EconS 301 – Intermediate Microeconomics

Review Session #2

1. Consider the utility function $U(x,y)=3x^2+5y$ with $MU_x=6x$ and $MU_y=5$.

a) Is the assumption that 'more is better' satisfied for both goods?

Answer

Yes, since the marginal utility is greater than zero for both goods, increasing consumption of either good will increase total utility. Remember that marginal utility measures the amount of utility that you will receive from one extra unit of that good. Thus, if MU is positive, more of that good can only leave you better off.

b) What is $MRS_{x,y}$ for this utility function? What does the $MRS_{x,y}$ tell us?

Answer

$$MRS_{x,y}=\frac{MU_x}{MU_y}=\frac{6x}{5}$$

The marginal rate of substitution tells us the tradeoff that this consumer is willing to make, while holding a constant level of utility. Also, the negative of the $MRS_{x.y}$ tells us the slope of the indifference curve.

c) Is the $MRS_{x,y}$ diminishing, constant, or increasing as the consumer substitutes x for y along an indifference curve?

Answer

$MRS_{x,y}$ is increasing as the consumer substitutes toward more x and less y since x appears in the numerator of $MRS_{x,y}$. That is, as consumption of good x increases, the numerator of this fraction gets larger, and therefore the $MRS_{x,y}$ gets larger as well.

d) Will the indifference curves corresponding to this utility function be convex to the origin (bowed toward the origin), concave to the origin (bowed away), or straight lines? Explain.

Answer

The indifference curves will be concave to the origin since the marginal rate of substitution is increasing as the consumer substitutes x for y along an indifference curve. To further explain, as we move from left to right on the indifference curve the slope will get steeper because MRS is getting larger.

2. Olivia likes to eat both apples and bananas. At the grocery store, each apple costs $0.20 and each banana cost $0.25. Olivia's utility function for apples and bananas is given by $U(A,B) = 6\sqrt{AB}$ where $MU_A = 3\sqrt{B/A}$ and $MU_B = 3\sqrt{A/B}$. If Olivia has $4 to spend on apples and bananas, how many of each should she buy to maximize her satisfaction?

Answer

Use the tangency condition to find the optimal amount of A to relative to B.

$$MU_A/P_A = MU_B/P_B$$

$$\frac{3\sqrt{B/A}}{0.20} = \frac{3\sqrt{A/B}}{0.25}$$

$$15\sqrt{B/A} = 12\sqrt{A/B}$$

$$\frac{225B}{A} = \frac{144A}{B}$$

$$\frac{225B^2}{144} = A^2$$

$$A = 1.25B$$

Now plug this into the budget constraint to find the optimal amount of B to purchase.

$$0.20(1.25B) + 0.25B = 4$$

$$0.50B = 4$$

$$B = 8$$

Finally, plug this result into the relationship between A and B above (that we found using the tangency condition) to determine the optimal amount of A; $A = 1.25(8) = 10$. Therefore, she should buy 10 apples and 8 bananas to maximize her utility.

3. A consumer has income of $180 per week and buys two goods, x and y. Initially, the prices are $(P_{x_1}, P_{y_1}) = (15,10)$, and the consumer chooses basket 1 containing $(x_1, y_1) = (10,3)$. Later, the prices change to $(P_{x_2}, P_{y_2}) = (12,12)$. At these prices the consumer chooses basket 2 containing $(x_2, y_2) = (5,10)$. The income is still $180 per week. Do the consumer's choices in these two situations maximize utility?

Answer

We can use the theory of revealed preference to answer this question. At the initial prices the baskets cost:

$$\text{Basket 1} \quad 15(10) + 10(3) = 180$$
$$\text{Basket 2} \quad 15(5) + 10(10) = 175$$

The consumer chose basket 1 rather than basket 2 in this case. Since basket 1 is more expensive, the consumer must prefer basket 1 to basket 2. Notice that both baskets are affordable at the initial prices. This has to be true with each set of prices before we can make any inferences about preferences.

To be consistent to utility maximization, with the second set of prices basket 2 must cost less than basket 1 (since basket 2 was chosen over basket 1). Let's check:

$$\text{Basket 1} \quad 12(10) + 12(3) = 156$$
$$\text{Basket 2} \quad 12(5) + 12(10) = 180$$

Since basket 2 was chosen and basket 2 is more expensive, this would imply that basket 2 is preferred to basket 1. But this contradicts the initial situation where we discovered that basket 1 was preferred to basket 2. Therefore, these choices by the consumer do not satisfy utility maximization by the consumer.

4. Sally likes peanut butter and jelly together in her sandwiches. However, Sally is very particular about the proportions of peanut butter and jelly. Specifically, Sally likes 2 scoops of jelly with each 1 scoop of peanut butter. The cost of "scoops" of peanut butter and jelly are $0.50 and $0.20, respectively. Sally has $9 each week to spend on peanut butter and jelly. (You can assume that Sally's mother provides the bread for the sandwiches.) If Sally is maximizing her utility subject to her budget constraint, how many scoops of peanut butter and jelly should she buy?

Answer

Notice that Sally only enjoys these goods if they are in the exact ratio she prefers. This means that peanut butter and jelly are perfect complements for Sally. Sally wants to consume at the "corner point" of her L-shaped indifference curve (least expensive point on any given utility curve). Thus, she will consume twice as much jelly as peanut butter. By consuming in this ratio, she will spend $0.90 for each peanut butter/jelly bundle. She has a total of $9 in income. Thus, she can afford 10 bundles:

$$\frac{\$9.00}{\$0.90} = 10.$$

Since each bundle contains two scoops of jelly, Sally should buy 20 scoops of jelly. Since each bundle contains one scoop of peanut butter, Sally should buy 10 scoops of peanut butter. At $PB = 10$ and $J = 20$, Sally is at the point where the corner of the L-shaped indifference curve just touches the budget constraint at that one point.