GENERAL

answers to microeconomics problem set 3

Published: September 19, 2026 | Index ID: #-

Answers to Microeconomics Problem Set 3: A Comprehensive Guide

Microeconomics can feel intimidating, especially when you're faced with a problem set that tests your grasp of supply and demand, cost analysis, and market structures. Problem Set 3 is often the turning point where concepts from earlier weeks coalesce into more challenging, real world scenarios. This article offers a deep dive into the typical questions you'll encounter, step by step solutions, and practical study tips. By the end, you'll not only have the answers you need but also a stronger framework for tackling similar problems in future assignments.

1. What to Expect from Problem Set 3

Problem Set 3 usually builds on the fundamentals of microeconomic theory: the law of demand, cost curves, and market equilibrium. However, it also introduces advanced topics such as:

- Elasticity of demand and supply
- Producer surplus and consumer surplus
- Short run vs. long run cost analysis
- Monopolistic competition and price discrimination
- Government intervention and externalities

Understanding how these concepts interrelate is key to solving each question efficiently. The problems often require you to combine multiple steps—calculating a price elasticity, then using it to determine the impact of a tax, and finally evaluating the welfare effects.

2. Core Microeconomic Concepts Reviewed

2.1 Supply and Demand Fundamentals

At the heart of microeconomics lies the interaction between supply and demand. The demand curve slopes downward, reflecting the inverse relationship between price and quantity demanded. Conversely, the supply curve slopes upward, indicating that higher prices incentivize producers to supply more.

When you're asked to find equilibrium, you set the quantity demanded equal to quantity supplied. Solve for the price that satisfies this equality, and you'll find the market clearing price and quantity.

2.2 Elasticity Calculations

Elasticity measures responsiveness. The price elasticity of demand (PED) is calculated as:

Where 9E is the change in quantity and 9E is the change in price. A PED greater than 1 indicates elastic demand; less than 1 signals inelastic demand. Understanding elasticity is crucial when evaluating how a price change or tax will affect market outcomes.

2.3 Cost Curves and Profit Maximization

Microeconomics teaches that firms aim to maximize profit, which occurs where marginal cost (MC) equals marginal revenue (MR). In perfect competition, MR equals the market price, so the rule simplifies to MC = P. In monopoly, MR is less than price because the firm must lower the price to sell additional units.

Cost curves—total cost (TC), average variable cost (AVC), and average total cost (ATC)—help determine the long run competitive equilibrium and identify the shutdown point in the short run.

2.4 Welfare Analysis

Consumer surplus (CS) is the area between the demand curve and the price line, while producer surplus (PS) is the area between the price line and the supply curve. Taxes or subsidies shift these areas, creating deadweight loss (DWL). Calculating CS, PS, and DWL requires integrating the demand and supply functions over the relevant quantity range.

3. Step by Step Solutions to Typical Problem Set 3 Questions

3.1 Question 1: Market Equilibrium with a New Tax

Problem: A $2 per unit tax is imposed on a good. The pre tax demand function is *D(p) = 100 - 2p* and the supply function is *S(p) = 3p - 30*. Find the new equilibrium price paid by consumers, the price received by producers, and the quantity traded.

Solution:

1. Adjust the supply function for the tax. The tax shifts the supply curve upward by $2: S_t(p) = 3(p - 2) - 30 = 3p - 36.
2. Set demand equal to the new supply. 100 - 2p = 3p - 36 !' 5p = 136 !' p = 27.20.
3. Determine the price received by producers. Producers receive p - tax = 27.20 - 2 = 25.20.
4. Compute the quantity traded. Plug p into either the demand or adjusted supply: Q = 100 - 2(27.20) = 45.6 units.

The equilibrium price paid by consumers rises to $27.20, producers receive $25.20, and 45.6 units are traded.

3.2 Question 2: Elasticity of Demand at a Specific Point

Problem: Using the demand function *D(p) = 80 - 4p*, calculate the price elasticity of demand at p = $10.

Solution:

1. Find quantity demanded at p = $10. Q = 80 - 4(10) = 40.
2. Compute the derivative of demand with respect to price. dQ/dp = -4.
3. Apply the elasticity formula. PED = (dQ/dp) * (p/Q) = (-4) * (10/40) = -1.

The demand is unit elastic at this point, meaning a 1% increase in price will reduce quantity demanded by 1%.

3.3 Question 3: Profit Maximization in a Monopoly

Problem: A monopolist faces a linear demand curve *p = 100 - 2q*. The total cost function is *TC = 20q + 100*. Determine the profit maximizing quantity, price, and profit.

Solution:

1. Compute marginal revenue (MR). MR = d(TR)/dq, where TR = p*q = (100 - 2q)q = 100q - 2q². Thus MR = 100 - 4q.
2. Compute marginal cost (MC). MC = d(TC)/dq = 20.
3. Set MR = MC. 100 - 4q = 20 !' 4q = 80 !' q = 20.
4. Find the price. p = 100 - 2(20) = 60.
5. Calculate total revenue and total cost. TR = 60*20 = 1,200. TC = 20*20 + 100 = 500.
6. Compute profit. < Ò TR - TC = 1,200 - 500 = 700.

The monopolist produces 20 units at a price of $60, earning a profit of $700.

3.4 Question 4: Welfare Impact of a Subsidy

Problem: A government introduces a subsidy of $1 per unit for a good with demand $D(p) = 120 - 3p$ and supply $S(p) = 4p - 40$. Calculate the new consumer surplus, producer surplus, and any deadweight loss.

Solution:

1. Adjust supply for the subsidy. The subsidy shifts the supply curve downward by $1: S_s(p) = 4(p + 1) - 40 = 4p - 36.
2. Find the new equilibrium. Set D(p) = S_s(p): 120 - 3p = 4p - 36 !' 7p = 156 !' p = 22.29. The price producers receive is p + subsidy = 23.29.
3. Compute quantity traded. Q = 120 - 3(22.29) "H 43.13 units.
4. Calculate consumer surplus. CS = 0.5 * (maximum willingness to pay - price) * quantity. The maximum willingness to pay (where Q=0) is p = 40. Thus CS = 0.5 * (40 - 22.29) * 43.13 "H 391.6.
5. Calculate producer surplus. PS = 0.5 * (price received - minimum price producers accept). Minimum price (where Q=0) is p = 10. PS = 0.5 * (23.29 - 10) * 43.13 "H 292.5.
6. Determine deadweight loss. DWL is the loss of total surplus due to the subsidy, often calculated as the area between the demand and supply curves that is not captured by CS or PS. In this case, the subsidy actually creates a net welfare gain, so DWL is negative (i.e., a welfare surplus). The total surplus increase equals the subsidy amount times quantity: $1 * 43.13 = 43.13.

Thus, the subsidy raises both consumer and producer surplus and generates a net welfare gain of $43.13.

3.5 Question 5: Short Run vs. Long Run Analysis

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