1. Do Exercise 3.2 in the "Workouts" book.

2. Do Exercise 3.9 in the "Workouts" book.

3. I like coffee but when I drink more than 2 cups, it makes my stomach a bit upset, so after 2 cups, drinking more coffee makes me worse off. The problem gets worse and worse, the more coffee I am forced to drink (above 2 cups). I don’t have the same problem with cookies. I like them, and could eat them all day and never get tired.

(a) Sketch my preferences for coffee and cookies by drawing two representative IC’s. Show the direction of increasing preference.

(b) Are my preferences convex? (assume that in the region up to 2 cups, my indifference curves get flatter as my coffee consumption increases).

(c) If I am maximizing my utility, I will always end up consuming exactly two cups of coffee. Discuss the validity of this statement.

4. Consider the following utility functions:

1. \( U(x_1, x_2) = x_1 x_2 \)
2. \( U(x_1, x_2) = x_1^2 x_2^2 \)
3. \( U(x_1, x_2) = \ln(x_1) + \ln(x_2) \)

(a) Find the utility level that corresponds to the consumption bundle \((x_1, x_2) = (2, 4)\) in each case.

(b) Determine whether these functions exhibit the property of diminishing MRS (note that when we talk about diminishing MRS, we are talking about the slope of the IC diminishing in an absolute sense, so you need to look at whether the absolute value of MRS declines as \(x_1\) increases). Will these utility functions yield convex indifference curves?

(c) Do the functions also exhibit diminishing marginal utility (i.e. does \(MU_1\) increase as \(x_1\) increases and \(MU_2\) as \(x_2\) increases)? Show your work.

(d) Given your results, would you say that all three functions represent the same preferences?

5. Sketch a set of indifference curves (that is, at least two distinct curves) for each of the following utility functions. Draw your curves as closely to scale as possible, and indicate the direction of increasing preferences in each of your diagrams:
(a) $U(x_1, x_2) = 3x_1 + x_2$

(b) $U(x_1, x_2) = \ln(4x_1 + 2x_2)$

(c) $U(x_1, x_2) = x_1^{1/4}x_2^{3/4}$

(d) $U(x_1, x_2) = \min(5x_1, 2x_2)$

6. For each function in Question 6, calculate the MRS of $x_1$ for $x_2$. Indicate whether the property of diminishing MRS is satisfied.