



• Name: \_\_\_\_\_

• Date: \_\_\_\_\_

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## **BUSN 301: Intermediate Microeconomic Theory**

### **Problem Set #1**

### **Spring 2026**

#### **INSTRUCTIONS:**

- Each problem set is graded on a 100-point basis and contributes to your Problem Set component of the course grade.
- You are expected to show all relevant steps and reasoning.
- Answers must be clearly written and well-organized.
- Graphs, when required, must be clearly labeled, with axes, curves, and key points identified.
- Problem sets must be submitted by the posted deadline.

**Problem 1. Budget Constraint: Basics**

Suppose that the prices of good 1 ( $x_1$ ) and good 2 ( $x_2$ ) are given as  $p_1 = 5$  and  $p_2 = 4$ , respectively. The consumer's income is  $m = 60$ , and the consumer allocates income across two goods only.

- 1.A. If the consumer spends their entire budget on only one good, determine the intercepts of the budget constraint. That is, calculate the maximum amount of  $x_1$  that can be consumed when  $x_2 = 0$ , and the maximum amount of  $x_2$  that can be consumed when  $x_1 = 0$ .
  
  
  
  
  
  
- 1.B. Is the bundle  $(5, 7)$  in the consumer's budget set? Show total expenditure and compare it to income.
  
  
  
  
  
  
- 1.C. Derive the equation for the budget line. Then calculate the slope of the budget line and provide an economic interpretation in terms of trade-offs between  $x_1$  and  $x_2$ .
  
  
  
  
  
  
- 1.D. Graph the consumer's budget constraint with  $x_1$  on the horizontal axis and  $x_2$  on the vertical axis. Clearly label the intercepts and indicate the feasible set.

**Problem 2. Budget Constraint: Comparative Statics**

Suppose the consumer faces the same initial prices and income as in Problem 1, with  $p_1 = 5$ ,  $p_2 = 4$ , and  $m = 60$ . Now suppose that the price of good 1 increases to  $p_1 = 10$ , while income and the price of good 2 remain unchanged.

2.A. Write down the consumer's new budget set and derive the equation for the new budget line.

2.B. How do the intercepts of the budget constraint change as a result of the increase in  $p_1$ ?

2.C. Compare the slope of the new budget line to the slope of the original budget line. Has the budget constraint shifted or rotated? Explain.

2.D. On a single graph, draw both the original and the new budget constraints. Clearly label all intercepts and indicate the direction of the change.

**Problem 3. Budget Constraints: Non-Standard Budget Constraints**

Suppose the consumer faces the same initial prices and income as in Problem 1, with  $p_1 = 5$ ,  $p_2 = 4$ , and  $m = 60$ .

3.A. Suppose the first 6 units of good 1 are free, but any additional units of good 1 cost  $p_1 = 5$  per unit. Graph the budget constraint.

3.B. Suppose instead that the consumer faces a quantity discount for good 1, where the first 5 units cost  $p_1 = 6$  per unit, and any additional units cost  $p_1 = 3$  per unit. Graph the budget constraint.

## Problem 4. Preferences

Assume that the preference relation ( $\succsim$ ) is well-behaved, as defined in class.

4.A. Suppose the consumer is indifferent between bundles  $X$  and  $Y$ , and indifferent between bundles  $Y$  and  $Z$ . What must be true about the relationship between  $X$  and  $Z$ ? Which axiom of preference justifies your answer?

4.B. Define an indifference curve. Explain why two indifference curves for the same preference relation cannot intersect.

4.C. In your own words, define the axiom of convexity. What does convexity imply about the shape of the consumer's indifference curve?

4.D. In your own words, define the axiom of weak monotonicity. What does weak monotonicity imply about the shape of the consumer's indifference curve?

4.E. Suppose bundle  $X$  lies on a higher indifference curve than bundle  $Y$ . Which bundle does the consumer prefer and why?

**Problem 5. Utility: Basics**

Assume that the preference relation ( $\succsim$ ) is well-behaved, as defined in class, and that  $u(x_1, x_2)$  is a representation of this preference relation.

5.A. What does it mean for a utility function to be an ordinal representation of preferences?

5.B. Why do monotonic transformations represent the same preferences?

5.C. Is it possible for two different utility levels to correspond to the same indifference curve? Explain.

5.D. In general, what does it mean for an indifference curve to be “further from the origin”? Why does this matter for ranking bundles?

5.E. Suppose bundle  $X$  lies on a higher indifference curve than bundle  $Y$ . What can we conclude about  $u(X)$  and  $u(Y)$ ? What does this say about the consumer’s preferences?

**Problem 6. Utility Functions, Marginal Utility, and the Marginal Rate of Substitution**

Suppose a consumer's utility function is given as  $u(x_1, x_2) = 4x_1x_2^2$ .

6.A. Compute the marginal utility of good 1 and the marginal utility of good 2.

6.B. Using your answers from part 6.A, derive the marginal rate of substitution (MRS).

6.C. Interpret the MRS economically.

6.D. As the consumer increases consumption of  $x_1$ , does the MRS increase, decrease, or remain constant? Explain briefly.

**Problem 7. Preferences and Indifference Curves**

Plot two indifference curves each, resulting from the following preferences, and indicate which indifference curve represents bundles that the consumer prefers over the other:

7.A. The consumer cannot tell the difference between Coffee and Tea.

7.B. The consumer likes Coffee, but dislikes Tea.

7.C. The consumer always takes 2 teaspoons of Sugar with each cup of Coffee.

7.D. The consumer enjoys Coffee up to 5 cups a day, but past that it causes discomfort.

**Problem 8. Optimal Choice**

Suppose a consumer has well-behaved preferences and faces a linear budget constraint.

8.A. Explain what it means for a bundle to be utility-maximizing.

8.B. Describe the tangency condition between the budget constraint and an indifference curve.

8.C. Under what circumstances might a utility-maximizing bundle occur at a corner solution?

**Problem 9. The Utility Maximization Problem: Cobb-Douglas Preferences**

Suppose a consumer's utility function is given by  $u(x_1, x_2) = 4x_1x_2^2$ . The unit prices of good 1 and good 2 are given as  $p_1 = 5$  and  $p_2 = 4$ , respectively. The consumer's income is  $m = 60$ , and the consumer allocates income across two goods only.

- 9.A. Using your answers from 1.C and 6.B, express the first-order condition for the consumer's utility maximization.
  
  
  
  
  
  
- 9.B. Solve the first-order condition from 9.A together with the budget constraint to find the utility-maximizing bundle  $(x_1^*, x_2^*)$ .
  
  
  
  
  
  
- 9.C. Verify that the utility-maximizing bundle exhausts the consumer's budget. Why does the utility-maximizing bundle exhaust the consumer's budget?
  
  
  
  
  
  
- 9.D. On a single graph, draw the consumer's budget constraint and an (approximate) indifference curve passing through the optimal bundle. Clearly indicate the point of tangency.

**Problem 10. Utility Maximization: Perfect Substitutes**

Suppose a consumer's utility function is given by  $u(x_1, x_2) = 3x_1 + 2x_2$ . The unit prices of good 1 and good 2 are given as  $p_1 = 2$  and  $p_2 = 2$ , respectively. The consumer's income is  $m = 50$ , and the consumer allocates income across two goods only.

10.A. Find the consumer's marginal utility with respect to goods 1 and 2, respectively.

10.B. Find the consumer's marginal rate of substitution.

10.C. Find the equation expressing the consumer's budget line.

10.D. State the necessary condition characterizing the consumer's utility-maximizing bundle for these preferences.

10.E. Solve the necessary condition from 10.D. together with the budget constraint from 10.C. to find the utility-maximizing bundle  $(x_1^*, x_2^*)$  and draw the consumer's budget constraint and the indifference curve passing through the optimal bundle.

**Problem 11. Utility Maximization: Perfect Complements**

Suppose a consumer's utility function is given by  $u(x_1, x_2) = \min\{x_1, 2x_2\}$ . The unit prices of good 1 and good 2 are given as  $p_1 = 5$  and  $p_2 = 2$ , respectively. The consumer's income is  $m = 50$ , and the consumer allocates income across two goods only.

11.A. Describe the shape of the consumer's indifference curves.

11.B. Is the marginal rate of substitution well-defined for these preferences? Explain briefly.

11.C. Find the equation expressing the consumer's budget line.

11.D. State the necessary condition characterizing the consumer's utility-maximizing bundle for these preferences.

11.E. Solve the necessary condition from 11.D. together with the budget constraint from 11.C. to find the utility-maximizing bundle  $(x_1^*, x_2^*)$  and draw the consumer's budget constraint and the indifference curve passing through the optimal bundle.

**Problem 12. Feedback Questions**

These questions are graded only on completion, and your responses to this question will be used to improve pacing and explanations in upcoming lectures.

12.A. Which part(s) of this problem set did you find challenging? (Select all that apply.)

- Budget constraints and comparative statics
- Preferences and indifference curves
- Utility functions and MRS
- Solving the utility maximization problem
- Interpreting graphs and optimal bundles

Briefly explain why you found this part challenging (1–2 sentences).

12.B. At this point in the course, which statement best describes you?

- I understand the ideas conceptually but struggle with the math
- I can do the math but do not always understand what it means
- I am comfortable with both the math and the intuition
- I feel lost and am not sure where my confusion starts

Briefly say what would help most in class.

• Score: \_\_\_\_\_

• Date: \_\_\_\_\_