21 and 20 near quantity 8 where MC crosses ATC; price

Question 3

= MR\$ crosses MC (near quantity 8) and also down to where it crosses AVC (near quantity 10); price 11 and 9 and 8 down near quantity 4 where AVC has its minimum.]

(a) Calculate Hansel Hangout's total fixed cost. Show your work.

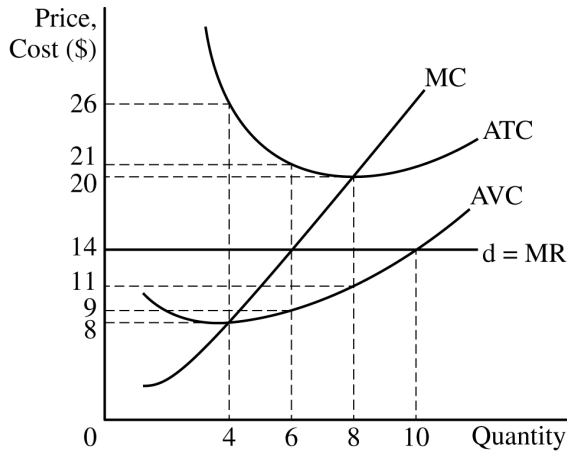
(b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.

(c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.

(d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.

(e) Assume the cross-price elasticity of demand between Good X and Good C is positive. Given the change in the long-run price of Good X in part (d), will the quantity demanded of Good C increase, decrease, or remain the same? Explain.

Question 3



Solution 3

(a)

Mark scheme

- Total Fixed Cost = (Average Total Cost – Average Variable Cost) $\times$ Quantity.
Using the $Q = 4$ row: $TFC = (26 - 8) \times 4 = 18 \times 4 = 72$. (Equivalently, from $Q = 6$: $(21 - 9) \times 6 = 72$; or from $Q = 8$: $(20 - 11) \times 8 = 72$.)

Solution 3

(b)

Mark scheme

- Price = \$14 and Hansel Hangout's profit-maximizing quantity of Good X is 6 units (the quantity from the data table where marginal revenue equals marginal cost, i.e., price equals marginal cost for this price-taking firm).

Solution 3

(c)

Mark scheme

- Economic Profit = (Price – Average Total Cost) $\times$ Quantity = $(\$14 - \$21) \times 6 = (-\$7) \times 6 = -\42 . (Equivalently, Total Revenue – Total Cost = $(\$14 \times 6) - (\$21 \times 6) = \$84 - \$126 = -\$42$.)

Solution 3

(d)

Mark scheme

- The market price of Good X will increase in the long run. Explanation: because firms are earning negative economic profit (a loss) at the current price, some firms will exit the market, shifting the market supply curve to the left (decrease in supply), which raises the market equilibrium price toward the zero-economic-profit long-run equilibrium.

Solution 3

(e)

Mark scheme

- The quantity demanded of Good C will increase. Explanation: a positive cross-price elasticity of demand between Good X and Good C indicates the two goods are substitutes in consumption; since the long-run price of Good X increases (from part (d)), demand for Good C increases (the demand curve for C shifts right), causing an increase in the quantity demanded of Good C.

Question 2

2017 ■ Q2

The table below shows the output a firm produces using different amounts of capital (K) and labor (L). The markets for capital and labor are perfectly competitive. The rental rate of capital is \$75 per unit, and the wage rate is \$200 per unit. In the short run, capital is fixed and labor is variable.

Labor	Output with K=1	Output with K=2
0	0	0
1	10	20
2	25	50
3	38	75

Question 2

- (a)** If the firm uses one unit of capital and one unit of labor, will it be operating with constant, increasing, or decreasing returns to scale? Explain using numbers from the table.
- (b)** Assume now that the firm currently has two units of capital and is using three units of labor.
- (b)(i)** Calculate the marginal product for the third unit of labor. Show your work.
- (b)(ii)** Did the firm experience diminishing marginal returns with the addition of the third unit of labor? Explain using numbers from the table.
- (b)(iii)** Calculate the firm's average total cost for its current level of production. Show your work.
- (b)(iv)** If the firm's output is sold in a competitive market, what is the lowest output price at which the third unit of labor would be hired?

Question 2

Labor	Output with $K=1$	Output with $K=2$
0	0	0
1	10	20
2	25	50
3	38	75

Solution 2

(a)

Mark scheme

- With one unit of capital and one unit of labor, the firm is operating with increasing returns to scale. Doubling both inputs (to two units of capital and two units of labor) more than doubles output – output rises from 10 units to 50 units, a five-fold increase versus only a doubling of inputs. Equivalently, average total cost falls from 27.50 to 11 when labor and capital both double, which also indicates increasing returns to scale.

Solution 2

(b)

Mark scheme

- Setup/context sentence only ('the firm currently has two units of capital and is using three units of labor') – establishes the scenario for parts (b)(i)-(iv) and carries no points of its own.

(b)(i)

Mark scheme

- Marginal product of the third unit of labor = $(\text{change in output})/(\text{change in labor}) = (75-50)/(3-2) = 25$ units. Show this work.

Solution 2

(b)(ii)

Mark scheme

- Yes, the firm experienced diminishing marginal returns with the addition of the third unit of labor, because the marginal product of the third worker (25 units) is less than the marginal product of the second worker (30 units).

Solution 2

(b)(iii)

Mark scheme

- Average total cost at 2 units of capital and 3 units of labor: $(75 \times 2)/75 + (200 \times 3)/75 = 2 + 8 = 10$ (*equivalently*, $((75 \times 2) + (200 \times 3))/75 = 750/75 = 10$). Show the capital-cost-per-unit-output plus labor-cost-per-unit-output work.

Solution 2

(b)(iv)

Mark scheme

- The lowest output price at which the firm would hire the third unit of labor is \$8. This is the price at which the value of the marginal product of the third worker ($\text{price} \times \text{MP} = \text{price} \times 25$) just covers the cost of hiring that worker, consistent with the \$200 labor cost used in the ATC calculation: $\text{price} \times 25 \geq 200$ implies $\text{price} \geq \$8$.