

Cambridge AS & A Level · Economics 9708 · Notes

Price elasticity, income elasticity and cross elasticity of demand

AS

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What you need to know

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

1. **Define the three elasticities of demand:** price elasticity (PED), income elasticity (YED) and cross elasticity (XED). Each measures how strongly the quantity demanded responds to a change in one thing: the good's own price, consumers' income, or the price of another good.
2. **Write the formula for each and calculate it** from percentage changes, and rearrange it to find a missing change, a new quantity or a new price.
3. **Explain what the size and sign of each coefficient tell you:** whether the quantity changes by a larger or smaller percentage than its cause, and which way it moves. For YED the sign separates normal and inferior goods, and the size separates necessities and luxuries; for XED the sign separates substitutes and complements, and the size shows how close the link is.
4. **Use the right words for each value of PED:** perfectly elastic, (highly) elastic, unit (unitary) elasticity, (highly) inelastic and perfectly inelastic.
5. **Explain why PED changes along a straight-line demand curve**, even though its slope stays the same.
6. **Explain the factors that affect PED, YED and XED.**
7. **Explain the link between PED and total expenditure** (the firm's total revenue) when the price changes.
8. **Explain what the three elasticities mean for decisions** by firms (pricing, revenue, what to produce, reacting to rivals) and by governments (taxes, subsidies), and how reliable they are.

Price elasticity of **supply** is the next topic; don't mix it up with PED.

Understand it

What elasticity measures

Every demand curve tells you that a lower price means more is bought. Elasticity answers the next question: **how much** more? It compares **percentage** changes, so it doesn't matter whether the good is measured in litres or tonnes, or priced in dollars or rupees.

$$\text{elasticity} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in the thing that caused it}}$$

A percentage change is always worked out from the **original** value: $\frac{\text{new} - \text{old}}{\text{old}} \times 100$.

Price elasticity of demand (PED)

PED measures how responsive the quantity demanded of a good is to a change in **its own price**.

$$\text{PED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ price of the good}}$$

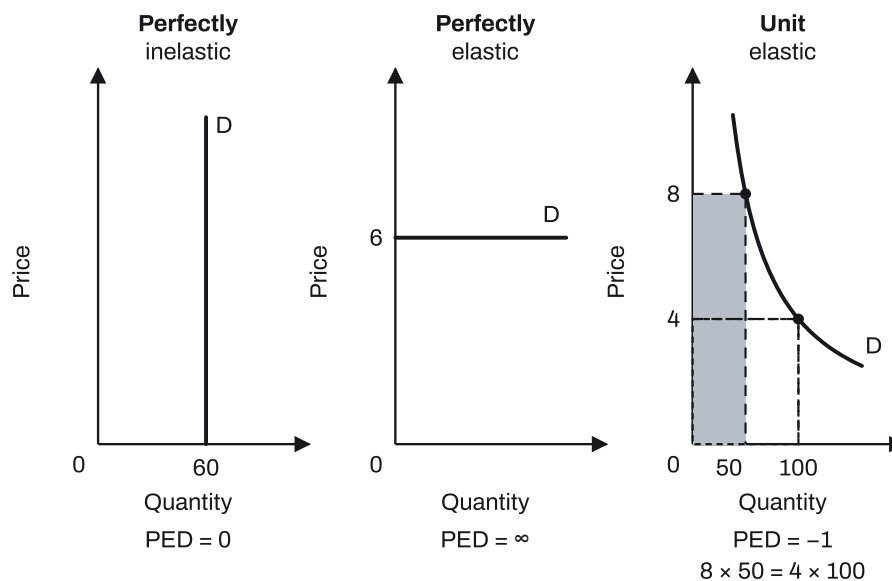
A café raises the price of a coffee from \$2.00 to \$2.20, a rise of 10%. Sales fall from 500 to 440 cups a day, a fall of 12%. So $\text{PED} = \frac{-12}{+10} = -1.2$.

The sign. Price and quantity demanded move in opposite directions (the law of demand), so PED is **negative**. People often quote only its size ("PED is 1.2"), and some multiple-choice options do too. Judge elastic or inelastic by the **size**, ignoring the minus sign.

The size compares the two percentage changes:

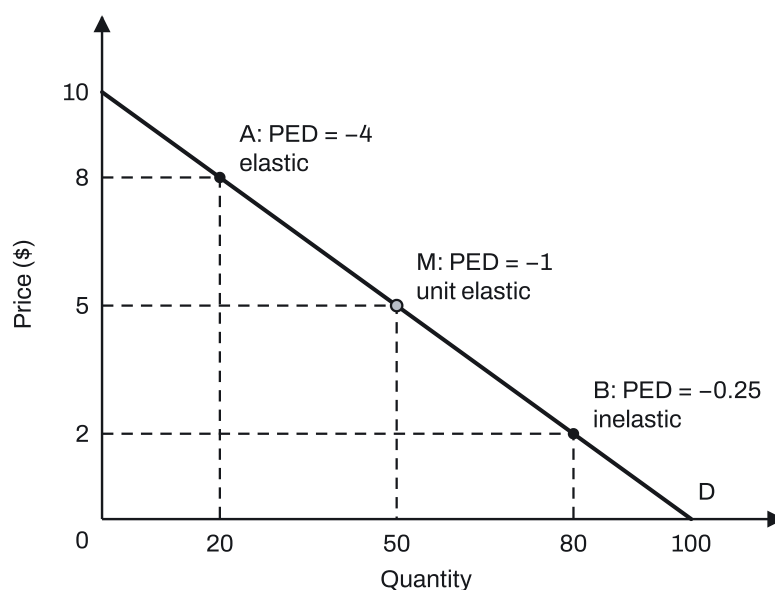
Value of PED (ignoring the sign)	Name	Meaning
0	Perfectly inelastic	Quantity doesn't change at all when price changes
between 0 and 1	Inelastic (highly inelastic when close to 0)	$\% \Delta Q$ is smaller than $\% \Delta P$
exactly 1	Unit (unitary) elasticity	$\% \Delta Q$ equals $\% \Delta P$
greater than 1	Elastic (highly elastic when well above 1)	$\% \Delta Q$ is larger than $\% \Delta P$
infinite (∞)	Perfectly elastic	At any price above the ruling one, quantity demanded falls to zero

"Elastic" does **not** just mean "demand changes a lot": it means the quantity changes by a **bigger percentage than the price**. Examiners regularly see answers that lose marks by saying "inelastic means demand doesn't change".



The two extreme cases are straight lines: a **vertical** demand curve is perfectly inelastic and a **horizontal** one is perfectly elastic. A demand curve that is unit elastic all along its length is not a straight line but a curve (a *rectangular hyperbola*): price $\times$ quantity is the same at every point, so the rectangles under it all have the same area.

PED along a straight-line demand curve



On this demand curve, every \$1 cut in price adds 10 units, wherever you are on the line. The slope is constant. But the **percentage** changes are not:

Price cut	Quantity	$\% \Delta P$	$\% \Delta Q$	PED
\$8 $\rightarrow$ \$7 (from A)	20 $\rightarrow$ 30	-12.5%	+50%	-4

Price cut	Quantity	$\% \Delta P$	$\% \Delta Q$	PED
\$5 → \$4 (from M)	50 → 60	−20%	+20%	−1
\$2 → \$1 (from B)	80 → 90	−50%	+12.5%	−0.25

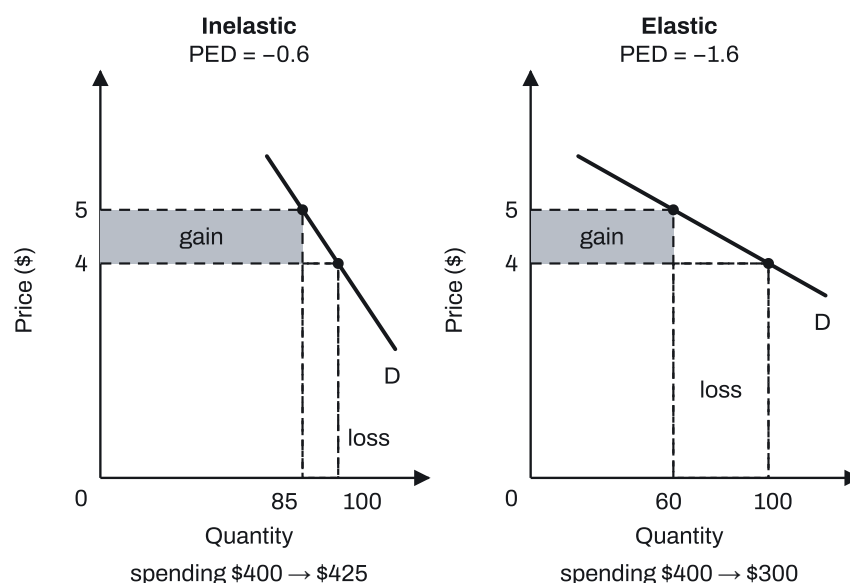
Near the top, the price is high and the quantity small, so a \$1 change is a small percentage of the price but 10 units is a big percentage of the quantity: demand is **elastic**. Near the bottom it's the other way round: demand is **inelastic**. So on any straight-line demand curve:

- demand is **unit elastic at the midpoint** (half-way between the two axes);
- **elastic above** the midpoint and **inelastic below** it;
- moving **down** the line, PED **falls** in size; moving up, it rises.

This is also why you can't judge PED from the slope alone. Two straight lines can only be compared at the same price and quantity: there, the flatter line is the more elastic.

PED and total expenditure

Total expenditure by consumers is price $\times$ quantity, which is the same as the firm's **total revenue**. When the price rises, each unit brings in more (a gain), but fewer units are sold (a loss). PED tells you which effect wins.



- **Inelastic demand:** a 25% price rise loses only 15% of sales. The gain (1×85 , so \$85) beats the loss (4×15 , so \$60), so spending **rises** from \$400 to \$425.
- **Elastic demand:** the same price rise loses 40% of sales. The loss (4×40 , so \$160) beats the gain (1×60 , so \$60), so spending **falls** from \$400 to \$300.

The rule:

PED	Price rises	Price falls
Elastic (size > 1)	Total expenditure falls	Total expenditure rises
Unit elastic (= 1)	No change	No change
Inelastic (size < 1)	Total expenditure rises	Total expenditure falls
Perfectly inelastic (0)	Rises by the same % as price	Falls by the same % as price

A short way to remember it: with **inelastic** demand, price and spending move in the **same** direction; with **elastic** demand, in **opposite** directions.

Income elasticity of demand (YED)

YED measures how responsive the quantity demanded of a good is to a change in consumers' **income**.

$$\text{YED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ income}}$$

Suppose incomes rise by 5%. Demand for restaurant meals rises by 12% (YED = +2.4), demand for bread rises by 1% (YED = +0.2) and demand for bus journeys falls by 2% (YED = -0.4).

The sign tells you the type of good:

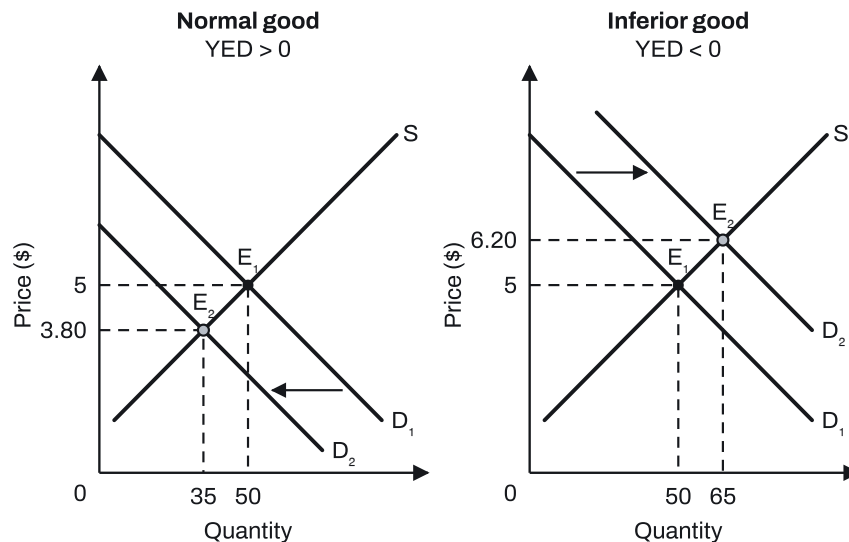
- **Positive YED: a normal good.** Income and demand move the same way.
- **Negative YED: an inferior good.** When incomes rise, people switch to something they now prefer (a car instead of the bus, fresh food instead of the cheapest tinned food), so demand falls; when incomes fall, demand rises.

The size, for a normal good, splits it further:

- **YED between 0 and 1: a necessity** (income inelastic). Demand rises, but by a smaller percentage than income: basic foods, electricity.
- **YED greater than 1: a luxury** (income elastic). Demand rises by a bigger percentage than income: foreign holidays, restaurant meals, sports cars.

An inferior good can also be income elastic or inelastic: YED of -2 means demand rises by 20% when incomes fall by 10%.

A change in income **shifts** the demand curve. Which way depends on the sign of YED, and how far depends on its size.



Cross elasticity of demand (XED)

XED measures how responsive the quantity demanded of **one** good (X) is to a change in the price of **another** good (Y).

$$XED_{X,Y} = \frac{\% \Delta \text{ quantity demanded of good X}}{\% \Delta \text{ price of good Y}}$$

The good whose **quantity** changes goes on top; the good whose **price** changes goes underneath. Getting them the wrong way round is the commonest error in XED calculations.

The sign tells you how the goods are related:

- **Positive XED: substitutes.** Goods used instead of each other. The price of tea rises by 20% and demand for coffee rises by 6%: $XED = +0.3$.
- **Negative XED: complements.** Goods used together (joint demand). The price of printer ink rises by 10% and demand for printers falls by 15%: $XED = -1.5$.
- **XED of zero (or close to it): unrelated goods.** A change in the price of one has no effect on the other.

The size shows how **close** the relationship is: +3 means very close substitutes (two brands of the same bottled water); +0.3 means weak ones. -1.5 is a strong complement; -0.1 a weak one.

Factors that affect the elasticities

PED is higher (more elastic) when:

- **there are many close substitutes.** One brand of petrol has elastic demand (drivers switch to the station next door); petrol as a whole has inelastic demand. The more narrowly a product is defined, the more substitutes it has.

- **it takes a large share of income.** A 10% rise in the price of a car is a big sum, so buyers shop around or wait; a 10% rise in the price of salt goes unnoticed.
- **it is a luxury rather than a necessity**, and it isn't habit-forming or addictive. Demand for cigarettes, basic foods and medicines is inelastic.
- **the time period is longer.** Straight after a price rise, habits and contracts keep people buying. Over months and years they find alternatives: they learn about substitutes, new substitutes are invented, and they replace equipment (a household switches from a gas boiler to an electric heat pump). So demand is **more elastic in the long run** than in the short run.
- **the purchase can be put off.** Replacing a sofa can wait; a business traveller's flight to a meeting often can't, so business demand for flights is less elastic than leisure demand.

YED depends on whether the good is a necessity or a luxury **for those consumers**, which depends on their income level. The same good can change category: a moped may be a luxury in a poor household, a normal good as income grows, and an inferior good once the household can afford a car.

XED depends on **how close** the substitute or complement is. Closer substitutes (same product, different brand) give larger positive values; goods that are almost always used together (cars and fuel) give large negative values.

What the elasticities are used for

Firms use them to make decisions:

- **PED → pricing and revenue.** With inelastic demand a firm can raise its price and increase revenue; with elastic demand it can raise revenue by cutting the price. Firms also use PED to forecast how many units they will sell at a new price, and so how much to produce and how many workers to hire.
- **YED → what to produce and sales forecasts.** In an economic boom, luxuries ($YED > 1$) grow fastest; in a recession, sales of luxuries fall hardest, while inferior goods sell **more**. A firm can switch its product range (a cheaper "value" line) or plan capacity to match forecast incomes.
- **XED → rivals and related products.** A firm with close substitutes (high positive XED) must watch rivals' prices and may match them. A firm selling complements can price one low to sell more of the other (cheap printers, expensive ink), or join with the maker of a complement in promotions.

Governments use PED too: an indirect tax on a good with inelastic demand raises a lot of tax revenue but cuts consumption only a little (so it is a weak way to reduce smoking); a subsidy on a good with elastic demand raises consumption a lot, so it costs the government more.

How reliable are they? Every value is an **estimate** from past data. It assumes all other things stay the same (*ceteris paribus*), but they rarely do. Values change over time (tastes, new substitutes, incomes), differ between groups of consumers, and PED changes along the demand curve, so a value measured for a small price change may not hold for a large one. Collecting the data costs time and money, and a small firm may not be able to afford it.

Key facts and formulas

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

Formula	Status
Percentage change = $\frac{\text{new} - \text{old}}{\text{old}} \times 100$	Learn it
$\text{PED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ price of the good}}$	Learn it
$\text{YED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ income}}$	Learn it
$\text{XED} = \frac{\% \Delta \text{ quantity demanded of good X}}{\% \Delta \text{ price of good Y}}$	Learn it
Rearranged: $\% \Delta Q = \text{elasticity} \times \% \Delta (\text{cause})$, and $\% \Delta (\text{cause}) = \% \Delta Q \div \text{elasticity}$	Learn it
Total expenditure (total revenue) = price $\times$ quantity	Learn it
PED: 0 perfectly inelastic; 0–1 inelastic; 1 unit; > 1 elastic; ∞ perfectly elastic (by size)	Learn it
YED < 0 inferior; 0–1 normal necessity; > 1 normal luxury	Learn it
XED > 0 substitutes; < 0 complements; 0 unrelated; bigger size = closer relationship	Learn it
Straight-line demand curve: unit elastic at the midpoint, elastic above, inelastic below	Learn it
Inelastic: price and total expenditure move the same way; elastic: opposite ways; unit: no change	Learn it

How to do it

In the questions we have tagged for this topic (89 questions, 2021–2025; one repeats another, so 88 different), 61 are Paper 1 multiple choice and 28 are Paper 2 data response or essay questions, where we counted only the parts about this topic. 22 questions mix types, so the counts add up to more than 88. One tagged question (9708/23/M/J/25 Q2) asks only about price elasticity of supply, so it has no type here.

Question type	Questions
Interpret the sign and size of YED or XED	30
Link PED to total expenditure when price changes	19
Evaluate how useful PED, YED or XED is to a firm	17
Calculate an elasticity, or use one to find a new quantity or price	14
Define an elasticity and give its formula	14
Describe elasticity values and how PED varies along a demand curve	8
Apply PED to a market or policy outcome	8
Explain the factors that determine PED, YED or XED	7

Paper 2 parts are marked in two ways. **Part (a), 8 marks**, is point-based: up to **3** marks for knowledge (AO1), **3** for analysis (AO2) and **2** for evaluation (AO3, the second kept for a justified conclusion). **Part (b), 12 marks**, is levels-marked: Table A gives up to **8** for knowledge and analysis (Level 3 is 6–8, Level 2 is 3–5, Level 1 is 1–2) and Table B up to **4** for evaluation (Level 2 is 3–4 with a justified conclusion; Level 1 is 1–2). A one-sided answer gets **no** evaluation marks.

1. Interpret the sign and size of YED or XED (30 questions)

1. **Name the elasticity** from what changed: income → YED; the price of another good → XED.
2. **Read the sign** first: YED + normal, – inferior; XED + substitutes, – complements.
3. **Then the size**: YED above 1 luxury, below 1 necessity; XED large means a close relationship.
4. **Say what it means for demand**: which way the demand curve shifts, and by more or less than the change in income or price.

Variations you will meet:

- **Classify from given values** (multiple choice). With several values at once, take them one at a time. If S and P have XED +1.5, they are substitutes; if S and R have –1.5, complements. A negative XED says nothing about whether a good is inferior; only YED does that.
- **Deduce from a table**. If the price of X falls and the quantity of Y also **falls**, the two moved the same way, so XED is positive: substitutes (people switched to cheap X). If the quantity of Z **rises** when X gets cheaper, XED is negative: complements. For YED from a table, compare the percentage change in quantity with the percentage change in income: if quantity goes from 0, or rises by a bigger percentage, YED is greater than 1.
- **Spending instead of quantity**. "Prices unchanged" means the percentage change in spending equals the percentage change in quantity. Income rises 10% and spending on a good rises from \$200 to \$230 (15%): YED = 1.5, a luxury. Spending that falls means YED is negative.
- **Using size to rank shifts**. When incomes **fall** by 5%, the demand curve shifts **furthest right** for the inferior good with the **largest negative** YED. A firm whose product has YED –3 can expect sales to rise sharply in a recession.
- **Who gains from a change in income distribution**. Taking income from high earners and giving it to low earners raises demand for goods the poor buy most (necessities) and lowers demand for luxuries.
- **Paper 2, 2–8 marks**. "Explain how economists would measure the effect of a rise in the price of X on the demand for Y" (2 marks): name **cross elasticity of demand** (or give its formula) (1) and state the expected sign (positive for substitutes) (1). Discussing PED here earns nothing. For "explain the significance of the size and sign of YED", use examples for each category, draw the demand shift (the diagram above), and evaluate how confident you can be: goods change category as incomes change, values differ between consumers, and they are estimates.

2. Link PED to total expenditure when price changes (19 questions)

1. **Decide whether demand is elastic or inelastic** (from the value, the percentages or the description).

2. **Apply the rule:** inelastic → price and spending move the **same** way; elastic → **opposite** ways; unit → spending constant.
3. **If numbers are given**, check with price × quantity before and after.

Variations you will meet:

- **Work backwards from spending.** A 5% price cut that cuts spending by exactly 5% means quantity didn't change: $PED = 0$. A fall in quantity that cuts revenue in the same proportion means price didn't change: a horizontal demand curve, PED infinite. (A unit elastic curve would leave revenue **unchanged**, which is the popular wrong answer.)
- **Tables of price and spending.** If spending stays the same at every price, demand is unit elastic. If spending divided by price (the quantity) is the same at every price in a market in equilibrium, the quantity never changes: the **supply** curve is vertical and PES is zero.
- **Spending–price graphs.** With price on the vertical axis and total expenditure on the horizontal, a vertical line (spending the same at every price) is unit elastic; spending that falls as price rises is elastic; spending that rises with price is inelastic.
- **Several consumers.** Given each person's PED for two goods, a price rise definitely raises spending only where **that person's** demand is inelastic. Where one buyer is elastic and another inelastic, the total effect on the seller's income can't be known without the quantities.
- **An indirect tax that raises total spending** means the price rose and demand is inelastic.
- **Elastic demand, yet revenue rose after a price rise:** the demand curve must have shifted right at the same time (incomes rose, or a substitute got dearer).
- **Paper 2, 8 marks** (formula, then the significance for a firm): AO1: PED measures the responsiveness of quantity demanded to a change in price (1), the formula (1), and elastic and inelastic in **percentage** terms (1). AO2: analyse a price **rise and a fall** with inelastic demand (spending moves with price) and with elastic demand (spending moves against price): both cases, both directions. AO3: what the firm should do in each case (raise the price when demand is inelastic; cut it when elastic), and a limit (PED is an estimate and changes along the curve; other things, like rivals' prices, change too), then a conclusion.

3. Evaluate how useful PED , YED or XED is to a firm (17 questions)

These are mostly the 12-mark part (b): "Assess whether knowledge of YED is more useful to a firm than knowledge of XED " (or PED against YED , or XED against PED), often in a setting such as **falling incomes**, **economic growth**, car makers or a firm trying to raise its sales revenue.

Answer plan:

1. **Define both measures briefly** with their formulas and signs (AO1). Keep it short: examiners give little credit for "everything I know about elasticity".
2. **Uses of the first measure, developed and tied to the setting** (AO2). For YED when incomes fall: it tells the firm whether its product is normal or inferior and whether it is a luxury, so it can predict how far sales and revenue will fall (or rise, for an inferior good), and change its range towards cheaper lines or plan output and staffing.

3. **Uses of the second measure** (AO2). For XED: when incomes fall, consumers trade down to cheaper substitutes, so a firm must know how close its rivals' products are; it predicts how sales react when a rival cuts its price, and how sales of complements affect its own.
4. **Limitations of each** (AO2/AO3): estimates from past data, other things change, values change over time and with income level, costly to collect, and knowing a value doesn't mean the firm can act on it (it may not control the price, or can't switch production quickly).
5. **Judgement** (AO3): answer the exact question, with a reason tied to the setting. For example: "When incomes are falling, YED is more useful because it predicts the size of the fall in demand directly, but only if the estimate is recent; for a firm with many close rivals, XED may matter more because customers trading down will switch brand before they stop buying."

Answers that aren't tied to the setting in the question ("when incomes are falling", "to increase income from sales", "during a period of growth") are capped at mid-Level 2.

Multiple choice versions: why a firm calculates PED (to predict what happens to revenue when it changes its price), and which elasticities matter for revenue (PED for its own pricing, XED for rivals' prices, YED for changes in income).

4. Calculate an elasticity, or use one to find a new quantity or price (14 questions)

1. **Work out each percentage change from the original value.**
2. **Put the right change on top:** always the quantity demanded (for XED, of the good whose quantity changed).
3. **Keep the signs:** a fall is negative.
4. **To find a missing change,** rearrange: $\% \Delta Q = \text{elasticity} \times \% \Delta (\text{cause})$ or $\% \Delta (\text{cause}) = \% \Delta Q \div \text{elasticity}$. Then apply the percentage to the original value.

Examples:

- **PED.** Price falls from \$50 to \$45 (-10%) and quantity rises from 400 to 460 ($+15\%$): $\text{PED} = \frac{+15}{-10} = -1.5$, elastic. An option giving 1.5 without the minus sign is the same answer.
- **New quantity from YED.** $\text{YED} = -0.5$ and incomes rise by 8% : $\% \Delta Q = -0.5 \times 8 = -4\%$, so sales of 5000 fall to $5000 \times 0.96 = 4800$. Watch the double negative: with a negative YED and a **fall** in income, quantity **rises**.
- **New price from PED.** $\text{PED} = -0.8$ and the firm wants to sell 10% more: $\% \Delta P = +10 \div (-0.8) = -12.5\%$, so a price of \$40 falls to \$35.
- **Unit elasticity to fill capacity.** A firm sells 6000 units at \$20 but can make 7500 ($+25\%$). With $\text{PED} = -1$, the price must fall by 25% , to \$15. (Keeping revenue at \$120 000 would give \$16; Cambridge's calculations use the percentage formula, so \$15.)
- **New price of another good from XED.** $\text{XED} = +1.5$ and demand for X must rise by 6% : the price of Y must rise by $6 \div 1.5 = 4\%$, for example from \$2.50 to \$2.60.

- **A diagram or table** gives two prices and quantities: read them off, then use the formula. A question with two products and one elasticity each (for example XED of two car models with the price of fuel) needs each change worked out separately and then added.

5. Define an elasticity and give its formula (14 questions)

1. **Definition:** "the responsiveness of the quantity demanded of a good to a change in [its price / income / the price of another good]".
2. **Formula:** percentage change in quantity demanded divided by percentage change in the cause, with the right good on top. Write it even if the question only says "with the help of a formula".
3. **Meaning of the values:** for PED, elastic when the value is greater than 1 (quantity changes by a **larger percentage** than price) and inelastic between 0 and 1. For YED and XED, the meaning of the sign.

Multiple choice versions test the formula (percentage changes, not absolute changes; the right good on top) and what each measure can do that the others can't: only YED separates normal from inferior goods.

6. Describe elasticity values and how PED varies along a demand curve (8 questions)

1. **Name the value** from the percentages: a 10% price rise that cuts sales of cheap seats by 5% is inelastic; one that cuts sales of dear seats by 12% is elastic.
2. **Shapes:** vertical demand (or supply) curve = perfectly inelastic; horizontal = perfectly elastic. If supply falls and the price stays the same, demand must be perfectly elastic.
3. **On a straight line:** unit elastic at the midpoint, elastic above, inelastic below. Moving **down** the line PED falls; moving **up** it rises. "From an inelastic point to a less inelastic point" means a move **up** the lower half of the line.
4. **Two straight lines:** a line with a constant slope never has the same PED all along it; compare lines only at the same point.

7. Apply PED to a market or policy outcome (8 questions)

Usually one strand of a Paper 2 part about another topic. Name PED, then give the **elastic versus inelastic** contrast with its effect on **quantity and spending**, then judge.

- **A rise in costs** raises the price: producers' revenue rises if demand is inelastic and falls if it is elastic.
- **An indirect tax:** with inelastic demand, consumption falls little and the government collects a lot; with elastic demand, consumption falls a lot. So taxing a demerit good with inelastic demand is a weak way to cut its use.
- **A subsidy:** the price falls; with elastic demand the quantity (and so the cost of the subsidy) rises a lot.
- **Consumer surplus:** a price rise on a good with inelastic demand takes a large amount of consumer surplus, because buyers keep buying at the higher price.
- **Rising food and energy prices:** demand is inelastic, so households keep buying and spend more; poorer households, who spend a large share of income on these, are hit hardest.

- **Trade and inflation:** when the price of exports rises, export **revenue** falls only if demand for them is elastic. Talk about spending (revenue), not just the number of units.

8. Explain the factors that determine PED, YED or XED (7 questions)

1. **Name the factor and say which way it pushes PED:** more close substitutes → more elastic; larger share of income → more elastic; necessity, habit or addiction → more inelastic; longer time period → more elastic.
2. **Develop it with an example in the setting:** a particular brand of car has close substitutes (other brands), and costs a large share of income, so its demand is elastic.
3. **Time,** a favourite part (a) question: in the short run, habit and a lack of known alternatives keep demand inelastic; in the long run consumers learn about and switch to substitutes, and new substitutes appear, so demand becomes more elastic. Judge which matters most for the product (for a habit-forming good, habit may outlast the time effect).
4. **Can firms change them?** Advertising and branding build loyalty and make demand less elastic; buying up or out-competing rivals reduces substitutes. But rivals respond, loyalty is costly to build, and the share of income or the need for the good is out of the firm's hands.

Worked examples

Example 1

When the price of good Y rises from \$8 to \$10, the quantity demanded of good X falls from 1200 to 1050 units a week. What is the cross elasticity of demand for X with respect to the price of Y, and how are the goods related?

- **A** +0.5, substitutes
- **B** -0.5, complements
- **C** -2.0, complements
- **D** +2.0, substitutes

[1]

$$\% \Delta P_Y = \frac{10 - 8}{8} \times 100 = +25\%. \quad \% \Delta Q_X = \frac{1050 - 1200}{1200} \times 100 = -12.5\%.$$

$$XED = \frac{-12.5}{+25} = -0.5. \text{ Negative, so they are complements (a weak link). The answer is B. (1)}$$

C puts the price change on top.

Example 2

Extract: In 2025 a rail company raised its average fare by 8%, from \$10.00 to \$10.80. The number of passenger journeys fell from 50 million to 48 million over the year.

(a) Calculate the price elasticity of demand for the company's rail journeys. [2]

(b) Explain what your answer suggests will happen to the company's revenue from fares. [2]

$$(a) \% \Delta Q = \frac{48 - 50}{50} \times 100 = -4\% (1). \text{ PED} = \frac{-4}{+8} = -0.5 (1).$$

(b) Demand is price inelastic, because the percentage fall in journeys is smaller than the percentage rise in fares (1). So the gain from charging more per journey outweighs the loss from fewer journeys, and revenue rises: from $\$10 \times 50 \text{ million} = \500 million to $\$10.80 \times 48 \text{ million} = \518.4 million (1).

Example 3

With the help of a formula, explain what is meant by income elasticity of demand and consider how a recession is likely to affect firms selling goods with different income elasticities of demand. [8]

Income elasticity of demand (YED) measures the responsiveness of the quantity demanded of a good to a change in consumers' incomes (AO1, 1). It is calculated as the percentage change in quantity demanded divided by the percentage change in income (AO1, 1). A positive value shows a normal good and a negative value an inferior good; for normal goods, a value above 1 shows a luxury and a value between 0 and 1 a necessity (AO1, 1).

In a recession incomes fall. A firm selling a luxury, such as foreign holidays with YED of +2.5, will see demand fall by a larger percentage than income: a 4% fall in income cuts demand by 10%, so the demand curve shifts well to the left and both price and sales revenue fall (AO2, 1). A firm selling a necessity such as bread, with YED of +0.2, loses only 0.8% of its sales, so it is hardly affected (AO2, 1). A firm selling an inferior good, such as a discount supermarket's own brand, gains, because consumers switch to it as their incomes fall: demand shifts right and its revenue rises (AO2, 1).

However, these effects depend on how reliable the estimates are: YED is measured from past data and may change, and in a recession consumers' expectations of job losses may cut spending on luxuries even further than YED predicts (AO3, 1).

So a recession is likely to hit sellers of luxuries hardest and may help sellers of inferior goods, but firms should treat the size of the change as a rough guide, not a precise forecast (AO3, 1, justified conclusion).

Total: 3 + 3 + 2 = 8.

Example 4

Assess whether knowledge of cross elasticity of demand is more useful than knowledge of price elasticity of demand to a mobile phone company deciding the price of its new model. [12]

Knowledge and analysis (Table A):

Price elasticity of demand measures how much the quantity demanded of the phone responds to a change in its own price: the percentage change in quantity demanded divided by the percentage change in price. Cross elasticity of demand measures how much the quantity demanded of the phone responds to a change in the

price of another good: the percentage change in quantity demanded of the phone divided by the percentage change in the price of the other good.

PED is directly useful for pricing. If the company estimates that demand for its new model is inelastic, for example because loyal customers want its features and switching brands is inconvenient, it can set a higher price: sales fall by a smaller percentage than the price rises, so revenue rises. If demand is elastic, a lower launch price raises revenue because sales rise by a larger percentage than the price falls.

XED is useful because the phone market has close substitutes. A high positive XED with a rival's model means that if the rival cuts its price, many buyers switch, so the company may need to match the cut. XED with complements also matters: if the phone has a negative XED with the company's paid apps or accessories, a lower phone price raises sales of those, so the company may accept a lower price on the phone to earn more from the complements.

Both have limits. They are estimates from past data; for a **new** model there is no past data, so both must be guessed from similar products. They assume other things stay the same, when rivals are also launching models and consumers' incomes are changing.

(Developed, accurate chains on both measures, focused on pricing a phone: Level 3, 8 marks.)

Evaluation (Table B):

PED is more directly useful, because it is about the one variable the company controls, its own price, and it predicts the effect on revenue. But in a market with very close substitutes, the company's PED is itself high **because** its XED with rivals is high: the price it can charge depends on what rivals charge. So XED is more useful when the market is highly competitive, and PED is more useful when the brand is strong and customers are loyal. For a leading brand launching a new model, PED is probably the more useful measure, as long as the company keeps its estimate up to date as rivals respond.

(A balanced judgement that answers the question, says what it depends on and gives a conclusion: Level 2, 4 marks.)

Common mistakes

- **Vague definitions.** "Elastic means demand changes a lot; inelastic means it doesn't change." Examiners report this every year. Elastic means quantity changes by a **greater percentage** than price; inelastic means by a **smaller percentage** (not zero).
- **Mixing up the elasticities.** Using PED where the question is about the price of **another** good (that's XED), or confusing PED with PES. Candidates who answered a "measure the effect of the price of olive oil on the demand for sunflower oil" part with PED scored nothing.
- **Upside-down formulas.** Quantity demanded always goes on top. For XED, it's the quantity of the good that **responds**; the price underneath is the **other** good's.
- **Using changes instead of percentage changes**, or working the percentage from the new value.
- **Losing the sign**, or getting double negatives wrong: a negative YED with a **fall** in income gives a **rise** in quantity.

- **Getting the direction along the line wrong.** PED falls moving **down** a straight-line demand curve. Many candidates pick a move down the top half when asked for a move from inelastic to less inelastic (it's a move **up** the bottom half).
- **Assuming unit elastic means "revenue falls with quantity".** A unit elastic curve keeps revenue **constant**; revenue falls in proportion to quantity only when price is fixed (perfectly elastic).
- **Talking about units instead of spending.** When the question is about revenue (exports, sales income, the current account), say what happens to **price** × **quantity**, not just to the number sold.
- **Writing "all I know about elasticity"** instead of answering the question. Descriptions of every elasticity, or diagrams of how to make demand more elastic, earn little when the question asks about something narrower (such as how hard it is for firms to control the factors).
- **No formula** when the question says "with the help of a formula". It costs a knowledge mark.
- **One-sided or generic part (b) answers.** Knowledge of YED and XED only earns credit when it's used to show how it helps **this** firm with **this** decision; ignore the setting ("falling incomes") and you are capped at mid-Level 2.

How to get the marks

- **Command words.** *Calculate*: show the percentage changes and the division; give the sign. *Explain*: say why, with "because... so...". *Consider, assess, discuss*: explain both sides, then judge.
- **Definitions** need three things: "responsiveness", "quantity demanded", and the cause (own price, income, another good's price). Then the formula with percentage changes.
- **Significance of values** means relative percentages **and** the sign: "YED of +2.5 means demand rises by 2.5 times the percentage rise in income, so it is a normal good and a luxury."
- **Part (a), 8 marks, is 3 + 3 + 2.** Knowledge: definition, formula, meaning of elastic and inelastic. Analysis: developed chains (up to 2 marks for one point), such as a price rise **and** a price fall under elastic **and** inelastic demand. Evaluation: one "it depends on" point, and one justified conclusion.
- **Part (b), 12 marks, is 8 + 4.** Level 3 needs accurate, developed analysis of **both** measures, focused on the setting in the question. Evaluation needs a weighed comparison and a conclusion that answers the exact words ("more useful", "more important", "always").
- **Evaluation on this topic** usually turns on: estimates from past data, ceteris paribus, values changing over time and along the curve, differences between consumers, the time period, and whether the firm can act on the information.
- **Data response parts** (2 marks): name the right elasticity (1) and give the expected sign or what it shows (1). Keep it short.
- **Diagrams** when asked: price and quantity on the axes, curves labelled D and S, the shift shown with an arrow ($D_1 \rightarrow D_2$) and the new equilibrium marked.
- **Multiple choice**: one mark each, no penalty for guessing. Write the percentages in the margin; check the sign and which good is on top.

Quick check

1. The price of a product rises from \$4 to \$5 and the quantity demanded falls from 300 to 270 a week. Calculate the PED, say whether demand is elastic or inelastic, and find what happens to total expenditure.
2. Three goods have YED values of $+1.6$, $+0.3$ and -0.7 . Classify each one.
3. A straight-line demand curve meets the price axis at \$30 and the quantity axis at 600 units. At what price is demand unit elastic? Is demand elastic or inelastic at a price of \$10?
4. The price of good P falls by 10% and the quantity demanded of good Q falls by 4%. Calculate the XED of Q with respect to the price of P, and say how the goods are related.
5. A good has a YED of -1.5 . A firm sells 2000 units a month. If incomes fall by 6%, how many units will it expect to sell?

Answers

1. $\% \Delta P = +25\%$, $\% \Delta Q = \frac{270 - 300}{300} \times 100 = -10\%$. $PED = \frac{-10}{+25} = -0.4$: inelastic. Total expenditure rises from $\$4 \times 300 = \1200 to $\$5 \times 270 = \1350 , as expected when price rises with inelastic demand.
2. $+1.6$: a normal good and a luxury (income elastic). $+0.3$: a normal good and a necessity (income inelastic). -0.7 : an inferior good.
3. At the midpoint: half of $\$30$ is **\$15** (quantity 300). $\$10$ is below the midpoint, so demand is **inelastic** there.
4. $XED = \frac{-4}{-10} = +0.4$: positive, so they are substitutes, but not close ones (people switched to the cheaper P).
5. $\% \Delta Q = -1.5 \times (-6) = +9\%$, so $2000 \times 1.09 = 2180$ units: an inferior good sells **more** when incomes fall.

Past questions to try

- **9708/12/M/J/23 Q8**: which change in bus fares gives a given rise in rail travel, from the XED.
- **9708/11/O/N/23 Q6**: how PED changes along a straight-line demand curve.
- **9708/12/M/J/23 Q14**: equal spending before and after a price change.
- **9708/21/M/J/23 Q3**: part (a), the formula for cross elasticity of demand and what determines its size and sign.