

Cambridge AS & A Level · Economics 9708 · Notes

Types of cost, revenue and profit, short-run and long-run production

A2

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What you need to know

By the end of this topic you should be able to:

1. **Short-run production:** fixed and variable factors; define and calculate total, average and marginal product (TP, AP, MP).
2. **The law of diminishing returns** (law of variable proportions).
3. **Short-run costs:** define and calculate fixed and variable costs, and total, average and marginal cost (TC, ATC or AC, MC), including TFC, AFC, TVC and AVC.
4. **Explain the shapes** of the short-run average and marginal cost curves.
5. **Long-run production:** no fixed factors; returns to scale.
6. **Long-run costs:** the shape of the long-run average cost (LRAC) curve and **minimum efficient scale** (MES).
7. **Economies of scale** and falling average cost; **internal** and **external** economies and diseconomies of scale.
8. **Revenue:** define and calculate total, average and marginal revenue (TR, AR, MR).
9. **Profit:** define normal, subnormal and supernormal profit, and calculate supernormal and subnormal profit.

How firms behave in each market structure is a separate topic; here you learn the costs, revenues and profits those models are built from.

Understand it

Short run and long run

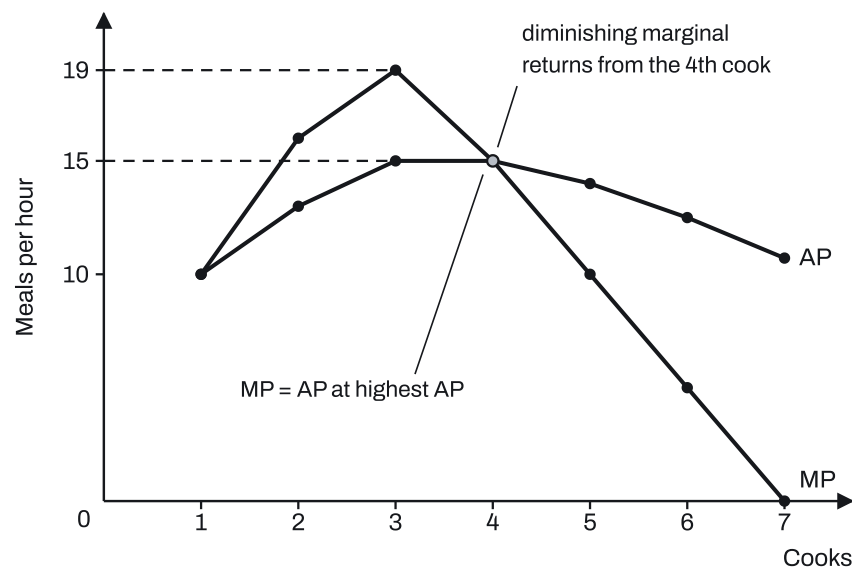
The **short run** is the period in which at least one factor of production is **fixed** (there is no time to build a bigger factory), while others, such as workers and materials, are **variable**. In the **long run all factors are variable**, so the firm can change its whole scale. Neither is a set number of months.

Total, average and marginal product

A café has a fixed kitchen and adds cooks. Output is meals per hour.

Cooks (L)	1	2	3	4	5	6	7
Total product (TP)	10	26	45	60	70	75	75
Marginal product (MP)	10	16	19	15	10	5	0
Average product (AP)	10	13	15	15	14	12.5	10.7

TP is the whole output; **AP** = $\frac{TP}{L}$ is output per worker; **MP** = $\frac{\Delta TP}{\Delta L}$ is what one more worker adds (the 4th cook adds $60 - 45 = 15$ meals).



The law of diminishing returns

At first, extra cooks let the kitchen be used properly (one cooks while another prepares), so **MP rises**. But the kitchen is fixed: once it is crowded, each extra cook has less equipment and space, so **MP falls**. That is the **law of diminishing (marginal) returns**: when more of a variable factor is added to a fixed factor, marginal product eventually falls. Here it **sets in with the 4th cook**, the first whose MP is lower than the one before. It is a **short-run** law, because it needs a fixed factor.

- **MP above AP pulls AP up; MP below AP pulls it down**, so MP cuts AP at AP's highest point (15). A new test mark above your average raises the average in the same way.
- **While MP is positive, TP still rises**; falling but positive MP means TP rises **at a falling rate**. TP is highest where MP is zero.

Short-run costs

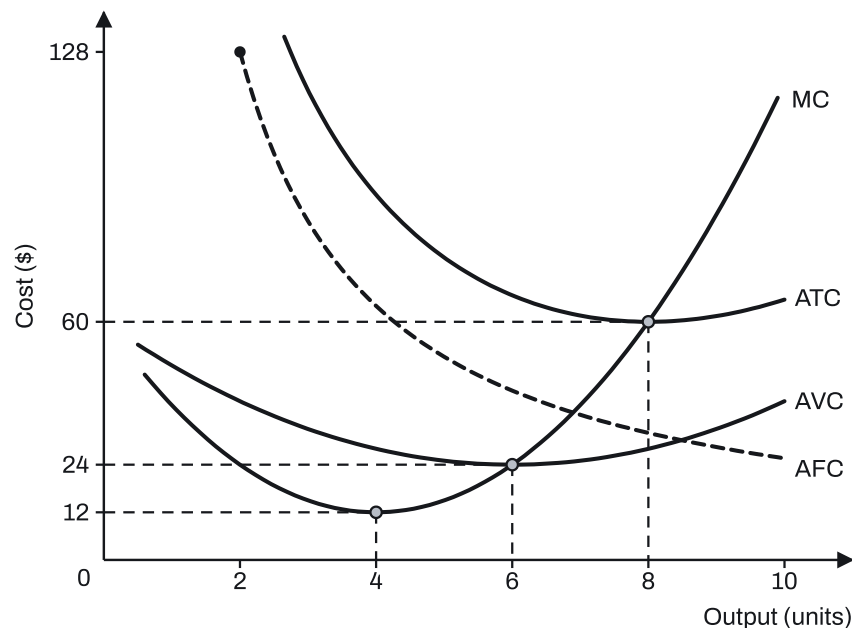
Fixed costs do not change with output in the short run and are paid even at zero output: rent, machines already bought, insurance, loan interest, a licence fee. **Variable costs** change with output: raw materials, fuel and energy, hourly wages.

$$TC = TFC + TVC \quad AFC = \frac{TFC}{Q} \quad AVC = \frac{TVC}{Q} \quad ATC = \frac{TC}{Q} = AFC + AVC$$

Marginal cost is the extra cost of producing one more unit: $MC = \frac{\Delta TC}{\Delta Q}$. Fixed cost does not change, so $\Delta TC = \Delta TVC$ and **MC does not depend on fixed costs**.

A firm with fixed costs of \$256 a day:

Output (Q)	2	4	6	8	10
TVC (\$)	80	112	144	224	400
TC (\$)	336	368	400	480	656
AFC (\$)	128	64	42.67	32	25.60
AVC (\$)	40	28	24	28	40
ATC (\$)	168	92	66.67	60	65.60



Why the short-run curves have these shapes

- **AFC falls all the time:** the same fixed cost is spread over more units, so AFC halves when output doubles (128 → 64 → 32). It never reaches zero (a rectangular hyperbola).

- **MC is U-shaped because of diminishing returns.** Each extra worker costs a wage W and adds MP units, so $MC = \frac{W}{MP}$. At \$60 an hour, the café's MC per meal is $\frac{60}{16} = \$3.75$ for the 2nd cook's meals, $\frac{60}{19} = \$3.16$ for the 3rd's, then $\frac{60}{15} = \$4$ for the 4th's. **Rising MP means falling MC; diminishing returns mean rising MC.**
- **AVC is U-shaped for the same reason:** $AVC = \frac{W}{AP}$, lowest where AP is highest.
- **MC cuts AVC and ATC at their lowest points** (the "new mark" rule): while MC is below an average, the average falls, even if MC itself is rising; once MC is above it, the average rises.
- **ATC = AVC + AFC.** Its lowest point comes at a **higher output** than AVC's (8 units against 6), because AFC is still falling after AVC starts to rise. The gap between ATC and AVC is AFC, so it narrows as output rises.

Reading a total cost curve. TC starts at TFC on the vertical axis. **MC is lowest where TC stops getting flatter and starts getting steeper.** ATC at an output is the gradient of a line from the **origin** to that point on TC, so **lowest ATC is where a line from the origin just touches TC**; lowest AVC is where a line from the **TFC intercept** just touches it, at a lower output. A long-run total cost curve starts at the origin, so lowest LRAC is also where a line from the origin touches it.

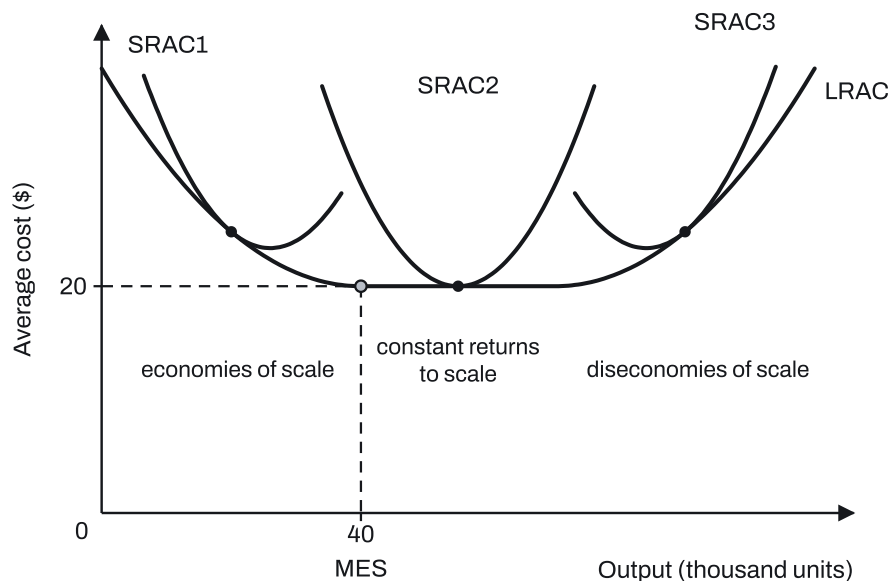
The long run: returns to scale

Returns to scale compare the change in output with a change in **all** inputs. If doubling every input more than doubles output, there are **increasing** returns to scale (average cost falls); exactly doubles, **constant** returns; less than doubles, **decreasing** returns (average cost rises).

Do not mix the two "laws". **Diminishing returns** are short run (one factor fixed) and explain the U-shape of **each SRAC** curve. **Returns to scale, and economies and diseconomies of scale**, are long run (all factors variable) and explain the shape of the **LRAC** curve.

The long-run average cost curve

For each possible size of plant there is a short-run average cost curve. In the long run the firm chooses the plant that gives the lowest average cost for the output it wants, so the **LRAC curve joins the lowest-cost points of all the SRAC curves**: it is an "envelope" that every SRAC curve touches from above.



- **Falling LRAC = economies of scale** (increasing returns to scale): bigger firms produce each unit more cheaply.
- **The lowest point, or the first point of the flat part, is the minimum efficient scale (MES)**: the smallest output at which LRAC stops falling (40 thousand here). A firm smaller than MES has a cost disadvantage.
- **Rising LRAC = diseconomies of scale** (decreasing returns to scale).

A firm on SRAC1 at an output where SRAC1 is above LRAC can cut its average cost at that output only by changing **both fixed and variable factors** to the plant that touches LRAC there: a change of scale, a long-run move.

LRAC is not always U-shaped. A firm that always enjoys economies of scale has an LRAC that **slopes down all the way**; many industries are "L"-shaped (falling, then flat). Where MES is large compared with market demand, only a few firms can produce at low cost, which tends to give oligopoly or monopoly (natural monopoly when MES is close to the whole market). Where MES is small, many firms can reach it and compete.

Economies and diseconomies of scale

Internal economies of scale are falls in a firm's long-run average cost that come from **its own growth**:

- **Technical**: larger, specialised machines; division of labour (each worker does one task and gets faster at it).
- **Purchasing (bulk buying)**: discounts on large orders of materials and equipment.
- **Financial**: big firms borrow at lower interest rates and can issue shares.
- **Marketing**: an advertising campaign's cost is spread over more units.
- **Managerial**: specialist managers (finance, marketing, production).
- **Risk-bearing**: many products, markets and customers, so a fall in one does less harm.

Internal diseconomies of scale raise LRAC as a firm grows too large: managers find it hard to **coordinate and control** many sites and staff; **communication** is slower through many layers of management; workers feel remote, so **morale and motivation** fall.

External economies of scale come from the growth of the **whole industry** or its concentration in one area: a pool of skilled workers, local colleges that train them, nearby specialist suppliers, better transport links.

External diseconomies: congestion, and higher rents, wages or input prices as many firms compete for the same resources.

On a diagram, **internal** economies and diseconomies are **movements along** one LRAC; **external** economies **shift the whole LRAC down** (diseconomies shift it up).

Revenue

$$TR = P \times Q \quad AR = \frac{TR}{Q} = P \quad MR = \frac{\Delta TR}{\Delta Q}$$

AR always equals the price, so **the AR curve is the firm's demand curve**.

- A **price taker** (a firm in perfect competition) sells every unit at the market price, so $AR = MR = P$: one horizontal line.
- A firm facing a **downward-sloping demand curve** must cut the price on all its units to sell one more, so **MR is below AR**. For a straight-line AR, MR falls twice as steeply. With $P = 20 - Q$: at $Q = 4$, $TR = 64$; at $Q = 5$, $TR = 75$; so the 5th unit's MR is \$11, below its price of \$15. TR is largest where $MR = 0$.

Normal, supernormal and subnormal profit

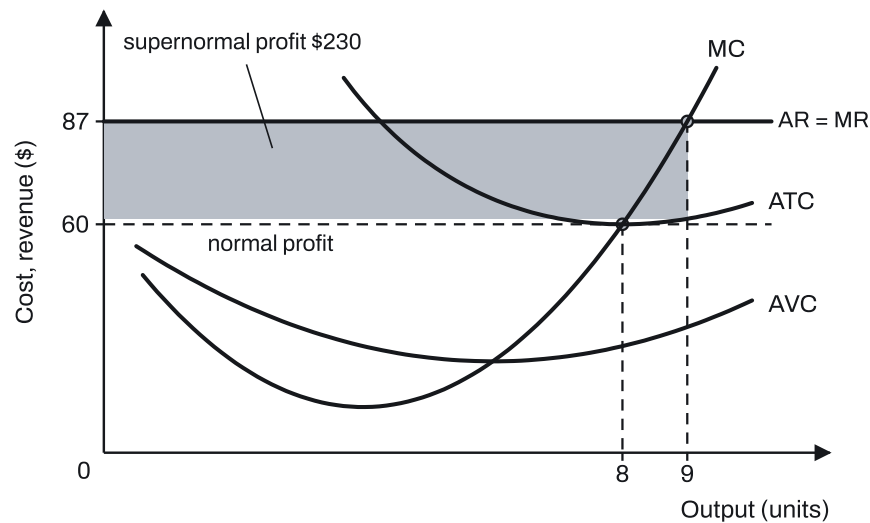
Economists count the owner's **opportunity cost** as a cost. **Normal profit** is the minimum profit needed to keep the firm in its industry in the long run, what the owner's money and effort could earn in their next best use. It is **included in total cost**, so when $TR = TC$ (that is, $AR = ATC$) the firm is making normal profit.

- **Supernormal (abnormal, excess) profit**: $TR > TC$, or $AR > ATC$.
- **Subnormal profit** (a loss): $TR < TC$, or $AR < ATC$.

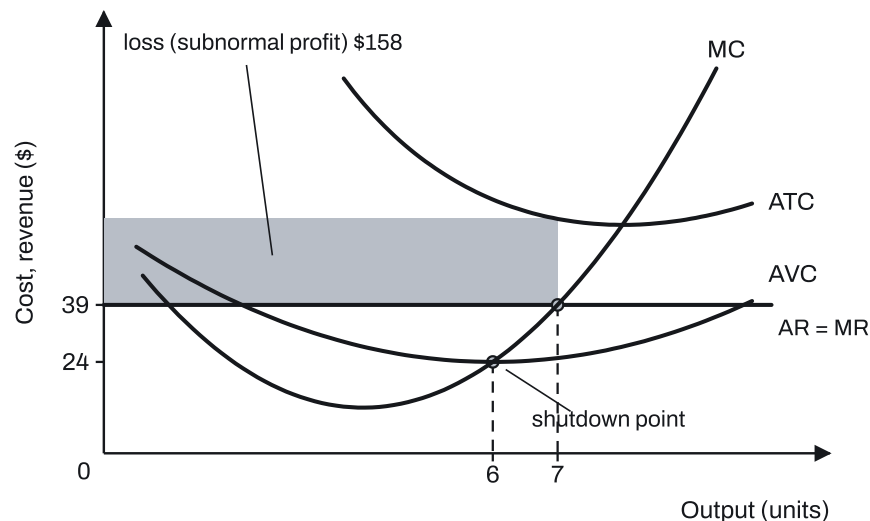
$$\text{supernormal (or subnormal) profit} = TR - TC = (AR - ATC) \times Q$$

A profit-maximising firm produces where $MC = MR$ (with MC rising through MR): every unit before that adds more to revenue than to cost.

Supernormal and normal profit



Subnormal profit

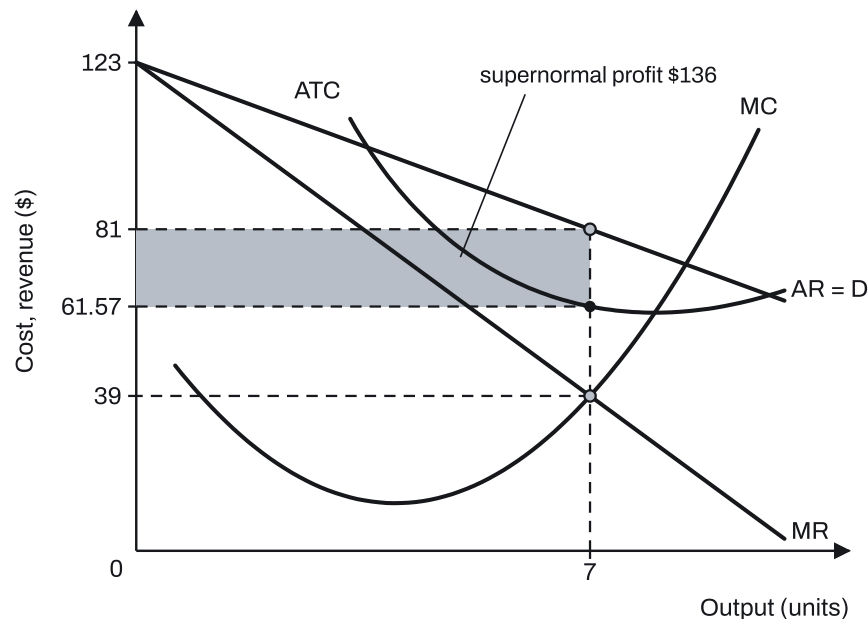


For a price taker with the costs above: at **\$87**, $MC = MR$ at 9 units, $TR = 783$ and $TC = 553$, so **supernormal profit is \$230**. At **\$60** (the lowest ATC), 8 units give $TR = TC = 480$: **normal profit**. At **\$39**, 7 units give $TR = 273$ and $TC = 431$: **subnormal profit (a loss) of \$158**.

Should a loss-making firm close? In the **short run** the fixed costs (\$256) are paid anyway. At \$39 revenue covers the variable cost (\$175) with \$98 left towards fixed costs, so producing loses \$158, less than the \$256 lost by shutting. **Keep producing in the short run as long as price $\geq$ AVC**. Below the lowest AVC (\$24, the **shutdown point**), close at once. In the **long run** all costs are variable, so the firm leaves unless price covers ATC. A firm with high fixed and low variable costs keeps producing through a large price fall; one with low fixed and high variable costs cuts output much sooner.

A change in fixed cost shifts ATC and AFC but **not MC**, so the profit-maximising price and output do not change; only profit does. A one-off advertising campaign is a fixed cost; if it works, it also shifts AR and MR to the right.

How profit changes over time



Whether supernormal or subnormal profit lasts depends on how easily firms can **enter and leave** (the full models are in the market structures topic):

- **Perfect competition** (many small firms, identical products, perfect information, free entry and exit): supernormal profit attracts entry, market supply rises and the price falls to the lowest ATC; subnormal profit makes firms leave until the price rises back to it. So **only normal profit in the long run**.
- **Monopolistic competition** (many firms, differentiated products, low barriers): supernormal profit can be made in the short run, but entry takes customers away, each firm's AR shifts left until it just touches ATC, so **normal profit in the long run**.
- **Monopoly: barriers to entry** (patents, economies of scale, licences, control of a resource) keep rivals out, so supernormal profit **can last in the long run**, and may fund research (dynamic efficiency). But it is not certain: demand may be too low, a regulator may cap the price (a natural monopoly may have to price at average cost), or the firm may pursue another aim, such as sales.
- **Oligopoly**: barriers allow long-run supernormal profit, especially if firms collude, but a price war can push profit down to normal or below, in the short or the long run.

Every firm, in any market structure, needs at least **normal profit in the long run** to stay; none needs supernormal profit to survive.

Key facts and formulas

There is no formula list in the 9708 exam, so everything here is "Learn it".

Formula	Status
Average product: $AP = \frac{TP}{L}$	Learn it
Marginal product: $MP = \frac{\Delta TP}{\Delta L}$	Learn it
Total cost: $TC = TFC + TVC$	Learn it
Average fixed cost: $AFC = \frac{TFC}{Q}$	Learn it
Average variable cost: $AVC = \frac{TVC}{Q}$	Learn it
Average total cost: $ATC = \frac{TC}{Q} = AFC + AVC$	Learn it
Marginal cost: $MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta TVC}{\Delta Q}$	Learn it
Cost–product link with one variable factor at wage W : $MC = \frac{W}{MP}$, $AVC = \frac{W}{AP}$	Learn it
Total revenue: $TR = P \times Q$	Learn it
Average revenue: $AR = \frac{TR}{Q} = P$	Learn it
Marginal revenue: $MR = \frac{\Delta TR}{\Delta Q}$; for a price taker $MR = AR = P$	Learn it
Supernormal (or subnormal) profit: $TR - TC = (AR - ATC) \times Q$	Learn it
Normal profit: $TR = TC$, that is $AR = ATC$	Learn it
Profit-maximising output: $MC = MR$	Learn it
Short-run shutdown rule: produce only if $P \geq AVC$ ($TR \geq TVC$); long run: stay only if $P \geq ATC$	Learn it

How to do it

We tagged 63 questions for this topic, from 2021 to 2026 (58 different ones; 5 are repeats across paper variants): 46 Paper 3 multiple choice and 17 Paper 4 data-response and essay questions. For Paper 4 we count only the parts about this topic. One question (9708/42/M/J/22 Q3) has a part in each of two types, so the counts add up to 64.

Question type	Questions
Identify short-run cost curve shapes and MC–average cost links	11
Read long-run cost diagrams: SRAC vs LRAC, returns to scale, economies and diseconomies	11
Define, classify and calculate fixed, variable, average and marginal costs	8
Explain or evaluate economies of scale and minimum efficient scale (written)	7
Identify internal vs external economies of scale	5

Question type	Questions
Calculate and interpret TP, AP, MP and diminishing returns	5
Calculate profit or the profit-maximising output from revenue and cost data	5
Explain which costs govern short-run price and output decisions (written)	4
Define and evaluate normal, subnormal and supernormal profit; AR and MR	4
Explain diminishing returns as the cause of short-run MC/AVC/ATC shapes (essay)	2
Predict the effect of a fixed-cost change on curves, output and profit	2

1. Identify short-run cost curve shapes and MC–average cost links (11 questions)

Multiple choice. Sketch MC, AVC and ATC in the margin, then test each option against the rules in "Understand it": AFC only falls; MC cuts AVC and ATC (never AFC or MR) at their lowest points; MC below an average means that average is falling, whichever way MC is moving; lowest AVC comes before lowest ATC.

Variants:

- **Diminishing returns start where MC starts to rise**, before AVC reaches its minimum.
- **"At what output does MC exceed ATC?"**: anywhere to the right of ATC's lowest point.
- **From a TC curve**: MC lowest where TC turns from getting flatter to getting steeper; lowest ATC where a line from the origin touches TC; lowest AVC where a line from the TFC intercept touches it.

2. Read long-run cost diagrams (11 questions)

Multiple choice. Ask first: is the statement about the **short run** (one SRAC, a fixed factor, diminishing returns) or the **long run** (LRAC, all factors variable, economies or diseconomies of scale, returns to scale)? Most wrong options mix the two.

Variants:

- **Cost change from switching plant**: read average cost on the old SRAC and on the SRAC that touches LRAC at the new output, and subtract.
- **Lowest cost at an output off LRAC**: change **fixed and variable** factors to reach the plant that touches LRAC there.
- **Lowest LRAC from an LRTC curve**: where a line from the origin just touches LRTC.
- **Production function**: it shows the **output** from each combination of **inputs**, so it tells you about **returns to scale**.
- **"Always economies of scale"**: LRAC slopes down all the way, not a U.

3. Define, classify and calculate costs (8 questions)

1. **Classify**: does it change with output **in the stated short run**? A building and machinery bought for the period are fixed; materials, fuel and hourly wages are variable.

2. **Calculate:** write out TC, AFC, AVC, ATC and MC for each output before comparing. The MC of the first unit uses TC at zero output, which is TFC. When asked which cost changes least, work out every one.
3. **Data response (2–3 marks):** define each cost and **quote an example of each from the extract**. The March 2022 report said general examples not from the article earned nothing.
4. **"Draw AFC":** a curve falling continuously towards the output axis without reaching it.

4. Explain or evaluate economies of scale and MES (written, 7 questions)

Data-response parts (3–5 marks):

1. **Define:** internal economies of scale are a fall in **long-run average cost** as the **firm's** output increases (1 + 1).
2. **Name the type and quote the extract** (1 + 1). For division of labour: specialisation → higher labour productivity → lower average cost.
3. **MES from a table:** define it, then find the first output after which average cost stops falling. If it is still falling at the largest output shown, MES has **not** been reached.
4. **Diagram** if asked: axes "average cost" and "output", LRAC falling, the falling part labelled.

Essays (12- or 13-mark parts to 2022; 20 marks from 2023): economies of scale and survival, whether small firms can survive, or how MES and market demand shape market structure.

1. Define economies of scale, LRAC and MES; explain several types; draw LRAC.
2. **Use the question's angle:** survival (lower costs → lower prices or more profit → rivals forced out) or market structure (MES compared with market demand → how many firms fit).
3. **Evaluate:** diseconomies; small firms survive in niches, with personal service or flexibility; MES may be small in services; external economies help small firms in a cluster.
4. **Conclude** on the question's words.

5. Identify internal vs external economies of scale (5 questions)

Multiple choice. Ask: does the saving come from **this firm being bigger** (internal: bulk discounts, cheaper loans, risk-bearing with many customers, specialised machines) or from **the industry or area** growing (external: a local training college, transport links, nearby suppliers and spare parts)?

On a diagram, internal economies and diseconomies are movements along one LRAC; external economies move the firm to the same output on a **lower** LRAC. Many layers of management, staff shortages or low morale are diseconomies.

6. Calculate and interpret TP, AP and MP (5 questions)

1. Make an MP row (change in TP) and an AP row ($TP \div \text{workers}$).
2. **Diminishing marginal returns set in** with the first worker whose MP is **lower** than the previous one's.
3. **"MP when AP is x ":** find the row where $AP = x$ and read that worker's MP.

4. **Productivity per hour:** total output $\div$ total hours, before and after, then subtract.
5. Falling but positive MP $\rightarrow$ TP rises at a **falling rate**. MP cuts AP at AP's maximum.

7. Calculate profit or the profit-maximising output (5 questions)

1. **Profit-maximising output:** the last unit where $MR \geq MC$, or the output with the largest $TR - TC$.
2. **Supernormal profit** = $(AR - ATC) \times Q$ or $TR - TC$; a negative answer is subnormal profit.
3. **"Only normal profit"** means $P = ATC$. Subtract AFC to get AVC: a price of \$15, output of 2000 and TFC of \$12 000 give AFC \$6, so AVC \$9.
4. **Price taker with a TC table:** produce up to where MC (the change in TC) reaches the price.
5. **Which aim does an output show?** Work out $TR - TC$, TR and ATC at every output: largest $TR - TC$ is profit maximising, largest TR is revenue maximising, lowest ATC is cost minimising, and the largest output with $TR \geq TC$ is sales maximising.

8. Explain which costs govern short-run decisions (written, 4 questions)

12- or 13-mark essay parts (2021) and a data-response part.

1. **Define** fixed, variable, average and marginal costs, and normal profit as a cost.
2. **Output and price:** set by $MC = MR$; fixed costs do not affect MC, so they do not affect this choice.
3. **Whether to produce:** in the short run, stay open if $P \geq AVC$; in the long run, P must cover ATC . Draw MC , AVC and ATC with a price between lowest AVC and lowest ATC (the bottom panel of the fourth diagram).
4. **Apply to the extract:** a producer with low fixed and high variable costs cuts output first when the price falls.
5. **Judge** ("relative importance"): MC decides how much; AVC decides whether to produce at all in the short run.

9. Define and evaluate normal, subnormal and supernormal profit; AR and MR (4 questions)

Multiple choice: supernormal profit is revenue above all costs, where costs include the minimum needed to keep the firm in business in the long run.

Essays (12 marks to 2022; 20 marks from 2023), such as whether these profits are only short run, or whether firms need supernormal profit to survive:

1. **Define** the short and long run, the three kinds of profit, AR and MR .
2. **Perfect competition** with a diagram ($MC = MR$, the profit or loss rectangle, MC through lowest ATC), then **the long run:** entry or exit takes the price to lowest ATC . The June 2024 report said weaker answers showed only the first equilibrium.
3. **Another structure** with sloping AR and MR (the fifth diagram): barriers let a monopoly keep supernormal profit.

4. **Evaluate** with the points in "How profit changes over time": a monopoly does not **always** earn it, and every firm needs only normal profit to survive. The June 2024 report said evaluation often stopped at "perfect competition can't keep it, monopoly can".
5. **Conclude** on the question's exact words ("only", "always", "necessary").

10. Explain diminishing returns as the cause of short-run cost shapes (essay, 2 questions)

12-mark parts (2021 and 2022). Define the short run, fixed and variable factors and the law; draw MP and AP; use $MC = W/MP$ and $AVC = W/AP$ to turn rising then falling MP into falling then rising MC and AVC; draw MC, AVC and ATC with MC through both minimums; explain that falling AFC puts lowest ATC to the right of lowest AVC. Stay in the **short run**: the November 2021 report said some answers drifted into the LRAC curve.

11. Predict the effect of a fixed-cost change (2 questions)

Multiple choice. A higher fixed cost (a licence fee, a one-off campaign) shifts **ATC and AFC up** and leaves **MC unchanged**, so **price and output stay the same and profit falls**. If an advertising campaign works, AR and MR also shift right.

Worked examples

Example 1

A workshop has total fixed costs of \$120 a week. The table shows its total variable cost.

Output (units)	1	2	3	4	5
Total variable cost (\$)	60	100	130	168	220

At which output is average variable cost lowest, and what is the marginal cost of the fourth unit?

	Lowest AVC at	MC of 4th unit
A	3 units	\$30
B	4 units	\$38
C	4 units	\$42
D	5 units	\$52

[1]

AVC: 60, 50, 43.33, 42, 44, so it is lowest at **4 units**. MC of the 4th unit = $168 - 130 = 38$. (Check: MC of the 5th unit is $52 > 42$, which is why AVC starts to rise.) C is the AVC at 4 units, not the MC; A gives the 3rd unit's MC; D the 5th unit's. The answer is **B** (1).

Example 2

A firm's average revenue and total cost are shown. Its total cost at zero output is \$20.

Output (units)	1	2	3	4	5	6
Average revenue (\$)	50	46	42	38	34	30
Total cost (\$)	40	62	80	100	126	160

What is the firm's supernormal profit at its profit-maximising output?

A \$13 B \$44 C \$52 D \$152 [1]

TR = AR × Q: 50, 92, 126, 152, 170, 180. MR: 50, 42, 34, 26, 18, 10. MC: 20, 22, 18, 20, 26, 34. MR ≥ MC up to the 4th unit, but the 5th adds 18 to revenue and 26 to cost, so the firm makes 4 units. Profit = 152 – 100 = 52 (the same as (38 – 25) × 4). A is profit per unit, B is profit at 5 units, D is TR. The answer is **C** (1).

Example 3

Extract: Tikana Cycles makes aluminium bicycle frames in one factory. As output has grown it has bought robotic welding machines, split production into separate cutting, welding and painting stages, and negotiated a 12% discount on aluminium. The firm's managers say that beyond about 80 000 frames a year a second factory and an extra layer of management would be needed. Table 1 shows estimated average costs.

Annual output (thousand frames)	10	20	40	60	80	100
Average cost (\$ per frame)	96	74	61	60	60	66

(a) Using Table 1, explain what is meant by minimum efficient scale and identify it for Tikana Cycles. **[3]**

(b) Explain **two** internal economies of scale shown in the extract. **[4]**

(c) Assess whether Tikana Cycles should expand output beyond 80 000 frames a year. **[8]**

(a) Minimum efficient scale is the lowest output at which long-run average cost stops falling (1). Average cost falls from \$96 to \$60 as output rises to 60 thousand frames, and is still \$60 at 80 thousand (1), so MES is about **60 000 frames a year** (1).

(b) Technical economies: robotic welding machines and splitting production into stages (division of labour) raise output per worker (1), so each frame uses less labour time and average cost falls (1). Purchasing economies: buying aluminium in bulk earns a 12% discount (1), lowering the cost of materials per frame (1).

(c) *Marked like a data-response "assess" part: up to 3 marks for each side and 2 for a conclusion.*

For expanding. Average cost fell by 37.5% between 10 and 60 thousand frames, and a larger firm may find more economies: bigger aluminium orders could earn a larger discount (1). Spreading marketing and research over more frames lowers their cost per unit (1). If demand is growing, more output brings market share and revenue; if rivals grow and Tikana does not, its costs could end up higher than theirs (1).

Against. Table 1 shows average cost rising from \$60 to \$66 between 80 and 100 thousand frames:

diseconomies of scale (1). The extract gives the reason: a second factory and another layer of management bring problems of coordination and communication (1). Expanding pays only if the extra frames sell above \$66; if the price must be cut to sell them, profit could fall (1).

Conclusion. On Table 1, Tikana should not expand beyond 80 000 frames: it already produces at MES and growth raises average cost (1). This could change if better management removed the diseconomies or demand grew enough to justify a much larger plant, so it should review the costs rather than rule out growth for good (1).

Example 4

"A firm that is making a loss should close down immediately."

Evaluate this view, with the help of diagrams. [20]

Model answer (outline of each paragraph):

- Definitions.** A loss is subnormal profit: total revenue below total cost, where cost includes normal profit. Fixed costs do not vary with output; variable costs do. The short run has at least one fixed factor; in the long run all are variable. (AO1.)
- The loss on a diagram.** Draw the bottom panel of the fourth diagram: MC, AVC and ATC, with the price line (AR = MR) between lowest AVC and lowest ATC. The firm produces where MC = MR; ATC is above AR there, so $(ATC - AR) \times Q$ is the loss. (AO2: *labelled diagram, MC through the lowest AVC and ATC.*)
- Why it should not close at once.** The fixed costs are paid whether it produces or not. If price is above AVC, revenue covers the variable costs and part of the fixed costs, so producing loses less than closing (which loses all of TFC). (AO2: *developed chain.*)
- When the view is right.** Below the lowest AVC (the shutdown point) every unit adds to the loss, so the firm should stop at once; in the long run a firm that cannot cover ATC should leave. (AO2.)
- The market adjusts.** In perfect competition, exit cuts market supply and raises the price back to the lowest ATC, so a firm that holds on may return to normal profit. (AO2/AO3.)
- It depends on the cost structure.** A firm with high fixed and low variable costs (a steel works, an airline) can bear a deep price fall before price drops below AVC; a firm with mostly variable costs cuts output much sooner. (AO3.)
- It depends on why the loss happened.** A temporary fall in demand (a recession, a bad season) suggests waiting; a permanent one (a product replaced by new technology) suggests leaving. A new firm may accept early losses while it grows towards minimum efficient scale, and a firm aiming at growth or market share may accept a loss for a time. (AO3.)
- Conclusion.** The view is too strong. A loss alone is not a reason to close: in the short run the test is whether price covers AVC, and in the long run whether it covers ATC. Close at once only if price is below AVC, or if the loss will last and the firm has no strategic reason to stay. (*Justified conclusion on "immediately", Table B Level 2.*)

(Table A Level 3: 14; Table B Level 2: 6; **20/20.**)

Common mistakes

- **Finding lowest ATC on a TC curve in the wrong place.** In March 2021, 40% chose the output where AVC is lowest. ATC is the slope of a line from the **origin**; AVC of a line from the **TFC intercept**.
- **Thinking AVC rises as soon as diminishing returns start.** In March 2021, 46% did. Diminishing returns make **MC** rise; AVC keeps falling until MC reaches it.
- **Saying AVC rises because MC is rising.** In June 2023, 37% did. If MC is below AVC, AVC is falling, whichever way MC is moving.
- **Changing only some factors to cut cost.** In November 2022, 49% chose reducing the scale. The lowest average cost at an output is on LRAC, reached by changing **both fixed and variable** factors.
- **A U-shaped LRAC for "always economies of scale".** Its rising part shows diseconomies; the November 2021 report said the curve must slope down all the way.
- **Mixing up the short and long run.** Diminishing returns explain SRAC; in November 2021 some answers to a short-run question wrote about LRAC.
- **Incomplete definitions.** The June 2024 report: definitions of internal economies left out "long run" or "average cost", and few could define MES.
- **Badly drawn diagrams.** MC must cut AC at its lowest point and profit is maximised where $MC = MR$ (June 2023 and June 2024 reports); LRAC diagrams lost marks for wrong axes or shape (November 2021).
- **Examples not from the extract** when the question says "from the information" (March 2022).
- **Ignoring the question's angle** (survival, MES and market demand, "always") and writing all you know (June 2022 and June 2023 reports).

How to get the marks

- **Multiple choice:** sketch the curves and build a quick table of AFC, AVC, ATC and MC before choosing. For every diagram, decide "short run or long run?".
- **Definitions** earn AO1 marks: give them for every key term in the question, with "long run", "average cost" and "the firm's output" where they belong.
- **"Explain" data-response parts (2–5 marks):** a definition (1), a type or example **from the extract** (1), and the chain to average cost (1). A diagram earns marks for labelled axes and the right curve and shape.
- **"Assess", "consider" or "discuss" parts (6–8 marks):** mark schemes cap each side (often at 3) and give marks for a conclusion, so use the data, write both sides and finish with a judgement that follows from them.
- **Essays:** 12-mark parts (to 2022) need definitions, full chains and accurate diagrams; 13-mark parts add evaluation and a conclusion. In 20-mark essays (from 2023), Table A (14) rewards accurate definitions, labelled diagrams used in the text and developed analysis; Table B (6) rewards evaluation of the question's key words and a justified conclusion. When a statement names one case ("only perfect competition"), analyse the others: they are your evaluation.
- **Diagram rules:** label the axes (cost/revenue, output) and every curve (MC, AVC, ATC, AR, MR, LRAC, SRAC); mark P and Q with dashed lines; shade and name the profit or loss rectangle; draw MC through the lowest AVC and ATC.

Quick check

1. Which is an external economy of scale for a software firm? **A** a lower interest rate because the firm has grown **B** a discount on buying 500 computers at once **C** a university nearby that trains programmers for all local firms **D** a specialist finance manager hired by the firm
2. The table shows a farm's output as more workers are hired. Find each worker's marginal product and the average product, say when diminishing marginal returns set in, and find the marginal product when average product is 9.

Workers	1	2	3	4	5
Total product (tonnes)	8	20	30	36	40

3. A price-taking firm sells 250 units a week at \$9 each. Its total fixed cost is \$500 a week and its average variable cost is \$6. (a) Find its AFC, ATC and its supernormal or subnormal profit. (b) The price falls to \$7 and output and costs do not change. Find the profit or loss, and say whether the firm should keep producing in the short run.
4. Explain the difference between the law of diminishing returns and diseconomies of scale. **[4]**
5. A firm faces the demand curve $P = 30 - 2Q$. Find TR, AR and MR when output rises from 6 to 7 units, and explain why MR is below AR.

Answers

1. **C.** It comes from the growth of the industry in the area and lowers costs for every local firm. A, B and D are internal: they come from the firm's own size. (1)
2. MP: 8, 12, 10, 6, 4. AP: 8, 10, 10, 9, 8. Diminishing marginal returns set in with the **3rd worker** (MP falls from 12 to 10). AP is 9 with 4 workers, when MP is **6 tonnes**.
3. (a) $AFC = \$500 \div 250 = \2 ; $ATC = \$2 + \$6 = \$8$. Profit = $(\$9 - \$8) \times 250 = \$250$ supernormal profit. (b) $(\$7 - \$8) \times 250 = -\$250$, a loss (subnormal profit) of \$250. Price \$7 is above AVC \$6, so revenue covers variable costs and \$250 of the \$500 fixed costs. Closing would lose all \$500, so it should keep producing in the short run.
4. The law of diminishing returns is a short-run idea: with at least one factor fixed, adding more of a variable factor eventually makes its marginal product fall (1), which makes short-run marginal and average costs rise (1). Diseconomies of scale are a long-run idea: when all factors are increased and the firm grows too large (1), problems such as poor coordination and communication make long-run average cost rise (1).
5. At 6 units $P = 18$, $TR = 108$; at 7 units $P = 16$, $TR = 112$. So $AR = 16$ and $MR = 112 - 108 = 4$. MR is below AR because, to sell the 7th unit, the firm lowers the price on all seven units: it gains \$16 from the extra unit but loses \$2 on each of the six it could have sold at \$18.

Past questions to try

- **9708/32/M/J/23 Q14**: marginal product when average product takes a given value.
- **9708/32/O/N/22 Q8**: which SRAC and LRAC statements are correct.
- **9708/42/O/N/21 Q4**: part (a), diminishing marginal returns and the shape of short-run MC and ATC.
- **9708/42/M/J/23 Q3**: a 20-mark essay on market demand, minimum efficient scale and market structure.