

1. Jan has the following utility function for broccoli:

$$U(B) = 54B - 0.5B^3$$

- What is Jan's marginal utility function?
- Plot the utility and the marginal utility functions on two separate graphs. Be sure to label the axes and the curves carefully.
- Suppose that Jan is allowed to consume as much broccoli as she likes and that broccoli costs her nothing. Show, both algebraically and graphically, the value of B at which she would stop consuming broccoli.

2. Consider the utility function $U(x, y) = 12x^{3/2}y^{1/2}$.

- What are MU_x and MU_y ?
 - Does the consumer believe that more is better for each good? Explain using your answer from a).
 - Do the consumer's preferences exhibit a diminishing marginal utility of x ? Is the marginal utility of y diminishing?
3. Draw indifference curves to represent the following types of consumer preferences. Make sure to include arrows to indicate direction of preference. (Hint: Start with a bundle (say 10 units of each), and think about other bundles that give the consumer the same utility.)

- I like Soda, but neither like nor dislike Coffee.
 - I dislike Soda, but neither like nor dislike Coffee.
 - I like Soda, but dislike Coffee.
 - I like both Soda and Coffee, and always get the same additional satisfaction from 1 ounce of Soda as I do from 2 ounces of Coffee.
 - I like Soda and Coffee, but I only want 2 ounces of Soda for every 1 ounce of Coffee.
4. The utility that Mary receives by purchasing E units of entertainment and purchasing F units of food is given by,

$$U(E, F) = E^{1/2}F$$

- What are the marginal utility functions?
- On a graph with E on the horizontal axis and F on the vertical axis, draw indifference curves for $U = 12$, $U = 18$, and $U = 24$.
- Do the shapes of these indifference curves suggest that Mary has a diminishing marginal rate of substitution of entertainment for food? Explain.
- Using the marginal utilities, determine the $MRS_{E,F}$.
- Calculate the slope of the indifference curve $U = 12$ at the points $(E, F) = (4, 6)$, $(1, 12)$. Do these slopes suggest diminishing marginal rate of substitution?

Now, assume that entertainment costs \$4 per unit and the food cost \$2 per unit. Mary has \$24 to spend on entertainment and food.

- Using algebra (the tangency condition and budget line), find the optimal choice of entertainment and food.

- Using a new graph with entertainment on the horizontal axis and food on the vertical axis, draw the budget line, the utility maximizing basket, and the indifference curve that contains the utility maximizing basket.

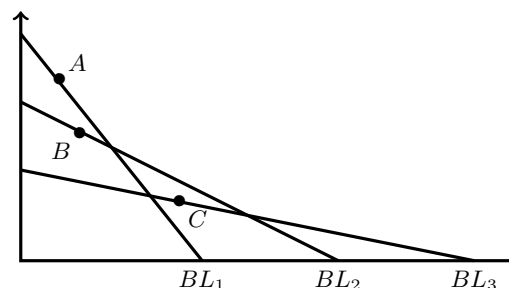
- Now, assume that Mary has \$ I and the prices are P_E and P_F , solve for the optimal basket as a function of I , P_E , and P_F .

5. Alex is currently spending all of his income and consumes 10 hamburgers and 3 salads each week. At his current consumption basket, his marginal utility for hamburgers is 5 and his marginal utility for salads is 2. If the price of one hamburger is \$3 and the price of one salad is \$1.50, is Alex currently maximizing his utility? If not how should he reallocate his spending in order to increase his utility?

6. Tom is trying to decide whether or not to buy Arizona season tickets for basketball. There are a total of 20 home games during the 2017-2018 basketball season. If Tom buys individual game tickets they cost \$25 each. A season ticket which allows Tom to go to all the games costs \$325. If for some reason Tom can't go to a game, then he can sell the tickets to his friend for \$10 per game.

- On a graph with games attended on the horizontal axis and "other goods" on the vertical axis draw Tom's budget line.
- On the graph from part (a) draw a set of indifference curves that illustrates why Tom may be better off without season tickets.
- On a new graph draw the same budget line you found in part (a). Now draw a set of indifference curves that illustrates why Tom might not be better off with season tickets.

7. A consumer buys two goods, food and housing, and likes both goods. When she has budget line BL_1 , her optimal choice is basket A. Given budget line BL_2 , she chooses basket B, and with BL_3 , she chooses basket C. Examine the following graph in order to answer the following questions: (Hint: use revealed preference, transitivity and more is better)



- What can you infer about how the consumer ranks baskets A, B, and C? If you can infer a ranking, explain how. If you cannot infer a ranking, explain why not.
- On the graph, shade in (and clearly label) the areas that are revealed to be less preferred to basket B, and explain why you indicated these areas.
- On the graph, shade in (and clearly label) the areas that are revealed to be (more) preferred to basket B, and explain why you indicated these areas.