

Cambridge IGCSE · Business Studies 0450 · Notes

Costs, scale of production and break-even analysis

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Read first: [Enterprise, business growth and size](#), [Production of goods and services](#)

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What you need to know

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

1. **Classify costs.** Sort a business's costs into fixed and variable costs, and work out total cost and average cost, with examples of each.
 2. **Use cost data to decide.** Use simple cost figures to make decisions, such as whether to stop making a product or carry on.
 3. **Economies of scale.** Explain why the average cost of each unit falls as a business grows, with examples: purchasing, marketing, financial, managerial and technical economies.
 4. **Diseconomies of scale.** Explain why the average cost of each unit can rise when a business becomes very large, with examples: poor communication, lack of commitment from employees and weak coordination.
 5. **The idea of break-even.** Explain what breaking even means.
 6. **Break-even charts.** Draw, finish or change a simple break-even chart, and read a given chart to analyse what is happening to a business.
 7. **Break-even output.** Calculate it from given figures.
 8. **Margin of safety.** Define it, calculate it and say what it tells the business.
 9. **Decisions.** Use break-even analysis to make simple decisions, such as what happens if the price goes up.
 10. **Limitations.** Explain why break-even analysis may not give an accurate picture.
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Understand it

Fixed and variable costs

Fixed costs are costs that do not change when output changes, in the short run. They are paid even if nothing is made. Examples: rent, insurance, managers' salaries, interest on loans, advertising, security.

Variable costs are costs that change directly with the level of output: make twice as many and they double; make nothing and they are zero. Examples: raw materials and components, packaging, wages paid for each item made, power for the machines.

A manager's **salary** is fixed, but **wages** paid per item are variable, and raw materials are always variable: examiners do not accept wages or materials as fixed costs.

- **Total variable cost** is the variable cost of one unit multiplied by the number of units made.
- **Total cost** is fixed costs plus total variable cost.
- **Average cost** is total cost divided by the number of units produced: the cost of making each unit.

A candle maker pays \$6000 a month in rent, salaries and insurance (fixed costs), and \$4 in wax, wicks and jars for each candle (variable cost). If it makes 1000 candles in a month:

- total variable cost = $4 \times 1000 = 4000$ dollars;
- total cost = $6000 + 4000 = 10\,000$ dollars;
- average cost = $10\,000 \div 1000 = 10$ dollars a candle.

If it makes 1500 candles, total cost rises to $6000 + 4 \times 1500 = 12\,000$ dollars, but average cost **falls** to $12\,000 \div 1500 = 8$ dollars a candle. The same \$6000 of fixed costs is shared over more candles.

Using cost data to make decisions

Cost figures help managers to **set prices** (above average cost, to make a profit), **decide whether to stop making a product or carry on**, **compare locations, suppliers or machines**, **set budgets** and **work out the break-even output**.

Stop or carry on? If the price does not even cover the **variable cost** of each unit, every unit sold makes the loss bigger, so stop. If the price covers the variable cost but not the average cost, the product makes a loss, but each unit still pays towards the fixed costs, which must be paid anyway. A product selling at \$9 with \$6 of materials per unit, selling 2000 a month, brings in $2000 \times (9 - 6) = 6000$ dollars towards the rent and salaries. In the short run, carrying on loses less than stopping while the business cuts costs or raises the price.

Economies of scale

Economies of scale are the cost advantages of being large: as a business increases its scale of production, the average cost of each unit falls. Total costs still rise; it is the cost **per unit** that falls.

Economy of scale	What happens	Why average cost falls
Purchasing	buying materials in bulk earns discounts from suppliers	each unit's materials cost less
Marketing	an advert costs the same whether the business sells 10 000 or 1 million products	promotion costs are spread over many more units

Economy of scale	What happens	Why average cost falls
Financial	banks see a large business as less risky, so they lend more easily and at lower interest rates	borrowing costs less
Managerial	it can employ specialist managers, each expert in one area	better decisions and fewer mistakes, so resources are used more efficiently
Technical	it can afford large, advanced machinery and flow production lines	each machine makes far more output for its cost

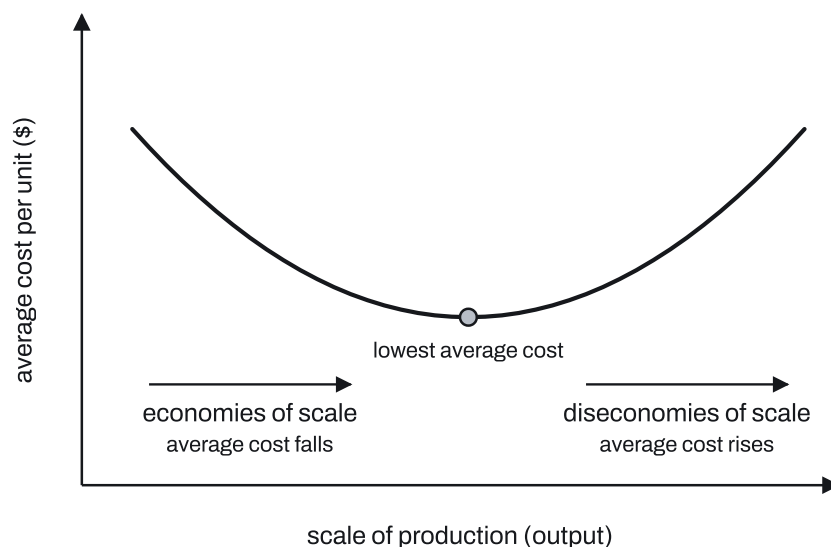
Lower average costs let a large business cut prices to win customers, or keep prices and earn more profit on each item.

Diseconomies of scale

Diseconomies of scale are the problems of being very large that make the average cost of each unit rise as a business keeps growing:

- **Poor communication.** Messages pass through many levels and sites, so they arrive late, get changed or are lost. Mistakes are made and work is repeated.
- **Lack of commitment from employees.** Workers in a huge business rarely see senior managers and feel unvalued, so morale falls, absenteeism rises and more leave; replacing them costs money.
- **Weak coordination.** With many departments, factories or countries, it is hard to keep everyone working towards the same aims, so work is duplicated and wrong decisions are made.
- **Lack of control** (also accepted): managers cannot see what everyone is doing, so effort and standards slip.

Name the actual problem; "managerial diseconomies" or "production diseconomies" are not credited.



The idea of break-even

Total revenue is the money from sales: price × quantity sold. A business makes a **profit** when total revenue is more than total cost, and a **loss** when it is less.

Break-even output is the number of units a business must make and sell so that its total revenue just covers its total cost; at this output it makes neither a profit nor a loss. Below it, the business makes a loss; above it, a profit.

Contribution per unit is the selling price minus the variable cost per unit: what each unit sold adds towards paying the fixed costs. The business breaks even once enough units are sold to pay all the fixed costs:

$$\text{break-even output} = \frac{\text{fixed costs}}{\text{selling price} - \text{variable cost per unit}} = \frac{\text{fixed costs}}{\text{contribution per unit}}$$

The candle maker sells candles at \$10 each. Contribution per candle = $10 - 4 = 6$ dollars, so

$$\text{break-even output} = \frac{6000}{6} = 1000 \text{ candles a month.}$$

Check: at 1000 candles, total revenue = $10 \times 1000 = 10\,000$ dollars and total cost = $6000 + 4 \times 1000 = 10\,000$ dollars. They are equal.

Break-even output is a number of **units**, never dollars. If the division isn't exact, round **up** (833.3 becomes 834).

Margin of safety

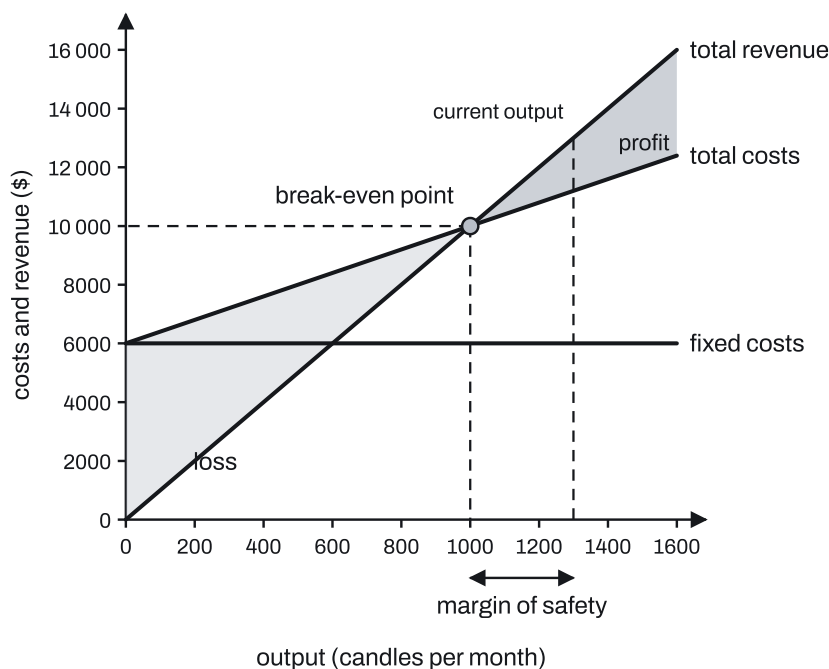
The **margin of safety** is the number of units by which current (or forecast) sales are above the break-even output.

$$\text{margin of safety} = \text{current output (or sales)} - \text{break-even output}$$

If the candle maker sells 1300 candles a month, its margin of safety is $1300 - 1000 = 300$ candles: sales could fall by 300 a month before it makes a loss. A **large** margin means sales could fall a long way safely; a **small** one means a new competitor or a recession could push it into a loss; a **negative** one means it is already making a loss. Use current or forecast sales, never the maximum output the factory could make.

Every unit above break-even adds its whole contribution to profit, so profit = margin of safety × contribution per unit: $300 \times 6 = 1800$ dollars. Check: $10 \times 1300 - (6000 + 4 \times 1300) = 13\,000 - 11\,200 = 1800$ dollars.

Drawing a break-even chart



To draw one:

1. **Axes.** Output (units) along the bottom, from 0 to maximum output; costs and revenue (\$) up the side, high enough for total revenue at maximum output. Label both and add a title.
2. **Work out the values at maximum output.** At 1600 candles: total revenue = $10 \times 1600 = 16\,000$ dollars; total cost = $6000 + 4 \times 1600 = 12\,400$ dollars.
3. **Fixed costs:** a horizontal line at \$6000.
4. **Total costs:** a straight line from \$6000 at zero output (fixed costs are paid even then) to \$12 400 at 1600 candles.
5. **Total revenue:** a straight line from the origin to \$16 000 at 1600 candles.
6. **Label every line** and mark the **break-even point**, where total revenue crosses total costs. Read down for the break-even output (1000 candles) and across for the **break-even revenue** (\$10 000).

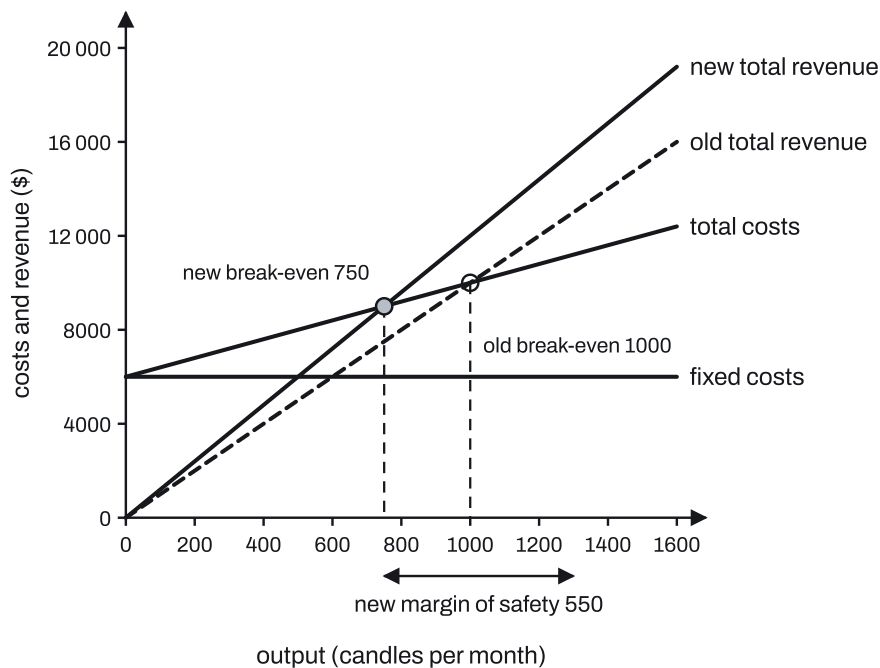
Reading a break-even chart

- **Profit or loss at any output:** read total revenue and total costs at that output and subtract. At 1600 candles, $16\,000 - 12\,400 = 3\,600$ dollars profit.
- **The margin of safety:** the distance along the output axis from break-even output to current output.
- **The profit area** is right of break-even (total revenue on top); the **loss area** is left of it (total costs on top).
- **Lines marked with letters:** the horizontal line is fixed costs; the line starting at the fixed costs level is total costs; the line starting at zero is total revenue; where they cross is the break-even point; the gap from break-even to current output is the margin of safety.

Changing a break-even chart

Break-even analysis tests "what if?" changes before they are made. Each change moves one line:

Change	What moves on the chart	Break-even output	Margin of safety
Price rises	total revenue line becomes steeper	falls	rises
Price falls	total revenue line becomes less steep	rises	falls
Fixed costs rise	fixed costs and total costs lines move up by the same amount	rises	falls
Fixed costs fall	fixed costs and total costs lines move down	falls	rises
Variable cost per unit rises	total costs line becomes steeper (still starting at fixed costs)	rises	falls
Variable cost per unit falls	total costs line becomes less steep	falls	rises



If the candle maker raises its price to \$12, contribution becomes $12 - 4 = 8$ dollars, so break-even output falls to $6000 \div 8 = 750$ candles, and the margin of safety at 1300 candles rises to $1300 - 750 = 550$ candles.

The chart assumes everything made is sold, so it shows only more revenue per unit. In real life a higher price may lose customers: a reason for caution, not a change to the chart.

Using break-even analysis to decide

- **A sales target:** how many units must be sold before any profit is made.
- **Profit or loss at any output,** including at forecast sales.

- **Risk:** the margin of safety shows how far sales could fall before a loss.
- **Testing changes:** a new price, a rent rise or cheaper materials can be tried on the chart before deciding.
- **Go-ahead decisions:** compare break-even with forecast sales to decide whether to launch a product, or to choose between options.
- **Support for a loan:** a business plan can show a bank that costs will be covered.

Limitations of break-even analysis

- **It assumes everything produced is sold**, with no unsold inventory.
- **It assumes one price for every unit**, but businesses give discounts for large orders or to clear stock.
- **It assumes fixed costs stay fixed**, which is true only while the scale of production stays the same.
- **It assumes straight lines**, but bulk-buying discounts can lower the variable cost per unit as output rises.
- **It covers one product at a time**; a business with many products needs a chart for each.
- **It relies on forecasts:** if demand or costs change (materials prices rise with inflation), break-even changes too.
- **Some costs are hard to split** into fixed and variable.
- **It ignores other factors**, such as quality, competitors or cash flow.

Key facts and formulas

This topic has no formula list in the exam. "Learn it" means you must remember it.

Fact	Status
Fixed costs: costs that do not change when output changes, in the short run (rent, insurance, salaries, interest, advertising)	Learn it
Variable costs: costs that change directly with the level of output (raw materials, packaging, wages paid per item)	Learn it
Total variable cost = variable cost per unit × output	Learn it
Total cost = fixed costs + total variable cost	Learn it
Average cost = $\frac{\text{total cost}}{\text{output}}$	Learn it
Total revenue = price × quantity sold; profit = total revenue – total cost	Learn it
Economies of scale: the cost advantages of being large: as a business increases its scale of production, the average cost of each unit falls (purchasing, marketing, financial, managerial, technical)	Learn it

Fact	Status
Diseconomies of scale: the problems of being very large that make the average cost of each unit rise as a business keeps growing (poor communication, lack of commitment, weak coordination)	Learn it
Break-even output: the number of units a business must make and sell so that its total revenue just covers its total cost; at this output it makes neither a profit nor a loss	Learn it
Contribution per unit = selling price – variable cost per unit	Learn it
Break-even output = $\frac{\text{fixed costs}}{\text{selling price} - \text{variable cost per unit}}$	Learn it
Margin of safety: the number of units by which current (or forecast) sales are above the break-even output	Learn it
Margin of safety = current output (or sales) – break-even output	Learn it

How to do it

We have tagged 45 questions on this topic (2021–2026), on Paper 1 and Paper 2. 14 of them have parts of more than one type, so the counts add to 61.

Question type	Questions
Choose between options using break-even and cost calculations	10
Define a cost or break-even term	9
Explain uses, benefits and limitations of break-even analysis	8
Explain diseconomies of scale or problems of growing	6
Calculate the margin of safety	5
Label or read values off a break-even chart	5
Calculate total variable cost or average cost	4
Ways to lower break-even output or raise the margin of safety	4
Weigh up economies of scale and judge which matters most	4
Outline economies of scale for a business	2
Calculate break-even output	2
Classify costs and use cost data for decisions	2

The mark scheme codes are **k** (knowledge: a correct point), **app** (application: a detail from the case), **an** (analysis: a developed consequence) and **eval** (evaluation: a justified judgement).

Part	Marks	What earns them
Paper 1 "Define"	2	a full definition; half = 1
Paper 1 "Identify"	1 each	short points; only the first ones asked for are marked
Paper 1 "Calculate"	2	right answer as the final answer, in the right units; correct method alone = 1
Paper 1 "Outline" (c)	4	each: k + app
Paper 1 "Explain" (d)	6	each: k + app + an
Paper 1 (e) "Do you think ...?"	6	2 k + 2 an + 2 eval; general, so no app
Paper 2 (a) "Explain two ..."	8	each point (1) + up to 3 for a chain of explanation, one of them a case detail; when four points are asked, each point (1) + 1 applied explanation
Paper 2 (b) "Consider ... Which ...? Justify"	12	levels: applied discussion of every option, then a choice that says why the others were rejected

1. Choose between options using break-even and cost calculations (10 questions)

Paper 2 (b), 12 marks: an appendix gives two or three options with prices, variable costs, fixed costs and forecast sales.

- Calculate for each option:** contribution, break-even output, margin of safety, total revenue, total cost and profit, each labelled ("Option A break-even = $6000 \div 20 = 300$ units").
- Say what each figure means:** "a margin of safety of only 20 units means a small fall in sales wipes out the profit".
- Add the case's other points:** forecast growth, exports, the target market, the need to borrow.
- Recommend one and say why the other was rejected.** Either choice can reach the top level if justified; weigh risk as well as profit.

Variations you will meet:

- Two new products, justified with break-even calculations:** boats at two prices for a boat builder ([0450/23/O/N/25 Q2](#), part (b)); bracelets or rings for a jewellery maker ([0450/22/M/J/24 Q1](#), part (b)).
- Two options with calculations:** two new cookies for a cookie maker ([0450/21/O/N/24 Q3](#), part (b)); two meals for a food business, where gross profit margin and profit margin also count ([0450/22/F/M/24 Q4](#), part (b)); two options for a bakery owner ([0450/21/M/J/22 Q3](#), part (b)); two options for a theatre's first performance ([0450/22/M/J/23 Q2](#), part (b)).
- Cost and profit comparisons without break-even:** two houses for a new builder, where the total cost of one is more than the money the owners have invested ([0450/23/O/N/23 Q3](#), part (b)); two orders for a sole trader ([0450/22/F/M/21 Q1](#), part (b)).
- Three options for growth** with calculations, for a safari tour business ([0450/21/O/N/22 Q3](#), part (b)).

- **Produce only large items or only small items** of playground equipment (0450/22/O/N/21 Q4, part (b)): total revenue, total cost and profit for each.

2. Define a cost or break-even term (9 questions)

Paper 1, 2 marks: two ideas for 2 marks, one for 1. Examples alone score nothing, and don't repeat the word being defined.

- **Fixed costs** (0450/12/O/N/25 Q4, part (a); 0450/12/M/J/21 Q3, part (a)): costs that do not change (1) when output changes, in the short run (1).
- **Variable costs** (0450/12/O/N/21 Q2, part (a)): costs that change (1) directly with the level of output (1).
- **Average cost** (0450/12/M/J/25 Q4, part (a); 0450/13/O/N/21 Q1, part (b)): total cost (1) divided by the number of units produced (1). "Cost divided by output" without "total" is only half.
- **Total cost** (0450/12/F/M/22 Q2, part (b)): fixed costs (1) plus variable costs (1). Not average cost or start-up capital.
- **Diseconomies of scale** (0450/11/M/J/24 Q1, part (a)): both ideas are needed: the business grows (1) and the average cost of each unit rises (1).
- **Break-even output** (0450/12/F/M/24 Q4, part (a)): the number of units a business must make and sell so that its total revenue just covers its total cost (2); "neither a profit nor a loss" alone is half.
- **Margin of safety** (0450/11/O/N/25 Q3, part (b)): the number of units by which current (or forecast) sales are above (1) the break-even output (1).

3. Explain uses, benefits and limitations of break-even analysis (8 questions)

1. **Name the benefit or limitation** precisely (lists in "Understand it"); say which decision, profit at which output, or why it is inaccurate.
2. On Paper 2 (a) and Paper 1 "outline", **apply it** with the case's figures: "it gives a target of 400 meals a week before any profit is made".

Variations you will meet:

- **Identify two limitations** (0450/11/O/N/23 Q2, part (a); 0450/12/O/N/21 Q2, part (b)) or **four limitations** (0450/21/M/J/21 Q4, part (a)(iii)): one mark each, all different.
- **Outline one benefit and one limitation** to a toy maker of using break-even analysis (0450/13/M/J/21 Q3, part (c)): k + app each.
- **Outline two ways break-even information can help** a new soft drinks business (0450/11/O/N/21 Q1, part (c)): it shows the potential profit at any output, not just the profit made.
- **Paper 2 (a), two benefits and two limitations** of break-even analysis to a furniture business, using an appendix (0450/23/M/J/24 Q3, part (a)), or **one benefit and one limitation of a break-even chart** to a bakery owner (0450/21/M/J/22 Q2, part (a)): the chart predicts, so it helps planning; it covers one product, so a second product needs another chart.

- **Paper 2 (a), four ways a break-even chart could help (0450/22/O/N/23 Q4, part (a)):** read figures off the appendix chart (break-even output, margin of safety, profit at maximum output) as the application for each way.

4. Explain diseconomies of scale or problems of growing (6 questions)

Name the diseconomy (k), tie it to the business (app: its employees, sites, countries or product), **give the consequence** (an: mistakes, workers leaving, wrong decisions). "Higher average cost" counts as analysis once only, so give a different consequence for the other point.

Variations you will meet:

- **Paper 1 (d), explain two diseconomies of scale** as the business grows: a glass maker with factories in many countries (0450/11/M/J/25 Q4, part (d)); a large hotel (0450/12/O/N/24 Q4, part (d)); a diamond mining company (0450/13/O/N/23 Q1, part (d)).
- **Paper 2 (a), explain two diseconomies of scale** as a business expands (0450/22/O/N/22 Q3, part (a)): point + chain of three links, one applied.
- **Paper 2 (a), explain two problems** of expanding or growing (0450/23/M/J/23 Q2, part (a); 0450/22/F/M/23 Q2, part (a)): diseconomies of scale fit well, and so does finding the money to grow. "It is expensive" needs to say what costs more and why that matters.

5. Calculate the margin of safety (5 questions)

Current (or forecast) output – break-even output (calculate break-even first if it isn't given). Subtract, don't divide; give the answer **in units**, with working.

Variations you will meet:

- **Both figures given:** for a bed maker (0450/12/F/M/26 Q3, part (b)); for a T-shirt seller, where the price and variable cost in the table are not needed (0450/12/F/M/24 Q4, part (b)); for a steel gate maker, where break-even is in the table (0450/12/M/J/21 Q3, part (b)).
- **A distractor:** the children's beds table also gives maximum factory output, which must be ignored (0450/11/M/J/22 Q2, part (b)).
- **Break-even first:** calculate the break-even level for tables, then the margin of safety (0450/21/M/J/21 Q4, part (a)(ii)).

6. Label or read values off a break-even chart (5 questions)

- **Identify lines or points marked with letters** (1 each; only your first answer counts): a break-even point and a total revenue line for a burger restaurant (0450/11/O/N/25 Q3, part (a)); total costs and total revenue lines for a bicycle maker (0450/13/O/N/24 Q1, part (a)); total revenue and the margin of safety on a new bookshop's chart (0450/12/F/M/22 Q2, part (a)). Use the full name ("total revenue", "break-even point"), and check whether a letter points at a line, a point or a gap.

- **Read break-even output and break-even revenue** from a watch maker's chart ([0450/12/M/J/23 Q1](#), part (b)): output in watches, revenue in dollars.
- **Calculate profit at a given output** from a cooking pot maker's chart ([0450/11/O/N/23 Q2](#), part (b)): read total revenue and total costs at that output, then profit = total revenue – total costs, with working.

7. Calculate total variable cost or average cost (4 questions)

- **Total variable cost** = variable cost per unit × output: for a tyre factory ([0450/12/M/J/25 Q4](#), part (b)), a phone maker ([0450/11/O/N/22 Q1](#), part (b)) and a toy maker ([0450/13/M/J/21 Q3](#), part (b)). Multiply, don't divide, and count the zeros: an answer in millions must say "million" or show every zero.
- **Average cost** = total cost ÷ output: for a clothing maker per week ([0450/12/O/N/25 Q4](#), part (b)). It is in dollars per unit, not units.

8. Ways to lower break-even output or raise the margin of safety (4 questions)

Raise the price, cut fixed costs (cheaper premises) or **cut variable costs** (cheaper materials). Each also raises the margin of safety. Use one fixed-cost and one variable-cost example, not two of the same kind.

Variations you will meet:

- **Outline two ways to lower break-even output** for a bicycle maker ([0450/13/O/N/24 Q1](#), part (c)): k + app each, using its figures.
- **Explain two ways to lower break-even output** for a cooking pot maker ([0450/11/O/N/23 Q2](#), part (d)): add the effect, such as higher revenue from each pot or lower total costs. You can add a risk: a higher price may lose customers.
- **Outline two ways to increase the margin of safety** for a camera maker ([0450/12/M/J/22 Q3](#), part (c)): price up, fixed or variable costs down. "More advertising" or "produce more" was not credited.
- **Outline two effects on the chart of a price rise** for a watch maker ([0450/12/M/J/23 Q1](#), part (c)): break-even output falls; the margin of safety rises; revenue and profit at each output rise. Don't write about sales falling: the chart assumes all output is sold.

9. Weigh up economies of scale and judge which matters most (4 questions)

Paper 2 (b), 12 marks, with three named economies:

1. **For each economy**, explain how it works **in this business** and why it lowers the **average cost**: what it buys in bulk, what it borrows for, which specialists it could hire.
2. **Conclude** which matters most, using the case (a big borrowing need favours financial economies), and say why the other two matter less. The question asks for benefits, so leave drawbacks out of the body.

Variations you will meet:

- **Financial, purchasing or managerial**: for a bathroom products maker planning a factory abroad ([0450/21/O/N/25 Q1](#), part (b)); for a soap powder maker ([0450/21/O/N/21 Q3](#), part (b)).

- **Purchasing, technical or financial**, judged by the greatest effect on profit (0450/22/M/J/22 Q1, part (b)): lower average cost raises profit on every unit.
- **Paper 1 (e), are economies of scale the most important reason for taking over another business?** (0450/11/M/J/21 Q1, part (e)): two developed reasons (lower average cost against, for example, removing a competitor and gaining market share), then a justified decision.

10. Outline economies of scale for a business (2 questions)

Paper 1 (c), 4 marks: **name the type** (k) and **tie it to the case** (app). A paint maker using flow production (0450/13/M/J/24 Q3, part (c)): technical economies from its flow production line; purchasing economies when buying its raw materials from suppliers. A steel maker (0450/12/O/N/23 Q2, part (c)): purchasing economies when buying iron ore in bulk; technical economies from the production method it already uses.

11. Calculate break-even output (2 questions)

Fixed costs ÷ (selling price – variable cost per unit), 2 marks; the method alone earns 1.

- For a camera, from a table of price, variable cost and fixed costs (0450/12/M/J/22 Q3, part (b)). Give the answer in units; adding a \$ sign loses a mark.
- For tables made each month, from an appendix (0450/21/M/J/21 Q4, part (a)(i)).

12. Classify costs and use cost data for decisions (2 questions)

- **Identify two examples of fixed costs** for a car maker (0450/12/O/N/22 Q4, part (b)), or **four fixed costs with two ways cost data helps decisions** (0450/11/M/J/24 Q1, parts (b) and (c)). Fixed: rent, insurance, salaries, interest, advertising, cleaning, maintenance (electricity or utilities counts once only). Not wages, raw materials or power for the machines. Decisions: setting prices, stopping or continuing production, choosing a location or supplier, setting budgets, break-even analysis.

Worked examples

Example 1

FrameCraft makes wooden picture frames and sells them to gift shops. An extract from its data is shown below.

Selling price per frame	\$25
Variable cost per frame	\$10
Fixed costs per month	\$9000
Forecast sales per month	800 frames

(a) Calculate the contribution per frame and the number of frames FrameCraft must sell each month to break even. Show your working. [2]

(b) Calculate FrameCraft's margin of safety and its forecast profit per month. Show your working. [4]

(c) The owner plans to raise the price to \$30 a frame. Calculate the new break-even output and outline one risk of the price rise. [4]

(a) Contribution per frame = $25 - 10 = 15$ dollars. Break-even output = $9000 \div 15 = 600$ frames (2).

(b) Margin of safety = $800 - 600 = 200$ frames (2).

Total revenue = $800 \times 25 = 20\,000$ dollars; total cost = $9000 + 800 \times 10 = 17\,000$ dollars; profit = $20\,000 - 17\,000 = 3000$ dollars (2). Check: the 200 frames above break-even each add \$15, and $200 \times 15 = 3000$.

(c) New contribution = $30 - 10 = 20$ dollars, so break-even output = $9000 \div 20 = 450$ frames (2).

Risk: the gift shops may buy cheaper frames from other makers (k), so FrameCraft could sell fewer than its forecast 800 frames a month and earn less than it does now (app).

Each calculation earns 2 marks for the right answer, or 1 for the right method with a slip; the outline is k + app ($2 + 2 + 2 + 2 + 2 = 10$ marks over the three parts).

Example 2

RapidBox delivers parcels for online shops. In two years it has grown from 4 depots to 12 and now employs 900 drivers. Its directors plan to buy 300 electric vans from one van maker.

The directors expect that growing this large will lower the cost of each delivery. Explain one reason why they could be right and one reason why they could be wrong. [6]

Right: purchasing economies of scale (k). Ordering 300 vans at once from one maker (app) should earn a bulk discount, so each van costs less and the average cost of delivering each parcel falls (an).

Wrong: poor communication, a diseconomy of scale (k). Instructions from head office now pass through managers at 12 depots before they reach 900 drivers (app), so they arrive late or changed; parcels go to the wrong address and have to be delivered again, which raises the average cost of each delivery (an).

Each point earns k + app + an ($3 + 3 = 6$). The two analyses are different: one cost falls, the other rises for a stated reason.

Example 3

Do you think break-even analysis is useful to a business planning to launch a new product? Justify your answer. [6]

Break-even analysis shows how many units must be sold to cover all costs (k). Managers can compare this with forecast sales: if forecast sales are well above break-even, the product is likely to make a profit, so the launch is worth the risk (an).

However, it assumes that every unit produced is sold at the same price (k). A new product has no sales history, so its forecast may be far too high, and early discounts to attract customers lower the revenue from each unit; the real break-even point could be much higher than the chart shows (an).

I think break-even analysis is useful, but only as a first check (eval). It is quick and shows clearly whether the product could ever make a profit at the planned price and costs, which is worth knowing before spending money on a launch. Because the figures for a new product are only forecasts, the business should also test what happens if sales are lower or costs higher, and use market research to make the forecast more reliable (eval).

This is a general question, so no business is named and there are no marks for application: $2k + 2an + 2\text{eval} = 6$. The judgement says **how** the tool should be used, rather than repeating the points.

Example 4

Inkwell is a small business owned by Leila. It prints posters for concerts, sports clubs and local events, using hand screen-printing. Leila is considering whether to lease a digital printer. Event organisers often want posters within a day, which screen-printing cannot always manage. The lease is a three-year contract.

	Option 1: keep screen-printing	Option 2: lease a digital printer
Selling price per poster	\$8	\$8
Variable cost per poster	\$4	\$2
Fixed costs per month	\$2000	\$5000
Forecast sales per month	900 posters	1200 posters

Using the table, recommend whether Leila should lease the digital printer. Support your recommendation with break-even and profit calculations for both options. [12]

Option 1: keep screen-printing. Contribution per poster is $8 - 4 = 4$ dollars, so break-even output is $2000 \div 4 = 500$ posters a month. The margin of safety is $900 - 500 = 400$ posters, so sales could fall by almost half before Inkwell makes a loss. Total revenue is $900 \times 8 = 7200$ dollars and total cost is $2000 + 900 \times 4 = 5600$ dollars, so profit is $7200 - 5600 = 1600$ dollars a month. This is low risk, but Inkwell may keep losing urgent orders it cannot print in time.

Option 2: lease a digital printer. Contribution per poster is $8 - 2 = 6$ dollars, so break-even output is $5000 \div 6 = 833.3$, rounded up to 834 posters a month. The margin of safety is $1200 - 834 = 366$ posters. Total revenue is $1200 \times 8 = 9600$ dollars and total cost is $5000 + 1200 \times 2 = 7400$ dollars, so profit is $9600 - 7400 = 2200$ dollars a month, \$600 more than Option 1. But the forecast of 1200 depends on winning extra next-day orders: if sales stayed at 900, profit would be only $900 \times 6 - 5000 = 400$ dollars, and the higher fixed costs are locked in for three years.

Recommendation. Leila should choose Option 2, the digital printer. It earns \$600 more profit a month if the forecast is met, and its margin of safety of 366 posters means sales could fall by nearly a third before a loss. Fast delivery is what event organisers want, so the extra orders are realistic. Option 1 is rejected because, although safer, its profit is lower and Inkwell would keep losing urgent orders to rivals. Leila should check the forecast with regular customers before signing the three-year lease.

Both options are discussed in context with calculations, and the recommendation says why the other option was rejected: **Level 3** (9–12 marks). Choosing Option 1 could score as well, for example by arguing that its lower break-even suits a small business that cannot risk a three-year lease.

Common mistakes

- **Dividing, or using maximum output, for the margin of safety.** It is current or forecast output **minus** break-even output.
- **Answering in dollars.** Break-even output and margin of safety are numbers of units (beds, tables, watches). A \$ sign costs a mark, and so does writing "units" after an average cost.
- **Getting the formula wrong for total variable cost:** dividing instead of multiplying, adding random numbers from the table, or dropping a zero. Show the method so a slip still earns 1 mark.
- **Defining by example or repeating the term.** "Fixed costs are rent and insurance" and "average cost is the average of the costs" earn nothing. Don't confuse total cost with average cost or start-up capital, or variable costs with fixed costs.
- **Listing variable costs as fixed costs.** Wages paid per item, raw materials and power for machines are not fixed.
- **Mislabelling the chart.** Calling the total revenue line "variable costs", or the gap between break-even and current output "profit" instead of the margin of safety.
- **Talking about falling sales when asked about the chart.** After a price rise the chart shows a lower break-even point and a bigger margin of safety; it assumes everything is sold.
- **Vague benefits and limitations.** "Helps make decisions", "shows profit", "it is inaccurate" and "it is time-consuming" are not credited. Say break-even shows the **potential** profit at any output, and say which assumption makes it inaccurate (all output sold, one price, straight lines).
- **Ways to raise the margin of safety the wrong way round** (lower the price, raise costs), or suggesting "more advertising" or "produce more", which were not credited.
- **"Costs are lower" for economies of scale.** Total costs rise as a business grows; it is the **average** cost that falls. Examiners also see answers stop at "bulk buying gives discounts" without the link to unit cost.
- **Inventing diseconomies.** "Managerial diseconomies" or "production diseconomies" are not credited. Name a real problem: poor communication, low commitment, weak coordination.
- **Copying the appendix figures without comment** in Paper 2 (b), or ignoring the appendix. Calculate, then say what each figure means; the best recommendations weigh risk and the case as well as profit.
- **Treating the chart as a record of the past.** A break-even chart is a forecast used for planning, which is why it helps before a decision and why its figures may turn out wrong.

- **Using the same case detail for both points**, or two explanations of the same point: each is credited once.

How to get the marks

- **Calculate** (2 marks): write the numbers you used, then the answer on the answer line with its units ("600 frames", "\$7"). A right method with a slip earns 1; a right answer left only in the working earns 1.
- **Define** (2 marks): both ideas: for diseconomies of scale, the business growing **and** average cost rising; for average cost, **total** cost divided by output.
- **Identify** (1 mark each): short and different; on a chart, the full name of the line or point. Only your first answer for each is marked.
- **Outline** (Paper 1 (c), 4 marks): a point and a case detail each, such as "lower fixed costs (k) by moving the bakery to a shop with lower rent (app)".
- **Explain** (Paper 1 (d), 6 marks): point, case detail, consequence, often what happens to the average cost.
- **Paper 1 (e)** (6 marks): general, so no case details: two developed points, then a decision that says when or why.
- **Paper 2 (a)** (8 marks): a chain of explanation for each point, with a different case detail each time.
- **Paper 2 (b)** (12 marks): figures for **every** option, what each means, the case's other points, then a choice and why the rejected option is worse **for this business**. "Using ... calculations" means an answer without them stays in the lower levels.

Quick check

1. A café has these costs each month. Classify each as fixed or variable: (a) rent; (b) coffee beans; (c) the manager's salary; (d) insurance; (e) paper cups.
2. A business making garden chairs has fixed costs of \$12 000 a month and a variable cost of \$7 per chair, and sells each chair for \$15. It makes and sells 2000 chairs a month. Calculate (a) total variable cost; (b) total cost; (c) average cost; (d) break-even output; (e) the margin of safety.
3. Using the first break-even chart in "Understand it" (the candle maker), find (a) the profit at 1600 candles a month; (b) the loss at 500 candles a month.
4. Name the economy of scale in each case. (a) A supermarket chain pays less for each tin of soup because it orders a million tins. (b) A large company borrows at a lower interest rate than a small one. (c) A firm hires a full-time specialist accountant. (d) The cost of one television advert is shared over the sales of millions of products. (e) A factory installs a large automated production line.
5. The candle maker's rent rises by \$1200 a month. Its price stays at \$10 and its variable cost at \$4. Describe two changes to its break-even chart, and calculate its new break-even output and margin of safety at 1300 candles.

Answers

1. Fixed: (a) rent, (c) the manager's salary, (d) insurance. Variable: (b) coffee beans, (e) paper cups.
2. (a) $7 \times 2000 = 14\,000$ dollars. (b) $12\,000 + 14\,000 = 26\,000$ dollars. (c) $26\,000 \div 2000 = 13$ dollars a chair. (d) $12\,000 \div (15 - 7) = 1500$ chairs. (e) $2000 - 1500 = 500$ chairs.
3. (a) Total revenue \$16 000, total costs \$12 400, so profit = $16\,000 - 12\,400 = 3600$ dollars. (b) Total revenue \$5000, total costs $6000 + 4 \times 500 = 8000$ dollars, so loss = $8000 - 5000 = 3000$ dollars.
4. (a) Purchasing. (b) Financial. (c) Managerial. (d) Marketing. (e) Technical.
5. The fixed costs line moves up from \$6000 to \$7200, and the total costs line moves up by the same \$1200 (it stays parallel to the old one); the break-even point moves to the right. New break-even output = $7200 \div (10 - 4) = 1200$ candles; margin of safety = $1300 - 1200 = 100$ candles.

Past questions to try

- 0450/12/M/J/22 Q3: parts (b) and (c), break-even output for a camera, then ways to increase the margin of safety.
- 0450/11/O/N/23 Q2: parts (a), (b) and (d), limitations, profit read from a chart, and ways to lower break-even output.
- 0450/22/M/J/24 Q1: part (b), choosing between two new products using break-even calculations.
- 0450/21/O/N/21 Q3: part (b), which of three economies of scale would benefit a soap powder maker most.