Past-paper walk-through

Marginal Analysis and Consumer Choice ▪ 1.6

eXercise

Questions in this set

- 2025 Set 2 Q3
- 2022 Set 1 Q3
- 2021 Set 2 Q3
- 2019 Set 1 Q2
- 2018 Q3
- 2016 Q2

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 3

2025 Set 2 ▪ Q3

3. The table provided shows the marginal utility for Lucy when she consumes Good X and Good Y.

Quantity of Good X	Marginal Utility of Good X (utils)	Quantity of Good Y	Marginal Utility of Good Y (utils)
1	20	1	28
2	16	2	24
3	12	3	16
4	8	4	8
5	4	5	–4
6	–2	6	–8

Question 3

A. If Good X and Good Y are free, how many units of each good will maximize Lucy's total utility?

B. Calculate Lucy's total utility if she consumes 2 units of Good X and 2 units of Good Y. Show your work.

C. Suppose instead that the price of each unit of Good X is $2 and the price of each unit of Good Y is $4. Lucy has a budget of $20 to spend on the two goods.

i. If Lucy purchases 2 units of Good X, what is the maximum quantity of Good Y Lucy can purchase?

ii. What is Lucy's optimal combination of Good X and Good Y? Explain your answer using marginal analysis and numbers.

Question 3

D. Suppose the price elasticity of demand for Good X is -2.0, the price elasticity of demand for Good Y is -0.8, and the cross-price elasticity of demand between Good X and Good Y is $+1.6$. Are goods X and Y complementary goods, substitute goods, normal goods, or inferior goods? Explain.

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- If Good X and Good Y are both free, Lucy maximizes her total utility by consuming each good up to the point where its marginal utility reaches zero (satiation) — 5 units of Good X and 4 units of Good Y.

Solution 3

(b)

Mark scheme

- Lucy's total utility from consuming 2 units of Good X and 2 units of Good Y is 88 utils. Show your work: Total utility from consuming 2 units of Good X = 20 utils + 16 utils = 36 utils (the sum of the marginal utilities of the 1st and 2nd units of X). Total utility from consuming 2 units of Good Y = 28 utils + 24 utils = 52 utils (the sum of the marginal utilities of the 1st and 2nd units of Y). Total utility from 2 units of X and 2 units of Y = 36 utils + 52 utils = 88 utils.

Solution 3

(c)(i)

Mark scheme

- With Good X priced at \$2/unit and Good Y priced at \$4/unit and a \$20 budget, if Lucy buys 2 units of Good X she spends \$2 $\times 2 = \$4$, *leaving* $\$16$ *of her budget. The maximum quantity of Good Y she can then purchase is* $\$16/\$4 = 4$ *units of Good Y.*

Solution 3

(c)(ii)

Mark scheme

- Lucy's optimal (utility-maximizing) combination is 4 units of Good X and 3 units of Good Y. Using marginal analysis: at this combination, the marginal utility per dollar spent on the last unit of Good X equals the marginal utility per dollar spent on the last unit of Good Y — 4 utils/\$ (= 8 utils / \$2) for Good X and 4 utils/\$ (= 16 utils / \$4) for Good Y — and this combination spends Lucy's entire \$20 budget: \$2 $\times 4 \mathit{unitsofGoodX} + \$4 \times 3 \mathit{unitsofGoodY} = \$8 + \$12 = \$20$.

Solution 3

(d)

Mark scheme

- Goods X and Y are substitute goods. The cross-price elasticity of demand between Good X and Good Y is positive (+1.6): a positive cross-price elasticity means an increase (decrease) in the price of Good X causes an increase (decrease) in the demand for Good Y, which is the defining property of substitute goods (rather than complements, which have negative cross-price elasticity).

Question 3

2022 Set 1 ▪ Q3

(a) The local market for Good X has a perfectly elastic supply. Draw a correctly labeled graph for the local market for Good X with a market equilibrium price of $5. Label the equilibrium price as $5, and label the equilibrium quantity for the market with a specific value based on the data provided in the table.

(b) Assume the cost of production increases, which causes the price of Good X to increase from $5 to $7.

(i) Calculate the price elasticity of demand for Good X as the price increases from $5 to $7. Show your work.
(ii) Identify whether the demand for Good X is elastic, inelastic, or unit elastic in that range of prices.

(c) Could Emily's marginal benefit for the second unit of Good X equal $4.50 ? Explain.

Question 3

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- Graph, 2 points (1 point each): (1) A downward-sloping demand curve D and a perfectly elastic (horizontal) supply curve S at price $= \$5$, both correctly labeled. (2) The equilibrium quantity, read from the given demand data at $P = \$5$, labeled as $Q = 8$ units on the quantity axis at the S-D intersection.

Solution 3

(b)(i) Mark scheme

- $E_d = \left| \frac{\%\Delta Q_d}{\%\Delta P} \right| = \frac{\left| \frac{4-8}{8} \times 100 \right|}{\left| \frac{7-5}{5} \times 100 \right|} = \frac{50\%}{40\%} = 1.25$ (magnitude of the price elasticity of demand as price rises from $5 to 7$ and quantity falls from 8 to 4 units).

Solution 3

(b)(ii)

Mark scheme

- Elastic, since $|E_d| = 1.25 > 1$.

Solution 3

(c)

Mark scheme

- No. Emily's marginal benefit for the second unit must be greater than or equal to the price she was willing to pay for it $(7) - -since she purchased it at 7$, her marginal benefit must be at least $7, so 4.50$ is inconsistent with that purchase.

Question 3

2021 Set 2 ▪ Q3

3. The table below shows the total cost and total benefit of advertisements placed by AZY Foods, a firm in the retail food market.

Number of Advertisements	Total Cost ($)	Total Benefit ($)
1	300	1,200
2	500	2,200
3	800	3,000
4	1,300	3,600
5	2,100	4,000
6	3,000	4,200

Question 3

7	4,100	4,200

(a) Calculate the total net benefit of placing three advertisements. Show your work.

(b) Calculate the marginal net benefit of the third advertisement. Show your work.

(c) What is the optimal number of advertisements placed by AZY Foods? Explain using marginal analysis.

(d) Suppose over the next year the marginal benefit that AZY Foods receives from each advertisement increases by $300. Identify the optimal number of advertisements.

(e) There are many firms in the retail food market. Each firm places its own firm-specific advertisements without considering the actions of its competitors. In what market structure is AZY Foods operating?

Question 3

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

Solution 3

(a)

Mark scheme

- Total net benefit of placing three advertisements = Total Benefit − Total Cost = \$3,000 − \$800 = \$2,200.

Solution 3

(b)

Mark scheme

- Marginal net benefit of the 3rd advertisement = (Total benefit at 3 ads − Total benefit at 2 ads) − (Total cost at 3 ads − Total cost at 2 ads) = ($3,000 − $2,200) − ($800 − $500) = $800 − $300 = $500.

Solution 3

(c)

Mark scheme

- The optimal number of advertisements is 4. Using marginal analysis: the marginal net benefit of the 4th advertisement is positive ($600 - 500 = 100 > 0$), *soitshouldbeplaced*; *themarginalnetbenefitofthe*5*thadvertisementisnegative*($400 - 800 = -400 < 0$), so it should not be placed. AZY Foods should add advertisements while marginal net benefit is positive and stop once it turns negative, giving 4 ads.

Solution 3

(d)

Mark scheme

- The optimal number of advertisements remains 4. With the marginal benefit of each advertisement up by \$300, the marginal net benefit of the 4th ad becomes (\$600+\$300) − \$500 = \$400 (still positive, so it is worth placing), while the marginal net benefit of the 5th ad becomes (\$400+\$300) − \$800 = −\$100 (still negative, so it is not worth placing). AZY Foods should still stop at 4 advertisements.

Solution 3

(e)

Mark scheme

- AZY Foods is operating in a monopolistically competitive market structure: many firms in the retail food market, each independently placing its own firm-specific advertisements without considering the actions of its competitors.

Question 2

2019 Set 1 ▪ Q2

2. The following is a table showing Dana's marginal benefit from purchasing bottles of water and good X from a grocery store.

Quantity of Water (in bottles)	Marginal Benefit of Water (in dollars)		Quantity of Good X (in units)	Marginal Benefit of Good X (in dollars)
1	24		1	24
2	18		2	18
3	12		3	12
4	6		4	6
5	3		5	3

(a) What is Dana's total benefit from purchasing 2 bottles of water and 1 unit of good X? Show your work.

(b) Assume the price of a unit of good X is $5. Calculate the total consumer surplus if Dana purchases 3 units of good X. Show your work.

Question 2

(c) Now assume the price of a bottle of water is $3 and the price of a unit of good X is $6. Dana spends her entire budget of $30 on bottles of water and good X.

(i) Explain why Dana does not maximize her benefit when she purchases 2 bottles of water and 4 units of good X. Use marginal analysis to explain your answer.

(ii) What are the optimal quantities of good X and bottles of water at these prices?

(iii) Suppose the price of a unit of good X drops to $3. Calculate Dana's cross-price elasticity of demand for bottles of water with respect to the price of good X, and state whether the two goods are substitutes or complements. Show your work.

Question 2

Solution 2

(a)

Mark scheme

- Dana's total benefit from purchasing 2 bottles of water and 1 unit of good X is 66. *Work* : *sumthemarginalbenefitsofeachunitconsumed* :24 + 18(*thetwobottlesofwater*)+24 (the one unit of good X) = 66, *equivalently*42 (water) + 24(*goodX*) =66.

Solution 2

(b)

Mark scheme

- Dana's total consumer surplus from purchasing 3 units of good X at a price of \$5 each is \$39. Work: sum (marginal benefit − price) for each of the 3 units: $(\$24 - \$5) + (\$18 - \$5) + (\$12 - \$5) = \$19 + \$13 + \$7 = \$39$, equivalently total benefit \$54 minus total expenditure $\$15 = \$39$.

Solution 2

(c)(i)

Mark scheme

- Dana does not maximize her benefit at 2 bottles of water and 4 units of good X because the marginal benefit per dollar spent on water exceeds the marginal benefit per dollar spent on good X: MB_water / P_water $>$ MB_X / P_X, i.e. $18/3 > 6/6$ ($6 > 1$, or $6 \neq 1$). Because the last dollar spent on water yields more benefit than the last dollar spent on good X, Dana is not at the utility-maximizing bundle (which requires MB_water/P_water $=$ MB_X/P_X).

Solution 2

(c)(ii)

Mark scheme

- At these prices (water 3, *goodX*6, budget 30), *theoptimal*(*benefit* − *maximizing*)*bundleis*3*unitsofgoodXand*4*bottlesofwater*—*thissatisfiesthebudgetconstrain* + 4×3 =18 + 12 =30) and equalizes marginal benefit per dollar across the two goods.

Solution 2

(c)(iii)

Mark scheme

- With the price of good X falling to \$3, Dana's cross-price elasticity of demand for bottles of water with respect to the price of good X is -0.5, and water and good X are complements. Work: (% change in quantity of bottles of water) / (% change in price of good X) $= 25\%$ / $(-50\%) = -0.5$. (Using the midpoint/arc-elasticity formula is also acceptable: $(1/4.5)$ / $(-3/4.5) \approx -0.33$.) A negative cross-price elasticity indicates the two goods are complements; the answer must be consistent with the quantity of water stated in part (c)(ii).

Question 3

2018 ▪ Q3

Nirali is a student at the University of Ainsley. She has 5 hours to study for two exams today. The tables below show Nirali's expected scores given the amount of time she studies for each exam.

Number of Hours Spent Studying Microeconomics	**Expected Score on Microeconomics Exam (100-point scale)**
5	100
4	96
3	90
2	82
1	60
0	0

Question 3

Number of Hours Spent Studying History	Expected Score on History Exam (100-point scale)
0	0
1	40
2	60
3	72
4	77
5	80

Question 3

(a) Nirali spends 3 hours studying microeconomics and 2 hours studying history. Calculate her gain from the second hour spent studying history.
(b) Calculate Nirali's opportunity cost of the second hour spent studying history.
(c) Assume Nirali increases the time she allocates to studying history. What happens to the opportunity cost of studying history? Explain.
(d) Assume that Nirali has a goal of maximizing the sum of her test scores (the score on microeconomics plus the score on history). How many hours should she study for each exam?

Question 3

(e) Nirali learns that her tennis practice has been canceled, freeing up an additional hour for studying. Given your answer to part (d), will Nirali allocate the additional hour to studying microeconomics or to studying history to maximize the sum of her test scores? Explain using marginal analysis.

Question 3

Number of Hours Spent Studying Microeconomics	Expected Score on Microeconomics Exam (100-point scale)
5	100
4	96
3	90
2	82
1	60
0	0

Number of Hours Spent Studying History	Expected Score on History Exam (100-point scale)
0	0
1	40
2	60
3	72
4	77
5	80

Solution 3

(a)

Mark scheme

- Nirali's gain (increase in her expected history score) from the second hour spent studying history is 20 points.

Solution 3

(b)

Mark scheme

- Nirali's opportunity cost of the second hour spent studying history is 6 points (or 6/20) — the expected microeconomics score she gives up by spending that hour on history instead of microeconomics.

Solution 3

(c)

Mark scheme

- The opportunity cost of studying history increases as Nirali allocates more time to it. Explanation (either): the expected score on microeconomics decreases at an increasing rate with each additional hour spent studying history; equivalently, the marginal cost (in forgone microeconomics score) is rising with each additional hour devoted to history.

Solution 3

(d)

Mark scheme

- To maximize the sum of her expected test scores, Nirali should study 2 hours for microeconomics and 3 hours for history — the allocation where the marginal (expected-score) benefit of an additional hour is equalized across the two subjects.

Solution 3

(e)

Mark scheme

- Nirali will allocate the additional freed-up hour to studying microeconomics. Explanation (marginal analysis): starting from the allocation in part (d), spending the extra hour on microeconomics increases her expected total score by 8 points, compared to only 5 points if the hour were spent on history instead — since the marginal benefit of microeconomics (8) exceeds the marginal benefit of history (5), she should study microeconomics.

Question 2

2016 ▪ Q2

2. Martha has a fixed budget of $20, and she spends it all on two goods, X and Y. The price of X is $4 per unit, and the price of Y is $2 per unit. The table below shows the total benefit, measured in dollars, Martha receives from the consumption of each good.

Quantity of X	Total Benefit from X	Quantity of Y	Total Benefit from Y
0	$0	0	$0
1	$16	1	$10
2	$28	2	$18
3	$36	3	$24
4	$40	4	$28
5	$41	5	$30

Question 2

(a) What is Martha's marginal benefit of the fifth unit of good X?

(b) Calculate the total consumer surplus if Martha consumes 5 units of X. Show your work.

(c) Martha is currently consuming 4 units of X and 2 units of Y. Use marginal analysis to explain why this combination is not optimal for Martha.

(d) What is Martha's optimal combination of goods X and Y?

(e) Indicate whether each of the following will cause the optimal quantity of good Y to increase, decrease, or stay the same.

(i) The price of good Y doubles.

(ii) Martha's income falls to $10 with no changes in prices.

(iii) Martha's income doubles, and the price of both goods double.

Solution 2

(a)

Mark scheme

- Martha's marginal benefit of the 5th unit of good X is \$1.

Solution 2

(b)

Mark scheme

- Total consumer surplus from 5 units of X = 21. *Using the marginal − benefit schedule* (*MB of units* 1–5 = 16, 12, 8, 4, 1) at a price of 4 *per unit* : *CS* = (16−4) + (12−4) + (8−4) + (4−4) + (1−4) = 12+8+4+0−3 = 21. (*Equivalently* : *total benefit* 41 − total expenditure 20 = 21.)

Solution 2

(c)

Mark scheme

- This combination (4 units of X, 2 units of Y) is not optimal because the marginal benefit per dollar spent on X is less than that on Y: MBx/Px $= 4/4$ $= 1$, while MBy/Py $= 8/2 = 4$, so MBx/Px $<$ MBy/Py. Martha could raise her total utility by buying less X and more Y until the marginal benefit per dollar is equalized across both goods.

Solution 2

(d)

Mark scheme

- Martha's optimal combination is 3 units of good X and 4 units of good Y.

Solution 2

(e)(i)

Mark scheme

- The optimal quantity of good Y will DECREASE. When the price of Y doubles, the marginal-benefit-per-dollar of Y (MBy/Py) falls, so Martha reoptimizes toward less Y (and more X) to re-equalize MB per dollar across goods.

Solution 2

(e)(ii)

Mark scheme

- The optimal quantity of good Y will DECREASE. With Y a normal good, a fall in income (to \$10) with no change in prices shrinks Martha's budget, so she buys less of both goods, including less Y.

Solution 2

(e)(iii)

Mark scheme

- The optimal quantity of good Y will STAY THE SAME. When income doubles and the prices of both X and Y also double, the budget line's slope ($-Px/Py$) is unchanged and the maximum affordable bundle in real terms is unchanged — the budget constraint is unaffected in real terms, so Martha's optimal (utility-maximizing) bundle of X and Y stays exactly the same.