

Cambridge IGCSE · Business Studies 0450 · Notes

Production of goods and services

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Read first: **Business activity**, **Enterprise**, **business growth and size**

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What you need to know

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

1. **What production means.** Explain how a business manages its resources well to make goods and services without waste.
 2. **Production and productivity.** Tell the difference between production (how much is made) and productivity (how much is made per worker or other input), and calculate labour productivity.
 3. **Efficiency.** Explain why a business benefits from becoming more efficient, and how it can do it: for example by raising productivity through automation and technology, or by improving its workers' skills.
 4. **Inventory.** Explain why businesses hold inventories of materials, part-finished goods and finished goods.
 5. **Lean production.** Explain what lean production is, how a business achieves it (for example with just-in-time inventory control and Kaizen) and what the business gains from it.
 6. **Methods of production.** Describe the features, benefits and limitations of job, batch and flow production, and recommend and justify the right method for a business in a given situation.
 7. **Technology.** Explain how technology has changed, and is changing, the way goods are made, such as computers used in design and manufacturing.
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Understand it

What production means

Production is turning resources into goods and services that customers want; it is measured by total output, such as cars a week or meals a day.

Managing resources effectively means having the right workers, machines, materials and money in the right place at the right time, and using them without waste: enough workers with the right skills, machines kept running, materials bought so production never stops but cash is not tied up in unused stock, and work organised so products move smoothly between stages.

Managed badly, the business pays for idle workers, unused machines and materials that go out of date, deliveries are late and the cost of each item rises. Managed well, it meets orders on time at a low cost per unit.

Production and productivity

- **Production** is turning resources into goods and services that customers want; it is measured by total output.
- **Productivity** is the output produced from the inputs used in a period, usually measured as output per worker (labour productivity).

$$\text{labour productivity} = \frac{\text{total output}}{\text{number of workers}}$$

For example, factory X has 50 workers and makes 10 000 units a week; factory Y has 20 workers and makes 6000 units a week. Factory X has the higher **production** (10 000 against 6000), but factory Y has the higher **productivity**: $6000 \div 20 = 300$ units per worker, against $10\,000 \div 50 = 200$ units per worker at X.

Productivity can rise even when production stays the same, if fewer workers make the same output.

Higher productivity is a sign of higher **efficiency**: producing goods and services with as few resources, and as little waste, as possible.

Why efficiency matters

- **Lower cost per unit**: the same workers, machines and materials make more output.
- **Lower prices or higher profit margins**: cut the price to win customers from rivals, or keep it and earn more on each item. Either way the business is more **competitive**.
- **Less waste** of materials, time and energy, which also helps the environment.
- **More output from the same resources**, so rising demand can be met without hiring or buying more.

How to increase efficiency

The syllabus names two main ways, and exams often ask you to compare them.

Automation and technology. Machines, robots and computer-controlled equipment do work that people did before.

Benefits	Limitations
machines work faster and can run all day and night, so output per worker rises	expensive to buy and set up; the business may have to borrow and pay interest
fewer workers needed, so the wage bill falls	workers who are no longer needed must be made redundant, which costs money and upsets those who stay
consistent quality and fewer mistakes, so less material is wasted	workers must be trained to use the machines, or new skilled staff hired
designs can be changed quickly by reprogramming	machines need maintenance and go out of date

Improving labour skills. Training workers so that they can do their jobs faster and better, or do more than one job.

Benefits	Limitations
skilled workers work faster and make fewer mistakes, so output per worker rises and less material is wasted	training costs money (courses, trainers, wages paid while learning)
workers feel valued, so motivation rises and fewer leave	output may fall while workers are away being trained
workers who can do several jobs can cover for absent colleagues, so production keeps going	trained workers may leave for a rival, taking the skills the business paid for
no large sum of money needs to be raised	gains are smaller and slower than a new machine gives

Other ways to raise efficiency include **motivating workers** (better pay, praise, more interesting jobs) and **lean production**, explained below.

Why businesses hold inventory

Inventory is the stocks of raw materials, part-finished goods (work in progress) and finished goods that a business holds. A bakery's inventory is its flour and sugar, its dough waiting to be baked, and its bread waiting to be sold.

Reasons for holding inventory:

- **To meet demand straight away**, including sudden or unexpected orders. Customers who find a product out of stock may buy from a rival and not come back.
- **To keep production running** if a supplier delivers late, a delivery is lost, or materials come from far away and take weeks to arrive. Without materials, workers and machines stand idle.
- **To get discounts for buying in bulk** (purchasing economies of scale), which lowers the cost of each unit.
- **To prepare for seasonal peaks**, such as a festival or summer, when demand is far higher than usual and cannot all be produced at the last minute.
- **To replace faulty goods quickly**, so customers stay satisfied.

Problems of holding **too much** inventory:

- **Cash is tied up**: money spent on stock cannot be used to pay wages or suppliers, so the business may face cash-flow problems. It could also have been used for something else (an opportunity cost).
- **Storage costs**: warehouse space, rent, insurance and security.
- **Risk of loss**: stock can be damaged, stolen, go out of date (food, medicines) or go out of fashion.

Problems of holding **too little**: orders cannot be met, so customers go to rivals; production stops if materials run out, while workers are still paid; and bulk discounts are lost.

How much to hold depends on: the **level and pattern of demand** (steady or seasonal, predictable or not); whether the product is **perishable**; the **storage space** and its cost; the **money available**; how **reliable and quick the suppliers** are; and the **method of production** (a flow line uses materials fast).

Lean production

Lean production is a group of methods that cut waste of every kind (time, materials, inventory, movement, faulty work) so that a business produces more with fewer resources. Waste is anything that adds cost but no value for the customer, such as stock waiting to be used, workers walking further than needed, or faulty products that must be redone.

The two methods named in the syllabus:

Just-in-time (JIT) inventory control is a way of managing inventory in which materials and components arrive just before they are needed in production, and finished goods are sent out as soon as they are made, so little or no inventory is held. The business agrees frequent, reliable deliveries with its suppliers instead of keeping a store of materials "just in case".

Benefits of JIT	Drawbacks of JIT
less money tied up in inventory, so cash flow improves	cannot meet a sudden rise in demand, as there is no spare stock
less warehouse space needed, so storage costs fall and space can be used for production	a late delivery stops production, so the business relies on suppliers being reliable
less stock goes out of date, out of fashion or is damaged	small, frequent orders lose bulk-buying discounts, and delivery costs may rise
problems are seen at once, since there is no stock to hide them	needs careful planning and good communication with suppliers

JIT works best when demand is **predictable** and suppliers are **reliable and close by**. It is about the arrival of materials; it does not mean a business needs no storage space at all, and it is not the same as making products only when an order comes in.

Kaizen (a Japanese word for "improvement") is continuous improvement through many small changes suggested by employees, usually working in teams. Workers know their own jobs best, so they are asked regularly how to cut waste: moving a machine so parts travel a shorter distance, changing the order of tasks, or redesigning a tool. Each change is small and cheap, but together they make large savings over time.

Benefits of Kaizen	Drawbacks of Kaizen
fewer mistakes and less rework, so less material and time are wasted	meetings take workers away from production, so some output is lost
faster production, as wasted steps and movements are removed	workers may need training to take part
workers feel involved and valued, so motivation rises	gains are small and gradual, not a quick fix
changes cost little, since they come from the workers' own ideas	some workers or managers may resist changing how things are done

Benefits of lean production for the business: less waste, so a lower cost per unit; less money tied up in inventory; less storage space needed; fewer faulty products, so a better reputation; faster production; and more motivated workers.

Lean production is a way of **managing** production, not a method of production. A business can use JIT and Kaizen alongside job, batch or flow production.

The three methods of production

Job production is a method in which one product, or a small number, is made at a time, each to a customer's own order. Examples: a made-to-measure suit, a wedding cake, a house designed for one family, a ship.

Features	Benefits	Limitations
each product is different, made to the customer's specification	the product meets exactly what the customer wants, so customers are happy and recommend the business	slow, so output is low
usually skilled workers, often using hand tools	a high price can be charged for a unique product, so the profit on each item can be high	labour intensive: skilled workers are expensive, so the cost per unit is high
workers carry out many different tasks	varied work is interesting, so workers are motivated	no economies of scale, as materials are bought in small amounts
	quality is usually high, since each item gets individual attention	a mistake on a one-off item can be expensive to put right

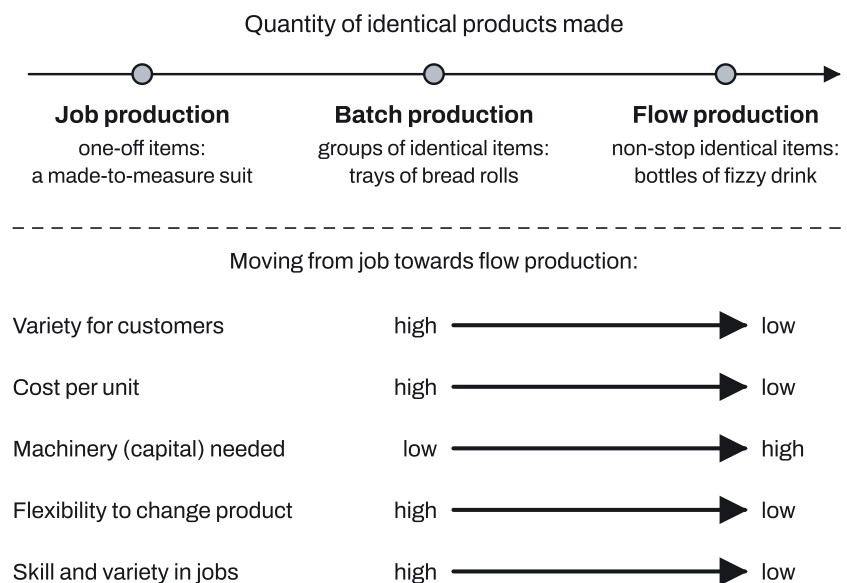
Batch production is a method in which a set quantity of identical products is made together, the whole group moving through each stage of production before the machines are changed to make a different product. Examples: a bakery making 300 white loaves, then 200 brown loaves; a clothing maker making shirts in one size and colour, then another.

Features	Benefits	Limitations
products are made in groups, each group identical	flexible: the business can switch between products as demand changes	machines must be cleaned and reset between batches, so time and output are lost
the group moves from stage to stage together	a range of products can be offered, reaching more customers and spreading risk	part-finished batches wait between stages, so storage space is needed
machines are general-purpose and can be changed	a breakdown on one product line need not stop all production	a mistake can spoil a whole batch, wasting materials

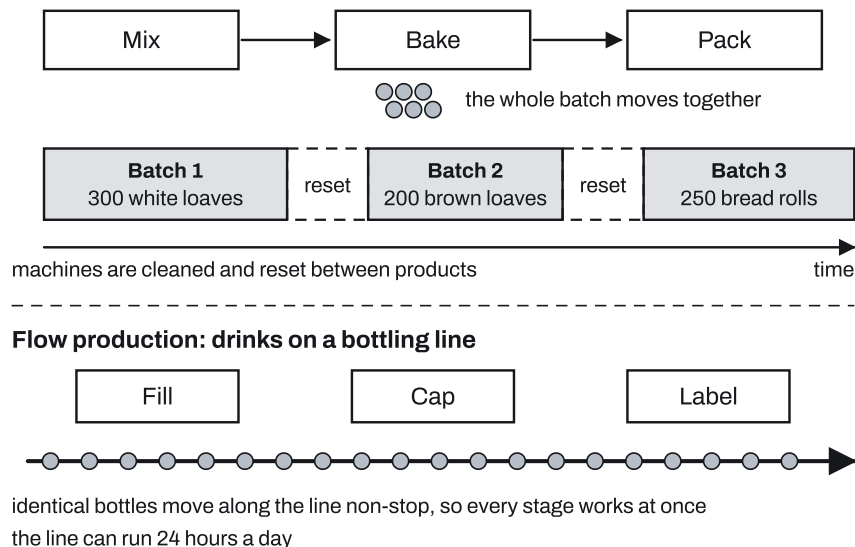
Features	Benefits	Limitations
	more output and lower unit cost than job production, as materials are bought in larger amounts	the work can be repetitive and less motivating than job production

Flow production is a method in which large quantities of identical products are made continuously, moving from one stage to the next along a production line. Examples: soft drinks, cars, paper, paint.

Features	Benefits	Limitations
a continuous production line, often automated	very high output	inflexible: the line makes one product, so it is hard to change to meet different customer needs
every product is the same (standardised)	economies of scale, so the cost per unit is low and the price can be low	very high cost to set up the line
capital intensive: many machines, few workers	can run 24 hours a day	if one machine breaks down the whole line stops
each worker does one small task (specialisation)	workers need little training for their one task	repetitive work is boring, so absenteeism and labour turnover can rise
		large inventories of materials are needed to keep the line going



The difference between batch and flow is in how the products move. In batch production the whole group finishes one stage before moving on, and the machines stop to be reset when the product changes. In flow production identical items move along the line one after another without stopping, so every stage is working at the same time.

Batch production: bread in a bakery

Choosing a production method

No method is best for every business. The right one depends on:

- **The size of the market and the level of demand.** A product bought by millions every week suits flow; a small or niche market cannot keep a flow line busy.
- **The type of product.** Is each one different (job), is there a range of versions (batch), or is every one the same (flow)?
- **Money available.** Flow lines cost a great deal to set up; a small business may only afford job or batch production.
- **The technology available** and the **skills of the workforce.**
- **How often demand or tastes change.** Fast-changing tastes favour the flexibility of batch production.

A business can use more than one method: a furniture maker might make standard chairs in batches and design one-off tables to order.

How technology has changed production

- **Computer-aided design (CAD):** products are designed, tested and changed on screen before anything is made, so new products are developed faster and more cheaply.
- **Computer-aided manufacture (CAM):** computers control the machines that cut, shape and assemble products, accurately and without breaks.
- **Automation and robots** carry out repetitive, heavy or dangerous tasks such as welding, painting or packing.
- **Computer inventory systems** record every item used and reorder automatically, which makes JIT possible.
- **Better communication:** email, shared online systems and video calls link designers, factories and suppliers, so mistakes and delays fall.

Effects on the business:

Positive	Negative
higher productivity and output	high cost to buy and install; may mean borrowing
consistent quality, fewer mistakes, less waste	workers need training, which costs money and time
fewer workers needed, so lower wage costs	technology changes fast and must be replaced often
new products designed more quickly	breakdowns can stop production
safer work, as machines take on dangerous tasks	redundancies, which cost money and can lower the motivation of those who stay

Effects on employees are mixed: some lose their jobs or find their work less skilled and more boring, while others learn new skills, earn more, and work in safer conditions.

Key facts and formulas

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

Fact	Status
Production: turning resources into goods and services that customers want; it is measured by total output	Learn it
Productivity: the output produced from the inputs used in a period, usually measured as output per worker (labour productivity)	Learn it
Labour productivity = $\frac{\text{total output}}{\text{number of workers}}$	Learn it
Percentage change = $\frac{\text{new} - \text{old}}{\text{old}} \times 100$	Learn it
Efficiency: producing goods and services with as few resources, and as little waste, as possible	Learn it
Ways to increase efficiency: automation and technology, improving labour skills (training), motivating workers, lean production	Learn it
Inventory: the stocks of raw materials, part-finished goods (work in progress) and finished goods that a business holds	Learn it
Reasons to hold inventory: meet (unexpected) demand, keep production going if supplies are late, bulk-buying discounts, seasonal peaks, replace faulty goods	Learn it
Lean production: a group of methods that cut waste of every kind (time, materials, inventory, movement, faulty work) so that a business produces more with fewer resources	Learn it

Fact	Status
Just-in-time (JIT): materials and components arrive just before they are needed in production, and finished goods are sent out as soon as they are made, so little or no inventory is held	Learn it
Kaizen: continuous improvement through many small changes suggested by employees, usually working in teams	Learn it
Job production: one product, or a small number, is made at a time, each to a customer's own order	Learn it
Batch production: a set quantity of identical products is made together, the whole group moving through each stage of production before the machines are changed to make a different product	Learn it
Flow production: large quantities of identical products are made continuously, moving from one stage to the next along a production line	Learn it
CAD: computer-aided design; CAM: computer-aided manufacture	Learn it

How to do it

We have tagged 52 questions on this topic (2021–2026), on Paper 1 and Paper 2. 7 of them have parts of more than one type, so the counts add to 59.

Question type	Questions
Explain benefits or limitations of job, batch or flow production	13
Explain lean production, just-in-time or Kaizen	9
Explain why a business holds inventory, or the effects of high or low inventory	8
Judge whether a production method is the best	7
Explain how technology changes production	6
Recommend a way to increase efficiency, productivity or output	5
Identify or explain ways to increase efficiency and why it matters	4
Factors that decide how much inventory to hold	2
Recommend who should buy the inventory (head office or local managers)	2
Define a production method	2
Calculate labour productivity	1

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" or "State"	1 each	short points; only the first ones asked for are marked
Paper 1 "Calculate"	2	right answer with units; correct method alone = 1
Paper 1 "Outline" (c)	4	each: k + app; no marks for analysis
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 ..." or "one ... and one ..."	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 other was rejected

1. Explain benefits or limitations of job, batch or flow production (13 questions)

1. **Name the benefit or limitation** (k) from the tables in "Understand it". Check which method the business uses, and whether benefits, limitations or one of each are wanted.
2. **Tie it to the business** (app): its product, workers, customers or size.
3. **Develop the consequence** (an): costs, revenue, profit, motivation or reputation.

Variations you will meet:

- **Paper 2 (a), two reasons a flower shop uses job production (0450/22/O/N/25 Q3, part (a))**: each reason plus up to 3 marks of explanation, one applied. A unique product made to each customer's wishes lets the shop charge more.
- **Paper 2 (a), two benefits and two limitations** of batch production for a cookie maker (0450/21/O/N/24 Q3, part (a)), or two advantages and two disadvantages of job production (0450/22/O/N/21 Q2, part (a)): four points, each with one applied explanation.
- **Paper 2 (a), one benefit and one limitation** of job production for a house builder (0450/23/O/N/23 Q3, part (a)), or one advantage and one disadvantage of flow production (0450/22/F/M/23 Q1, part (a)): two points, each with a chain of three links.
- **Paper 1 (d), k + app + an each**: two benefits of job production to a house builder (0450/13/O/N/25 Q3, part (d)); two limitations of flow production for a paint maker (0450/13/M/J/24 Q3, part (d)); two advantages of batch production for a bed maker (0450/11/M/J/22 Q2, part (d)); one advantage and one disadvantage of flow production for a glass bottle maker (0450/12/F/M/22 Q1, part (d)) or of job production for a maker of personalised phone cases (0450/11/M/J/21 Q4, part (d)).
- **Paper 1 (c), outline two benefits** of batch production for a soft drinks maker (0450/12/O/N/24 Q2, part (c)): k + app each.

- **Identify two methods of production** (0450/11/M/J/23 Q1, part (b)): job, batch, flow (not lean, JIT or Kaizen). **Identify two features of batch production** (0450/13/M/J/22 Q1, part (b)): identical items made in groups; machines reset between batches; a variety of products.

2. Explain lean production, just-in-time or Kaizen (9 questions)

Same plan as type 1: **method or benefit** (k), **how it works in this business** (app: which materials arrive just in time, what the workers would improve), **effect** on costs, cash, space, speed or quality (an).

Variations you will meet:

- **Paper 1 (d), two methods of lean production** for a computer maker (0450/13/O/N/25 Q1, part (d)): JIT for its imported raw materials, so less storage space and lower storage costs; Kaizen, so workers' small changes remove errors when making the computers.
- **Two benefits of lean production:** for a food maker on Paper 1 (d) (0450/11/M/J/25 Q2, part (d)), or on Paper 2 (a) (0450/22/M/J/22 Q2, part (a)). Give benefits, not features.
- **JIT advantages and disadvantages:** two of each for a clothing maker (0450/23/O/N/24 Q4, part (a)); one of each, outlined, for a car maker (0450/11/O/N/21 Q2, part (c)); two advantages for a maker of cleaning products (0450/13/M/J/22 Q1, part (d)).
- **One advantage and one disadvantage of introducing Kaizen** for an office products maker (0450/13/O/N/21 Q1, part (d)): say what the workers would change, and a real cost such as time in meetings.
- **Paper 2 (b), Kaizen or JIT** for a bakery (0450/21/M/J/22 Q2, part (b)): JIT concerns the ingredients arriving, not storing the finished bread.
- **Identify two factors to consider before introducing JIT** (0450/12/O/N/21 Q1, part (b)): supplier reliability; how predictable demand is.

3. Explain why a business holds inventory, or the effects of high or low inventory (8 questions)

Plan: **reason, advantage or problem** (k), **what the inventory is** or a case number (app), **effect** on customers, revenue, unit cost or cash flow (an).

Variations you will meet:

- **Paper 1 (c), outline two reasons a bed maker holds a high level of inventory** (0450/12/F/M/26 Q3, part (c)): k + app each. The case's rise in demand can be the reason or the application, not both.
- **Paper 1 (d), two reasons inventory is important** for a steel maker (0450/13/M/J/25 Q3, part (d)); **two problems of a high level** for a steel maker (0450/12/O/N/23 Q2, part (d)).
- **One advantage and one disadvantage of holding inventory** for a rug maker on Paper 2 (a) (0450/22/F/M/25 Q3, part (a)), or of a high level for a boat builder on Paper 1 (d) (0450/11/M/J/24 Q1, part (d)). Say "storage costs", not "higher costs".
- **Identify four reasons businesses hold inventory** (0450/12/F/M/23 Q2, part (c)): four different reasons.

- **Paper 2 (a), two reasons a business might hold low inventory** (0450/23/O/N/22 Q3, part (a)): the problems of holding a lot, turned round. **Four reasons the level of inventory matters** to a toy shop (0450/22/M/J/21 Q4, part (a)): too little loses sales of popular toys; too much ties up cash and space.

4. Judge whether a production method is the best (7 questions)

1. **A point about the named method** (k), **developed** (an).
2. **A point about another method or a drawback** (k), **developed** (an). For "advantages greater than disadvantages", you need a valid one of each.
3. **Decide and justify** (eval, 2 marks): say when the named method wins and why the other point matters less.

These are general questions: no marks for case details.

- **Is batch production the best method** for a business? (0450/12/F/M/25 Q3, part (e); 0450/13/O/N/24 Q1, part (e)). **Is flow production the best method** for a manufacturer? (0450/12/M/J/22 Q3, part (e)). **Is job production the best method?** (0450/12/M/J/23 Q1, part (e)): compare with batch; flow does not suit a small business.
- **Are the advantages of flow production greater than the disadvantages** for a manufacturer? (0450/12/M/J/24 Q4, part (e)).
- **Is the size of the market the most important factor** when choosing a method? (0450/13/O/N/22 Q2, part (e)): weigh it against another factor, such as money available. **Identify four factors** to consider when choosing a method (0450/11/O/N/22 Q1, part (c)).

A good judgement says **when**: batch suits a business selling several versions of a product whose demand changes, because a flow line would turn out large amounts of one version that might not sell; flow suits one product with large, steady demand, because its low cost per unit allows a lower price.

5. Explain how technology changes production (6 questions)

Plan: **change or effect** (k: CAD, CAM, robots, higher productivity, fewer workers, high cost, redundancies), **what the business makes** (app), **effect** on unit cost, reputation, sales or debt (an).

- **Paper 1 (d), two effects of introducing new technology** for a small furniture maker (0450/11/O/N/25 Q1, part (d)): positive or negative effects both count.
- **Paper 1 (c), outline two advantages** of new technology to a steel maker (0450/13/M/J/25 Q3, part (c)): "lower costs" counts once unless two different costs are named.
- **Identify two ways technology could change production methods** (0450/12/F/M/23 Q1, part (b)); **explain two ways technology might have changed production** at a toy maker (0450/13/M/J/21 Q3, part (d)).
- **Paper 2 (a), two benefits of new technology** described in an appendix, at an airport (0450/23/O/N/21 Q3, part (a)): use the appendix figures as application.
- **Paper 1 (e), do these changes benefit all employees?** (0450/11/O/N/21 Q2, part (e)): new skills and safer work against redundancy and duller jobs; decide.

6. Recommend a way to increase efficiency, productivity or output (5 questions)

1. **Discuss each option**, advantages and disadvantages, developed and applied (use the tables under "How to increase efficiency").
 2. **Recommend one** using the case: money available, the workers' current skills, the product.
 3. **Say why the other was rejected**, without repeating earlier points.
- **Paper 2 (b), improving labour skills or automation and technology** for a sports equipment maker (0450/22/M/J/25 Q2, part (b)) and a pottery maker (0450/21/M/J/24 Q3, part (b)). If the workers are already skilled, training may add little.
 - **Paper 2 (b), new technology or more of the existing equipment** to raise output at a maker of traditional food (0450/22/F/M/24 Q3, part (b)): cost, training and the effect on the food's taste.
 - **Paper 2 (b), new technology or more training** to raise employees' productivity (0450/23/M/J/23 Q3, part (b)).
 - **Paper 1 (e), is improving labour skills the best way** for a manufacturer to increase efficiency? (0450/11/M/J/23 Q1, part (e)).

7. Identify or explain ways to increase efficiency and why it matters (4 questions)

- **State four benefits of increasing efficiency** (0450/13/M/J/23 Q2, part (c)): lower cost per unit, lower prices, higher profit, less waste. Productivity and efficiency count as one point.
- **State two ways to increase productivity** (0450/12/M/J/21 Q2, part (b)): new technology, training, motivation, lean production; hiring more workers raises output, not productivity.
- **Paper 1 (d), two methods a car maker could use to increase efficiency** (0450/12/O/N/22 Q4, part (d)): method + case detail + effect.
- **Paper 2 (a), two reasons to manage resources effectively when manufacturing** (0450/21/M/J/21 Q2, part (a)): avoid wasted materials and time, keep costs down, have enough materials and workers to meet orders on time.

8. Factors that decide how much inventory to hold (2 questions)

- **Identify two factors** (0450/12/O/N/24 Q2, part (b)): level of demand, perishability, storage space and cost, money available, supplier reliability, seasons, method of production.
- **Paper 1 (e), explain two factors and judge which matters most** (0450/13/M/J/23 Q2, part (e)): say why each changes the amount held, then decide; for example, unreliable suppliers matter most when a stoppage would idle the whole factory.

9. Recommend who should buy the inventory (2 questions)

- **Head office buying for every site**: bulk discounts (purchasing economies of scale, so a lower cost per unit), the same quality everywhere, experienced buyers; but transport and warehouse costs, and it may not suit local tastes.

- **Local managers buying for their own site:** they know local demand, supplies are fresher and quicker, managers feel trusted; but smaller discounts, quality may vary, and managers may lack the skills or time.

Discuss both in context, choose, and say why the other was rejected: head office or factory managers in each country buying raw materials for a sports equipment maker (**0450/22/M/J/25 Q3**, part (b)); head office or restaurant managers buying inventory (**0450/21/M/J/23 Q1**, part (b)).

10. Define a production method (2 questions)

Each definition needs two ideas for 2 marks.

- **Flow production** (**0450/13/O/N/21 Q4**, part (a)): large quantities of identical products (1), made continuously along a production line (1).
- **Batch production** (**0450/12/F/M/21 Q3**, part (b)): a set quantity of identical products is made together (1), the whole group moving through each stage of production before the machines are changed to make a different product (1). Don't use the word "batch" in the definition.

11. Calculate labour productivity (1 question)

- **Output per worker per week** (**0450/13/O/N/21 Q4**, part (b)): total output ÷ number of workers, with units. Use the right year's figures; correct working with a wrong answer still earns 1 mark.

Worked examples

Example 1

VoltRide assembles electric scooters, which it sells to scooter-hire companies in cities. The hire companies compare prices from several makers before ordering. In 2025, 40 production workers assembled 12 000 scooters. Early in 2026, VoltRide installed robotic welding arms and trained its workers to use them. In 2026, 36 workers assembled 12 600 scooters.

- (a) Define "productivity". **[2]**
- (b) Calculate the percentage change in VoltRide's labour productivity from 2025 to 2026. Show your working. **[2]**
- (c) Outline two benefits to VoltRide of its higher labour productivity. **[4]**
- (a)** The output produced from the inputs used in a period (1), usually measured as output per worker (1).
- (b)** Labour productivity in 2025: $12\,000 \div 40 = 300$ scooters per worker. In 2026: $12\,600 \div 36 = 350$ scooters per worker.

$$\text{Percentage change} = \frac{350 - 300}{300} \times 100 = 16.7\% \text{ (2)}.$$

Notice that production rose by only $\frac{12\,600 - 12\,000}{12\,000} \times 100 = 5\%$, while productivity rose by 16.7%: fewer workers made more scooters.

(c) Lower labour cost per scooter (k): VoltRide pays 4 fewer workers but makes 600 more scooters (app).

It could lower its price (k) and win more orders from the hire companies, which compare prices before they order (app).

Part (a) needs both ideas; part (b) is 2 marks for the right answer, 1 for the right method with a slip; part (c) is k + app for each benefit, using a different case detail each time (2 + 2 = 4).

Example 2

Polar Scoop makes ice cream and sells it to supermarkets. Sales double during hot weather, and heatwaves are hard to forecast more than a few days ahead. Polar Scoop imports its vanilla and cocoa from other countries, and each shipment takes three weeks to arrive. The operations manager wants to switch to just-in-time inventory control.

Explain how switching to just-in-time inventory control might affect each of the following at Polar Scoop. **[6]**

- its costs
- its sales

Costs: its storage costs would fall (k). It would no longer keep weeks of imported vanilla and cocoa in its stores (app), so it spends less on warehouse space and insurance, and less cash is tied up in stock, which helps its cash flow (an).

Sales: it may lose sales in hot weather (k). A heatwave can double supermarket orders within days, but with no spare vanilla or cocoa, and three weeks to wait for more, Polar Scoop cannot raise output quickly (app). The supermarkets may fill their freezers with a rival's ice cream instead, so Polar Scoop loses revenue and its reputation for reliable supply (an).

Each effect earns k + app + an (3 + 3 = 6). A good answer could also say that one late shipment would leave the factory idle while workers are still paid, raising its costs.

Example 3

Do you think a business should always keep its inventory as low as possible? Justify your answer. **[6]**

Keeping inventory low reduces holding costs (k). Less is spent on warehouse space and insurance, and less money is tied up in stock, so more cash is available to pay wages and suppliers and cash-flow problems are less likely (an).

However, a business with very little inventory may run out (k) if demand rises unexpectedly or a supplier is late. Production then stops or customers are turned away, and they may switch to competitors for good (an).

I do not think a business should always keep inventory as low as possible (eval). Low inventory suits a business whose demand is steady and whose suppliers are close and reliable, because then the risk of running out is small and the savings are certain. Where demand is seasonal or supplies come from far away, the sales lost by running out would cost more than the storage saved, so holding more is the better choice (eval).

This is a general question, so no business is named and there are no marks for application: $2\text{ k} + 2\text{ an} + 2\text{ eval} = 6$. The judgement earns its marks by saying **when** each side wins, not by repeating the points.

Example 4

Kerbline is a partnership that makes skateboards. Its 6 skilled workers make custom boards by hand, each one painted to a customer's design; each worker makes 1 board a day, on 250 days a year, and each board costs \$60 to make. A chain of sports shops has offered Kerbline a contract for 20 000 identical boards a year at \$45 each. Kerbline is considering three methods for the contract:

- **Job production:** keep making every board by hand, at \$60 a board.
- **Batch production:** lease pressing and cutting machines for \$40 000 a year; materials and labour cost \$25 a board. The machines can be reset to make the custom boards between batches.
- **Flow production:** lease a production line for \$400 000 a year; materials and labour cost \$12 a board. The line can only make the standard board.

Consider the three methods. Which should Kerbline choose? Justify your answer with calculations. [12]

Job production. Kerbline's workers make $6 \times 250 = 1500$ boards a year, far short of the 20 000 the chain wants, and each board would cost \$60 to make but sell for only \$45, a loss of \$15 a board. Job production cannot deliver this contract.

Batch production. The total cost of 20 000 boards is $40\,000 + 25 \times 20\,000 = 540\,000$ dollars, an average of $540\,000 \div 20\,000 = 27$ dollars a board. Revenue is $20\,000 \times 45 = 900\,000$ dollars, so profit is $900\,000 - 540\,000 = 360\,000$ dollars a year. Because the machines can be reset, Kerbline can make a batch of the chain's boards and then a batch of custom boards, so it keeps its existing customers. Against this, time is lost resetting the machines, and part-finished batches need storage space.

Flow production. The total cost is $400\,000 + 12 \times 20\,000 = 640\,000$ dollars, an average of $640\,000 \div 20\,000 = 32$ dollars a board, so profit is $900\,000 - 640\,000 = 260\,000$ dollars a year. Each extra board costs least on the line, but at this output the high leasing cost is spread over too few boards, the line cannot make custom boards (so Kerbline loses its existing customers), and a breakdown stops all production. Flow only becomes cheaper than batch when $40\,000 + 25q = 400\,000 + 12q$, that is $q = 360\,000 \div 13 \approx 27\,692$ boards a year.

Recommendation. Kerbline should choose batch production. It earns \$360 000 a year from the contract, \$100 000 more than flow, and it keeps the flexibility to go on making the custom boards its business was built on. Job production is rejected because the workers can make only 1500 of the 20 000 boards and each would make a loss. Flow production is rejected because, at 20 000 boards, it earns less and cannot make custom boards; it would only be worth considering if orders grew beyond about 27 700 boards a year.

Every method is discussed in context, using the case's figures, and the recommendation says why both alternatives were rejected: **Level 3** (9–12 marks).

Common mistakes

- **Mixing up the methods.** Examiners report candidates saying batch production runs continuously or flow production is flexible, and defining flow when batch was asked.
- **Definitions that repeat the question.** "Batch production is producing in batches" earns nothing. Say that identical items are made **in a group** and that the **whole group moves through each stage together**.
- **"Cheaper" and "quicker" with nothing to compare.** Batch production is not simply "cheaper"; it is cheaper **per unit than job production**, because materials are bought in bulk. Comparisons only count when the other method is named.
- **Economies of scale with no unit cost.** "Flow production gives economies of scale, so costs fall" is not enough: say the **average or unit cost** falls.
- **Assuming high output means high sales.** Sales only rise if customers want the extra products.
- **Mirror arguments.** "Job production has no economies of scale" and "batch production has some economies of scale" are the same point turned round, and earn the mark only once.
- **Vague answers on lean production and Kaizen**, reported in several years. "Kaizen is continuous improvement, so it reduces waste" is too vague: say who suggests the changes (workers), what kind (small, frequent) and what they save.
- **Confusing lean production with flow production**, or listing lean, JIT or Kaizen as methods of production. Lean production is a way of managing any method.
- **Confusing JIT inventory control with making to order**, or claiming JIT means **no** storage space at all. JIT means materials arrive just before they are needed, so far **less** space is needed.
- **Giving features instead of benefits.** "JIT means materials arrive just in time" describes the method; the benefit is that less money is tied up and storage costs fall.
- **Vague costs.** "Holding inventory increases costs" is too general: name the cost (storage, insurance, warehouse rent) or the risk (damage, going out of date).
- **Repeating the same point.** "Meet demand" as two reasons, "productivity" and "efficiency" as two benefits, or one analysis used for every point: each counts once.
- **Using a case detail as both point and application.** "To meet increased demand, as demand rose 30%" is one mark, not two.
- **Repeating the knowledge point instead of developing it.** "Flow production has high output, so it produces a lot" adds nothing; "high output, so the fixed costs are spread over more units and the cost per unit falls" is analysis.
- **Writing about employees instead of the business.** For Kaizen or training, turn employee benefits into business ones: motivated workers make fewer mistakes, so less is wasted.
- **Applying a general (e) question to the case business**, defining terms in it, or ending with a conclusion that repeats earlier points: none of these earns marks.

How to get the marks

- **Define** (2 marks): both ideas of the definition. Learn the method definitions word-perfect, and don't use the word being defined.
- **Identify or State** (1 mark each): short, different points. Only the first ones asked for are marked.
- **Calculate**: show the working and give units ("per worker", "%").
- **Outline** (Paper 1 (c), 4 marks): a point and a case detail for each. Analysis earns nothing here, so keep it short.
- **Explain** (Paper 1 (d), 6 marks): point, case detail, consequence. The consequence should reach costs, revenue, profit, cash flow, motivation or reputation.
- **Paper 1 (e)** (6 marks): general, so no case details. Two developed points, often one for and one against, then a decision that says **when** or **why** one side wins.
- **Paper 2 (a)** (8 marks): each point plus a chain of explanation with one case detail. Use a **different** case detail for each point; the same application used twice is credited once.
- **Paper 2 (b)** (12 marks): discuss **every** option in the case, advantages and disadvantages, using the case's figures. Then choose and say why the rejected option is worse **for this business**. A choice without reasons stays in Level 1 or 2.
- **Use the case's words**: the product, the number of workers, the method it uses. "Its products" is not application.

Quick check

1. Name the method of production. (a) A tailor makes a suit to fit one customer's measurements. (b) A bakery bakes 400 white loaves, cleans the mixer, then bakes 300 brown loaves. (c) A car body moves along a line non-stop while each worker fits the same part to every car.
2. Factory P has 120 workers and makes 30 000 units a month. Factory Q has 80 workers and makes 22 000 units a month. (a) Which factory has the higher production, and which the higher productivity? (b) After training, factory Q's 80 workers make 24 200 units a month. Calculate its new labour productivity and the percentage increase.
3. Is each one JIT, Kaizen or neither? (a) A bakery's flour is delivered every morning just before baking starts. (b) Teams of workers meet every week to suggest small changes to their work. (c) A factory keeps three months of spare components in case its supplier is late. (d) Workers suggest moving the packing table next to the end of the line, so they walk less.
4. A garden centre holds a lot of inventory of plants in spring. Give two reasons why, and one problem this could cause.
5. What do CAD and CAM stand for? Give one benefit of each to a manufacturer, and one way new technology might be a problem for employees.

Answers

1. (a) Job production. (b) Batch production. (c) Flow production.
2. (a) Factory P has the higher production (30 000 against 22 000). Factory Q has the higher productivity:
 $22\,000 \div 80 = 275$ units per worker, against $30\,000 \div 120 = 250$ at P. (b) $24\,200 \div 80 = 302.5$ units per worker; increase = $\frac{302.5 - 275}{275} \times 100 = 10\%$.
3. (a) JIT. (b) Kaizen. (c) Neither: it is holding extra inventory just in case, the opposite of JIT. (d) Kaizen: a small improvement suggested by workers that cuts wasted movement.
4. Reasons: demand is seasonal and far higher in spring, so it must have plants ready to sell; buying in bulk before the season can earn discounts. Problem: plants are perishable, so any that do not sell may die and be wasted; or money is tied up in stock, which can cause cash-flow problems.
5. CAD is computer-aided design: new products can be designed and changed on screen, so they are developed faster and more cheaply. CAM is computer-aided manufacture: computer-controlled machines make products accurately and without breaks, so quality is consistent and output rises. For employees: some may lose their jobs or find their work duller and less skilled.

Past questions to try

- **0450/21/M/J/22 Q2:** part (b), Kaizen or just-in-time for a small bakery.
- **0450/22/M/J/25 Q2:** part (b), improving labour skills or automation to increase efficiency.
- **0450/23/O/N/24 Q4:** part (a), two advantages and two disadvantages of just-in-time for a clothing maker.
- **0450/13/M/J/24 Q3:** part (d), two limitations of flow production for a paint maker.