

Review Session Handout #4

Chapter 5: Consumer Preferences

Introduction to Microeconomics: Markets, Strategy, and Real-World Cases

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Exercise R4.1. A consumer chooses among bundles of pizza slices and cans of soda. The table lists six bundles and the utility number she attaches to each.

Bundle	Pizza slices	Cans of soda	Utility
A	2	6	12
B	3	4	12
C	4	3	12
D	6	2	12
E	4	5	18
F	2	3	6

- (a) Rank the six bundles from most preferred to least preferred. Which bundles lie on the same indifference curve?
- (b) Without using the utility numbers, explain why the rule that more is better already tells you that the consumer prefers E to C and C to F.
- (c) Moving from A to B, from B to C, and from C to D, compute how many cans of soda the consumer gives up for each extra slice of pizza while staying equally satisfied. What pattern do you find, and what is it called?
- (d) Draw the indifference curve through A, B, C, and D, and mark bundles E and F on your diagram.

Solution.

Part (a). A higher utility number marks a more preferred bundle. The ranking is: E first (utility 18); then A, B, C, and D, among which the consumer is indifferent (utility 12 each); and F last (utility 6). Bundles A, B, C, and D lie on the same indifference curve. E lies on a higher curve and F on a lower one. The utility numbers only record this ranking (Section 5.2): E is preferred to A, although the fact that 18 is 50 percent more than 12 does not make E “50 percent better” than A.

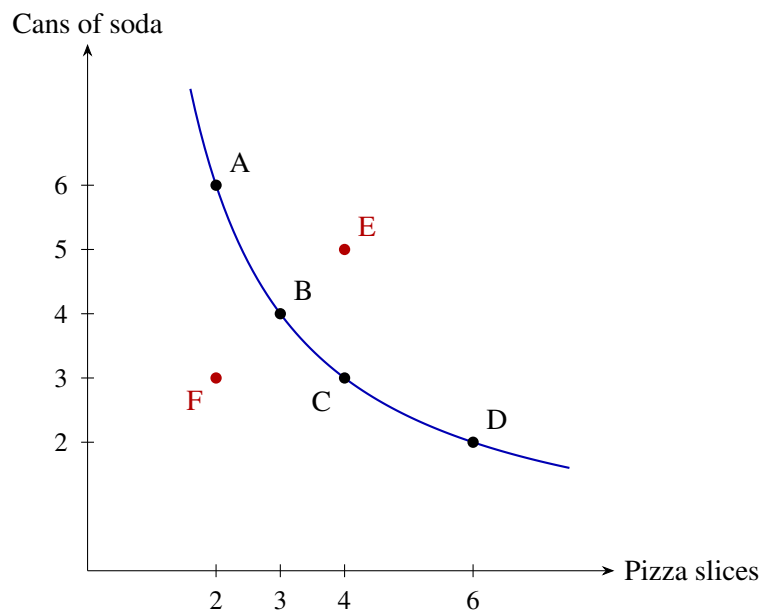
Part (b). Bundle E (4 slices, 5 cans) has the same pizza as C (4 slices, 3 cans) and 2 more cans of soda, so by the rule that more is better, she prefers E to C. Bundle C (4 slices, 3 cans) has the same soda as F (2 slices, 3 cans) and 2 more slices of pizza, so she prefers C to F. By transitivity, she also prefers E to F.

Part (c). The table lists the trades along the indifference curve.

Move	Extra pizza slices	Cans of soda given up	Cans given up per extra slice
A to B	1	2	2
B to C	1	1	1
C to D	2	1	$\frac{1}{2}$

The number of cans she gives up for each extra slice, her marginal rate of substitution, falls from 2 to 1 to one-half as she gets more pizza and less soda. This is the principle of diminishing marginal rate of substitution: the more pizza she already has, the less soda she will sacrifice for still more of it.

Part (d). The indifference curve through A, B, C, and D slopes downward and is bowed toward the origin: steep where she has much soda and little pizza, flat where she has much pizza and little soda. Bundle E lies above and to the right of the curve, and bundle F lies below and to the left of it.



Remark. Bundles with very different mixes, such as A (2 slices, 6 cans) and D (6 slices, 2 cans), can be equally preferred. The diminishing marginal rate of substitution found in part (c) is what bows the curve toward the origin.

Exercise R4.2. Consider three properties of indifference curves: (i) they slope downward, (ii) they do not cross, and (iii) they are bowed toward the origin. For each property, answer the following:

- State the rule of preferences from Section 5.2, or the principle from Section 5.4, that it reflects.
- Explain why the property follows from that rule or principle.
- Provide an example using food and clothing.

Solution.

Property (i): indifference curves slope downward.

- It reflects the rule that more is better: other things equal, more of a good is preferred to less.
- Start from a bundle on an indifference curve. If the consumer gains one meal without losing any clothing, she has more of one good and no less of the other, so she prefers the new bundle, which lies on a higher indifference curve. The only way to stay equally satisfied while gaining food is to give up some clothing, so the curve must slope downward.

- (c) A student is equally satisfied with 3 meals and 5 shirts or with 4 meals and 3 shirts: gaining a meal requires giving up shirts to stay equally satisfied.

Property (ii): indifference curves do not cross.

- (a) It reflects transitivity: if she prefers bundle A to B, and B to C, then she prefers A to C (and, in the same way, if she likes A and B equally, and B and C equally, she likes A and C equally). The rule that more is better also plays a part.
- (b) Consider that two indifference curves cross at a bundle X. Pick a bundle A on the first curve and a bundle B on the second, where A has more of both goods than B. Since A and X lie on the same curve, she likes them equally; since B and X lie on the same curve, she likes them equally too. Transitivity then says she likes A and B equally. But A has more of both goods than B, so by the rule that more is better she prefers A to B, a contradiction. Indifference curves therefore cannot cross.
- (c) A consumer is equally satisfied with (2 meals, 6 shirts) and (3 meals, 4 shirts), and equally satisfied with (3 meals, 4 shirts) and (5 meals, 2 shirts). Transitivity says she must also be equally satisfied with (2 meals, 6 shirts) and (5 meals, 2 shirts), so all three bundles lie on one curve. If a second curve passed through (3 meals, 4 shirts) and (2 meals, 7 shirts), she would be equally satisfied with (2 meals, 7 shirts) and (2 meals, 6 shirts), which contradicts the rule that more is better, since the first bundle has one more shirt.

Property (iii): indifference curves are bowed toward the origin.

- (a) It reflects the principle of diminishing marginal rate of substitution (Section 5.4): the more of a good the consumer already has, the less of the other good she will give up for still more of it. Unlike the three rules of Section 5.2, this is a principle about how strongly she wants each good.
- (b) The marginal rate of substitution is the slope of the indifference curve. When the consumer has little food and much clothing, an extra meal is worth many shirts, so the curve is steep; when she has much food and little clothing, an extra meal is worth few shirts, so the curve is flat. A curve that becomes flatter as we move to the right is bowed toward the origin. Section 5.4.1 links this to marginal utility: the marginal rate of substitution equals the ratio of the two goods' marginal utilities, so diminishing marginal utility of each good helps produce the bow.
- (c) A consumer with 1 meal and 10 shirts might give up 4 shirts for one more meal, while the same consumer with 8 meals and 3 shirts would give up only 1 shirt for one more meal.

Remark. The first two properties follow from the rules of Section 5.2: more is better gives the downward slope, and transitivity, together with more is better, rules out crossing. The third rests on the principle of diminishing marginal rate of substitution, which reflects diminishing marginal utility.

Exercise R4.3. A student compares apartments by their living space, measured in hundreds of square feet, and by the daily free time they leave her, in minutes (an apartment closer to campus saves commuting time and leaves more free time). She likes both more space and more free time. At an apartment with 600 square feet and 120 minutes of free time, her marginal rate of substitution of free time for space is 10.

- (a) Explain in words what a marginal rate of substitution of 10 means for this student.
- (b) A second apartment offers 700 square feet and 115 minutes of free time. Does it lie on a higher, a lower, or the same indifference curve as the first apartment? Explain.
- (c) As the student moves to apartments with more space (holding her satisfaction constant), does her marginal rate of substitution rise or fall? What does a diminishing marginal rate of substitution mean in this context?

Solution.

Part (a). At 600 square feet and 120 minutes, the student would give up 10 minutes of daily free time to gain one more unit of space, 100 square feet, and stay equally satisfied. In other words, an apartment with 700 square feet and 110 minutes of free time is exactly as good for her as the first apartment.

Part (b). From part (a), the apartment with 700 square feet and 110 minutes lies on the same indifference curve as the first apartment. The second apartment has the same space, 700 square feet, and 5 more minutes of free time, 115 instead of 110, so by the rule that more is better she prefers it to the 700-square-foot, 110-minute apartment. By transitivity, she prefers it to the first apartment as well: it lies on a higher indifference curve. Intuitively, the move asks her to give up only 5 minutes for 100 extra square feet, while she would have been willing to give up 10.

Part (c). The marginal rate of substitution falls. As she moves along her indifference curve toward apartments with more space and less free time, each extra 100 square feet adds less to her satisfaction, while each minute of free time, now scarcer, matters more. She is therefore willing to give up fewer minutes for each additional 100 square feet. For example, in a 400-square-foot apartment she might give up 20 minutes for another 100 square feet, while in a 900-square-foot apartment she might give up only 4. A diminishing marginal rate of substitution means that the more space she already has, the less free time she will sacrifice for still more space, which bows her indifference curves toward the origin.

Remark. The marginal rate of substitution compares two goods the student values. It describes her willingness to trade at a given bundle, so it changes as she moves along an indifference curve.