

## Exercise 2: Consumption and Demand

### Problem 1 (*Budget Restriction*)

Consider an individual who allocates  $Z = 24$  hours on labor  $L$  and free time  $F$ . Per hour of labor, the individual earns the wage rate  $w = 25$ . He spends his entire earned income  $wL$  on a particular consumption good, the quantity of which is denoted by  $q$  and whose price is given by  $p = 1$ .

- (a) Specify the individual's budget restriction with respect to his potential income  $wZ$ , and draw his budget line in a diagram with the quantity of free time  $F$  on the horizontal axis and the quantity of the consumption good  $q$  on the vertical axis.
- (b) How does the individual's budget line change if
  - (i) an income tax reduces the wage rate to  $(1 - t)w = 20$ ?
  - (ii) a consumption tax raises the price of the consumption good to  $(1 + \tau)p = 1.25$ ?
  - (iii) earned income below a threshold  $wL < 200$  is subsidized with a social transfer  $S = 200 - wL$ ?

### Problem 2 (*Assumptions on Preferences*)

Consider an individual who derives utility from two goods, apples and oranges. Assume that she is indifferent between consumption bundle  $A$  (8 apples, 2 oranges) and consumption bundle  $B$  (2 apples, 8 oranges) and that she prefers consumption bundle  $B$  to consumption bundle  $C$  (6 apples, 6 oranges). Determine, whether the four assumptions on preferences (completeness, transitivity, monotonicity, and convexity) can hold together in this case.

### Problem 3 (*Individual Demand*)

Consider an individual with a given income  $y > 0$  and a utility function  $U(q_1, q_2) = q_1^{\frac{1}{2}} + q_2^{\frac{1}{2}}$ , where  $q_1$  and  $q_2$  denote the quantity consumed of good 1 and good 2, respectively. The goods prices are given by  $p_1 > 0$  and  $p_2 > 0$ , respectively.

- (a) Determine the individual demand for each good as a function of prices and income.
- (b) Characterize each good with respect to the change of consumption resulting from income and price changes.

**Problem 4** (*Substitution and Income Effects*)

Consider an individual with a given income  $y = 600$  and a utility function  $U(q_1, q_2) = (q_1 \cdot q_2)^{\frac{1}{2}}$ , where  $q_1$  and  $q_2$  denote the quantity consumed of good 1 and good 2, respectively. Initially, the goods prices are given by  $p_1 = 25$  and  $p_2 = 25$ , respectively.

- (a) Determine the optimal consumption bundle and depict it in a diagram.

Consider a price increase of good 2 to  $p'_2 = 100$

- (b) Decompose the total effect of the price increase mathematically as well as graphically into substitution and income effects.
- (c) What income is necessary after the price increase, so that the individual can obtain the initial level of utility?

**Problem 5** (*Optimal Consumption*)

Consider an individual with a given income  $y = 100$  and a utility function  $U(q_1, q_2) = q_1 + 2q_2$ , where  $q_1$  and  $q_2$  denote the quantity consumed of good 1 and good 2, respectively. The goods prices are given by  $p_1 = 4$  and  $p_2 = 5$ , respectively.

- (A) If the marginal rate of substitution and the price ratio are never equal, no optimal consumption bundle can be determined.
- (B) The individual spends her entire budget on good 2.
- (C) The optimal consumption bundle contains twice as many units of good 2 as of good 1.
- (D) The individual spends her entire budget on good 1.

**Problems 6-10** (*Optimal Consumption*)

Consider an individual with a given income  $y = 12$  and a utility function  $U(q_1, q_2) = q_1^{\frac{1}{4}} q_2^{\frac{3}{4}}$ , where  $q_1$  and  $q_2$  denote the quantity consumed of good 1 and good 2, respectively. The goods prices are given by  $p_1 = 1$  and  $p_2 > 0$ , respectively.

**Problem 6**

If  $p_2 = 1$ , the individual's optimal consumption bundle is

- (A)  $q_1 = 2$  and  $q_2 = 6$ .
- (B)  $q_1 = 2$  and  $q_2 = 9$ .
- (C)  $q_1 = 3$  and  $q_2 = 6$ .
- (D)  $q_1 = 3$  and  $q_2 = 9$ .

**Problem 7**

If  $p_2 = 3$ , the individual's optimal consumption bundle causes expenses of

- (A) 6 for good 1.
- (B) 9 for good 1.
- (C) 6 for good 2.
- (D) 9 for good 2.

**Problem 8**

Regarding good 1, the substitution and income effects of an increase in the price of good 2 from  $p_2 = 1$  to  $p_2 = 3$  work

- (A) in the same direction.
- (B) in opposite directions, while the substitution effect prevails.
- (C) in opposite directions, while both effects neutralize.
- (D) in opposite directions, while the income effect prevails.

**Problem 9**

Regarding a price increase of good 2 from  $p_2 = 1$  to  $p_2 = 3$ , the two goods can be characterized as follows:

- (A) Good 1 is a normal good, and good 2 is an ordinary good.
- (B) Good 1 is a normal good, and good 2 is a Giffen good.
- (C) Good 1 is an inferior good, and good 2 is an ordinary good.
- (D) Good 1 is an inferior good, and good 2 is a Giffen good.

**Problem 10**

If  $p_2 = 3$ , the indifference curve through the consumption bundle  $q_1 = 3$  and  $q_2 = 3$

- (A) runs completely beyond the budget line.
- (B) is tangent to the budget line.
- (C) intersects the budget line once.
- (D) intersects the budget line twice.