Consumer and Producer Surplus

Solutions manual and marking guidance (for learners checking their work, and for instructors).

O1: Explain willingness to pay, and read it from a demand curve.

Q01 [Foundational · short answer] Define willingness to pay.

Answer: The highest price a buyer would pay for a unit of a good rather than go without it.

1. It reflects how much the buyer values that unit.

Q02 [Foundational · multiple choice] On a demand curve, the height at a given quantity shows: (a) the total amount spent (b) the willingness to pay of the marginal buyer (c) the seller's cost (d) consumer surplus

Answer: (b)

1. Reading the demand curve vertically gives the marginal buyer's willingness to pay.

Q03 [Core · numerical] Using the mango demand curve (price height = (1100 - Q)/200), what is the willingness to pay of the buyer of the 300th kilogram?

Answer: $4

1. (1100 - 300)/200 = 4.00.

Q04 [Core · conceptual] Explain why a demand curve made from many buyers looks like a smooth line, while one made from five buyers looks like a staircase.

Answer: Each buyer is a step; with very many small buyers the steps become tiny and merge into a line.

1. Lining up buyers by willingness to pay gives one step per buyer.

Q05 [Core · numerical] At what price does the mango demand curve meet the price axis, and what does that price mean?

Answer: $5.50: the price at which no one would buy (quantity demanded falls to zero).

1. Set Qd = 0: 1100 - 200P = 0, P = 5.50.

Q06 [Applied · scenario] Two friends both buy a coffee for $3. One would have paid $6, the other $3.10. Did they gain equally from the purchase? Explain.

Answer: No: consumer surplus is $3 for the first and $0.10 for the second.

1. The same price gives different gains because willingness to pay differs.

O2: Calculate consumer surplus for individual buyers and as an area on a demand diagram.

Q07 [Foundational · numerical] Lena would pay up to $80 for a concert ticket and pays $50. What is her consumer surplus?

Answer: $30

1. 80 - 50 = 30.

Q08 [Core · numerical] Using the five buyers in the lesson (willingness to pay $5, $4.50, $4, $3.50, $3), find consumer surplus at a price of $4.

Answer: $1.50

1. Gains: 1, 0.50, 0 (Ben is just willing); Chen and Dara do not buy.
2. Total = 1.5.

Q09 [Core · numerical] In the mango market, the price is $4. Find consumer surplus.

Answer: $225

1. Qd(4) = 300.
2. CS = 1/2 x 300 x (5.50 - 4) = 225.

Q10 [Core · true/false] True or false: consumer surplus is the whole area under the demand curve up to the quantity bought.

Answer: False

1. That area is total value to buyers; consumer surplus subtracts what they pay (price x quantity).

Q11 [Applied · numerical] The mango price falls from $3 to $2. By how much does consumer surplus rise, and how much of the rise goes to buyers who were already buying?

Answer: Rise $600; existing buyers $500

1. New CS 1,225, old 625.
2. Existing buyers: 500 kg x $1 = 500; new buyers: 100.

Q12 [Applied · conceptual] Explain in words why a fall in price raises consumer surplus in two distinct ways.

Answer: Existing buyers pay less for what they already bought, and new buyers whose willingness to pay lies between the old and new price now buy.

1. Rectangle (existing buyers) plus triangle (new buyers).

G01a [Core · numerical] Market for bread loaves per day: Qd = 1200 - 200P and Qs = -200 + 200P. Find the equilibrium and the consumer surplus.

Answer: P* = 3.5, Q* = 500, CS = 625

1. P* = (1200 - (-200))/(200 + 200) = 3.5; Q* = 500.
2. Demand meets the price axis at 1200/200 = 6.
3. CS = 1/2 x 500 x (6 - 3.5) = 625.

G02a [Core · numerical] Market for cinema seats per night: Qd = 900 - 60P and Qs = -60 + 60P. Find the equilibrium and the consumer surplus.

Answer: P* = 8, Q* = 420, CS = 1470

1. P* = (900 - (-60))/(60 + 60) = 8; Q* = 420.
2. Demand meets the price axis at 900/60 = 15.
3. CS = 1/2 x 420 x (15 - 8) = 1470.

G03a [Core · numerical] Market for bus rides per day: Qd = 6000 - 1000P and Qs = -1000 + 1000P. Find the equilibrium and the consumer surplus.

Answer: P* = 3.5, Q* = 2500, CS = 3125

1. P* = (6000 - (-1000))/(1000 + 1000) = 3.5; Q* = 2500.
2. Demand meets the price axis at 6000/1000 = 6.
3. CS = 1/2 x 2500 x (6 - 3.5) = 3125.

O3: Calculate producer surplus for individual sellers and as an area on a supply diagram.

Q13 [Foundational · numerical] A farmer would accept as little as $1.20 per kg and sells for $3. What is her producer surplus per kilogram?

Answer: $1.80

1. 3.00 - 1.20 = 1.80.

Q14 [Foundational · short answer] Where is producer surplus on a supply and demand diagram?

Answer: The area above the supply curve and below the price, up to the quantity sold.

1. Compare consumer surplus: below demand, above the price.

Q15 [Core · numerical] Using the five sellers (lowest acceptable prices $1, $1.50, $2, $2.50, $3), find producer surplus at a price of $2.50.

Answer: $3

1. Gains: 1.50, 1, 0.50, 0; Tom does not sell.
2. Total = 3.

Q16 [Core · numerical] In the mango market, find producer surplus at the equilibrium price of $3.

Answer: $625

1. Supply meets the price axis at $0.50.
2. PS = 1/2 x 500 x 2.50 = 625.

Q17 [Applied · conceptual] A stall owner says: 'My producer surplus is $625 a day, so I make $625 profit.' Explain the error.

Answer: Producer surplus ignores fixed costs such as rent, so profit is lower than producer surplus (it may even be negative).

1. Producer surplus is measured against the extra cost of each unit only.

Q18 [Applied · numerical] If the mango price were $3.50 with 500 kg still traded, how would producer and consumer surplus change compared with $3?

Answer: PS rises by $250; CS falls by $250; total unchanged.

1. Each of 500 kg moves $0.50 from buyers to sellers: 500 x 0.50 = 250.

G01b [Core · numerical] In the same market, find producer surplus and total surplus at equilibrium.

Answer: PS = 625, total = 1250

1. Supply meets the price axis at 200/200 = 1.
2. PS = 1/2 x 500 x (3.5 - 1) = 625.
3. Total = 625 + 625 = 1250.

G02b [Core · numerical] In the same market, find producer surplus and total surplus at equilibrium.

Answer: PS = 1470, total = 2940

1. Supply meets the price axis at 60/60 = 1.
2. PS = 1/2 x 420 x (8 - 1) = 1470.
3. Total = 1470 + 1470 = 2940.

G03b [Core · numerical] In the same market, find producer surplus and total surplus at equilibrium.

Answer: PS = 3125, total = 6250

1. Supply meets the price axis at 1000/1000 = 1.
2. PS = 1/2 x 2500 x (3.5 - 1) = 3125.
3. Total = 3125 + 3125 = 6250.

O4: Explain why a competitive equilibrium maximises total surplus, and state the limits of that result.

Q19 [Foundational · short answer] Define total surplus.

Answer: Consumer surplus plus producer surplus: the value of the goods to buyers minus the cost to sellers.

1. Also called social surplus.

Q20 [Core · numerical] Find total surplus in the mango market at equilibrium.

Answer: $1,250

1. 625 + 625 = 1,250 per day.

Q21 [Core · true/false] True or false: if the mango market traded 600 kg instead of 500 kg, total surplus would rise because more mangoes change hands.

Answer: False

1. Units beyond 500 kg cost more than they are worth; $50 per day is lost.

Q22 [Applied · numerical] Only 300 kg of mangoes are traded. Calculate the lost surplus and the remaining total surplus.

Answer: lost $200; total $1,050

1. At 300 kg: value $4, cost $2.
2. Lost triangle = 1/2 x 200 x 2 = 200.

3. Total = 1250 - 200 = 1050.

Q23 [Applied · conceptual] Explain why the market equilibrium is called 'efficient', and give one reason why an efficient outcome may still be criticised.

Answer: It maximises total surplus: every unit worth more than it costs is traded, and no unit costing more than it is worth is traded. It may still be criticised as unfair (distribution, people priced out).

1. Efficiency concerns the size of the gains, not how they are shared.

Q24 [Advanced · critical thinking] A factory's production pollutes a river, harming people downstream. Explain why the market quantity may no longer maximise total surplus.

Answer: The supply curve reflects only the sellers' costs, not the harm to others, so some units whose full cost exceeds their value are produced.

1. Market quantity is too high relative to the efficient quantity.
2. This is an externality, studied in later lessons.

Q25 [Advanced · long answer] In about 150 words, with a labelled diagram, explain the statement: 'The price in a competitive market is a transfer; the quantity determines efficiency.'

Answer: Marking points: diagram with CS and PS; a higher price at the same quantity shifts area from CS to PS without changing the total; changing the quantity away from equilibrium creates a lost-surplus triangle; therefore efficiency depends on quantity; clear and accurate wording.

1. 1 mark each: diagram; transfer explained; total unchanged at given quantity; lost triangle for wrong quantity; conclusion; clarity (max 6).

G01c [Applied · numerical] If only 400 units were traded in that market, how much total surplus would be lost?

Answer: 50

1. Value at 400: 4; cost at 400: 3.
2. Lost = 1/2 x 100 x 1 = 50.

G02c [Applied · numerical] If only 336 units were traded in that market, how much total surplus would be lost?

Answer: 117.6

1. Value at 336: 9.4; cost at 336: 6.6.
2. Lost = 1/2 x 84 x 2.8 = 117.6.

G03c [Applied · numerical] If only 2000 units were traded in that market, how much total surplus would be lost?

Answer: 250

1. Value at 2000: 4; cost at 2000: 3.
2. Lost = 1/2 x 500 x 1 = 250.

Marking scheme: Assignment 1: who gains from a market? (individual, about 600 words)

- Clear definitions applied to the chosen market: 3 marks
- Correct, labelled diagram with both surplus areas: 3 marks
- Correct analysis of the price change on CS and PS: 3 marks
- Efficiency and fairness distinguished, with a valid reason for inefficiency: 3 marks
- Organised, accurate writing: 2 marks (total 14)

Marking scheme: Assignment 2: calculation set (individual)

- Equilibrium P = 30, Q = 100: 4 marks
- CS = 500, PS = 1000, total = 1500, with working: 6 marks
- Lost surplus at 70 repairs = 1/2 x 30 x 9 = 135: 3 marks
- Explanation: 2 marks (total 15)