

1. Suppose the consumer has a utility function $U(Q_x, Q_y) = \sqrt{Q_x Q_y}$, where Q_x and Q_y are the quantity of good x and quantity of good y respectively. Assume his income is I and the prices of the two goods are P_x and P_y . Write down the consumer's problem.
2. Suppose Jack is deciding on the quantities of pizza and movie to buy. He has \$100. The price of a pizza is \$5, and the price of a movie is \$10.
 - a. Write down his budget constraint. Draw the diagram and show his opportunity set. What is the slope of the budget line? (Put pizza on the horizontal axis.)
 - b. Suppose the government imposes a 20% consumption tax on movie. Write down his budget constraint, and add the new budget constraint line to the above diagram. What is the slope of the new budget line?
 - c. Because his income is low, suppose Jack gets \$20 food stamp from the government which can only be used to buy pizza. Draw the new budget constraint line.

(Note: Please label your diagram clearly.)

3. Mary doesn't like working but enjoy the leisure time. If she works, she earns a wage of \$10/hour and she can use the income to buy all the goods she need to consume. Assume the price of the goods she consumes is equal to \$1. Also assume Mary's utility function is $U(C, N) = \sqrt{CN}$, where C is her consumption (quantity of all the goods she consumes) and N is her leisure hours. Denote by L her labor hours, $L + N = 24$. Derive Mary's demand curve for Leisure and supply curve for Labor.

(Hint: 1. Her marginal utilities are: $MU_C = \frac{\sqrt{N}}{2\sqrt{C}}$, $MU_N = \frac{\sqrt{C}}{2\sqrt{N}}$; 2. Try different wages and calculate the leisure hours corresponding to each of them.)

4. *Economist George Stigler once wrote that, according to consumer theory, "if consumers do not buy less of a commodity when their incomes rise, they will surely buy less when the price of the commodity rises." Explain this statement.*
5. What's the economic meaning of MRS?
6. You consume only soda and pizza. One day, the price of soda goes up, the price of pizza goes down, and you are just as happy as you were before the price changes.
 - a. Illustrate this situation on a graph.
 - b. Can you afford the bundle of soda and pizza you consumed before the price changes?
7. Describe the four properties of indifference curves and explain why they are true. (You may need to refer to the basic assumptions we make on the consumer's preference.)
8. Compare the following two pairs of goods:
 - Coke and Pepsi
 - Skis and ski bindings

In which case do you expect the indifference curves to be fairly straight, and in which case do you expect the indifference curves to be very bowed? In which case will the consumer respond more to a change in the relative price of the two goods?

9. Steve's utility function is $U = BC$, where B = veggie burgers per week and C = packs of cigarettes per week. Here, $MU_B = C$ and $MU_C = B$. Steve's income is \$120, the price of a veggie burger is \$2, and that of a pack of cigarettes is \$1.
 - a. What is his marginal rate of substitution if veggie burgers are on the vertical axis and cigarettes are on the horizontal axis?
 - b. How many burgers and how many packs of cigarettes does Steve consume to maximize his utility?
 - c. When a new tax raises the price of a burger to \$3, what is his new optimal bundle?
 - d. If there is no income effect, what is his optimal bundle as a result of substitution effect?
 - e. Is a burger a normal good or an inferior good?
 - f. Illustrate your answers above in a graph. (Clearly label the substitution and income effects)
10. Edward's budget on video games and movies is \$60/month. The price of a game is \$1 and the price of a movie is \$2. Edward's utility function is $U = 4G + 3M$, where G is the quantity of games and M is the quantity of movies he buys.
 - a. How many games and movies he buys each month.
 - b. Now suppose the price of a game increases to \$4. How many games and movies he buys each month.