Applied Microeconomics Problem Set With Solutions

Applied Microeconomics Problem Set With Solutions Applied Microeconomics Problem Set with Solutions This problem set is designed to help students develop their understanding of applied microeconomics concepts and apply them to realworld situations It covers a range of topics including consumer theory producer theory market structure and welfare economics The problems are designed to be challenging but solvable with careful application of the tools and concepts presented in class Solutions are provided for each problem to facilitate understanding and encourage learning Section 1 Consumer Theory Problem 1 Sarah has 100 to spend on two goods books and coffee The price of a book is 10 and the price of a cup of coffee is 5 Sarahs utility function is UB C B05 C05 where B represents the number of books and C represents the number of cups of coffee a What is Sarahs budget constraint b Find Sarahs optimal consumption bundle c What is Sarahs utility level at the optimal consumption bundle Solution a Sarahs budget constraint is 10B 5C 100 b To find the optimal consumption bundle we need to find the point where Sarahs indifference curve is tangent to her budget constraint This means finding the point where the marginal rate of substitution MRS equals the price ratio The MRS is the ratio of the marginal utility of books to the marginal utility of coffee MRS MUB MUC 05B05 C05 05B05 C05 CB The price ratio is PB PC 105 2 Setting the MRS equal to the price ratio we get CB 2 or C 2B Substituting this into the budget constraint we get 10B 52B 100 or B 5 Plugging this value back into the equation C 2B we get C 10 Therefore Sarahs optimal consumption bundle is 5 books and 10 cups of coffee c Sarahs utility level at the optimal consumption bundle is U5 10 505 1005 5 2 316 158 Problem 2 Suppose the price of books increases to 15 How does this affect Sarahs optimal consumption bundle Solution With the price of books increasing the budget constraint becomes steeper This means Sarah can now buy fewer books for the same amount of money The new budget constraint is 15B 5C 100 Repeating the steps from Problem 1 we find the new optimal consumption bundle is B 4 and C 8 Sarah now buys fewer books 4 instead of 5 and fewer cups of coffee 8 instead of 10 due to the higher price of books Section 2 Producer Theory Problem 3 A firm produces output using two inputs labor L and capital K Its production function is Q L05 K05 The price of labor is 10 and the price of capital is 20 a Find the firms total cost function b Find the firms marginal cost function c If the firm wants to produce 100 units of output how much labor and capital should it use Solution a The total cost function is the sum of the cost of labor and the cost of capital TC wL rK where w is the wage rate r is the rental rate of capital and L and K are the quantities of

labor and capital used Substituting the given values we get TC 10L 20K b The marginal cost function is the change in total cost divided by the change in output MC TC Q To find this we first need to find the firms costminimizing input combination for a given level of output This is achieved by setting the ratio of marginal products equal to the ratio of input prices MPL MPK wr The marginal product of labor is MPL 05L05 K05 and the marginal product of capital is MPK 05L05 K05 Plugging these into the equation above we get 05L05 K05 05L05 K05 1020 or K 2L Substituting this into the production function we get Q L05 2L05 2L Solving for L we get L Q2 Plugging this back into the equation K 2L we get K Q Therefore the costminimizing input combination for a given level of output Q is L Q2 and K Q Substituting these into the total cost function we get TC 10Q2 20Q 15Q The 3 marginal cost function is therefore MC TC Q 15 c To produce 100 units of output the firm should use L 1002 50 units of labor and K 100 units of capital Section 3 Market Structure Problem 4 A monopolist faces a demand curve of P 100 Q where P is the price and Q is the quantity Its total cost function is TC 10Q a What is the monopolists profitmaximizing price and quantity b What is the monopolists profit c What is the deadweight loss associated with the monopolists output Solution a The monopolists profit is maximized where marginal revenue MR equals marginal cost MC Total revenue TR is equal to price times quantity TR P Q 100 Q Q 100Q Q2 Marginal revenue is the change in total revenue divided by the change in quantity MR TR Q 100 2Q Marginal cost is the change in total cost divided by the change in quantity MC TC Q 10 Setting MR equal to MC we get 100 2Q 10 or Q 45 Substituting this value back into the demand curve we get P 100 45 55 Therefore the monopolists profitmaximizing price is 55 and its quantity is 45 units b The monopolists profit is equal to total revenue minus total cost TR TC 55 45 10 45 2025 450 1575 c The deadweight loss associated with the monopolists output is the difference between the consumer surplus in a perfectly competitive market and the consumer surplus in a monopolistic market In a perfectly competitive market the price would be equal to marginal cost which is 10 This would lead to a quantity of 90 units 100 P 100 10 90 The consumer surplus in a perfectly competitive market is equal to the area of the triangle between the demand curve and the price line which is 12 90 90 4050 The consumer surplus in a monopolistic market is equal to the area of the triangle between the demand curve and the price line which is 12 45 45 101250 The deadweight loss is therefore 4050 101250 303750 Section 4 Welfare Economics Problem 5 4 The government is considering imposing a tax on gasoline to reduce pollution The current price of gasoline is 3 per gallon and the demand curve is Q 100 2P The supply curve is Q 4P 12 a What is the consumer surplus and producer surplus before the tax b What is the optimal tax rate that maximizes government revenue c What is the deadweight loss from the tax at the optimal tax rate Solution a To find the equilibrium price and quantity before the tax we set demand equal to supply 100 2P 4P 12 Solving for P we get P 1867 Substituting this back into either the demand or supply equation we get Q 6267 Consumer surplus is the area of the triangle between the demand curve and the price line which is 12 6267 100 1867 254056 Producer surplus is the area of the triangle

between the supply curve and the price line which is 12 6267 1867 3 49056 b The optimal tax rate that maximizes government revenue is the tax rate that leads to a halfreduction in the quantity demanded This is because the tax revenue is maximized when the elasticity of demand is unitary In this case the elasticity of demand is 2PQ 2 1867 6267 06 To achieve unitary elasticity the price needs to increase by 167 106 Therefore the optimal tax rate is 167 per gallon c The deadweight loss from the tax is the loss in consumer and producer surplus due to the reduction in quantity traded The new equilibrium quantity after the tax is 4267 100 21867 167 4267 The deadweight loss is equal to the area of the triangle between the demand and supply curves which is 12 6267 4267 167 1667 Conclusion This problem set has provided students with an opportunity to apply microeconomic concepts to realworld scenarios By working through these problems and understanding the solutions students can develop a deeper understanding of economic principles and their practical applications Further Study Students interested in further exploring applied microeconomics can delve into topics such as game theory behavioral economics and the economics of information These topics are highly relevant to understanding the complexities of modern markets and can provide valuable insights into decisionmaking in various contexts 5 This article is an example of how to create a structured 1000word article with a problem set You can adapt it to your specific needs by changing the problems solutions and sections Remember to include clear explanations diagrams and realworld examples to enhance understanding

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