Problem Set 1: Solutions

ECON 301: Intermediate Microeconomics
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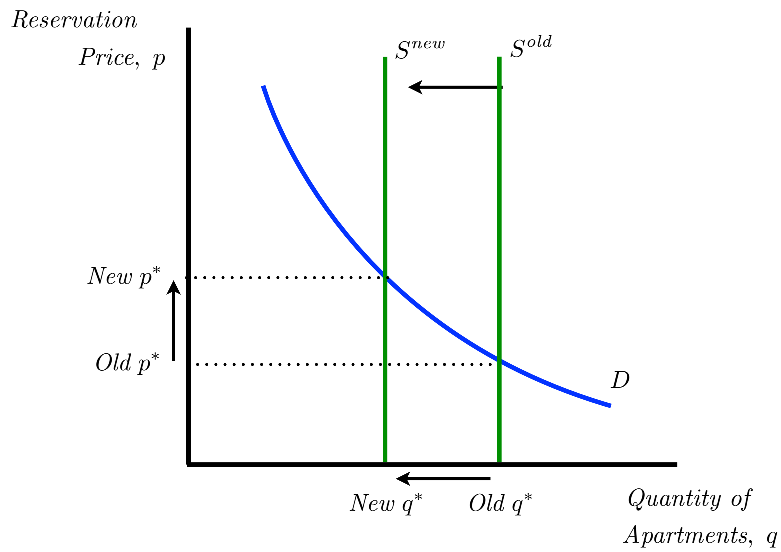
Problem 1 (From Varian Chapter 1)

In this problem, the supply curve shifts to the left as some of the apartments are converted into condominiums. The demand curve, however, is not changed; the "inner ring" people who were already renting apartments are still in the market for apartments (they did not move into the condominium market—only the "outer-ring" people are in that market). The equilibrium rental price is higher, while the equilibrium quantity of apartment rentals in this market is lower.



Problem 2 (Murphy's Budget Set)

(a) The formula for the budget constraint with two goods is $p_1x_1 + p_2x_2 \leq m$. For this problem, $p_1 = 2$ (we'll just assume French Fries are x_1, since that's what we'll have on the horizontal axis), the price of Beef Jerky is $p_2 = 5$ per pack. With income $m = 100$, Murphy's budget constraint is

$$2x_1 + 5x_2 \leq 100\,.$$

Notice that the budget *constraint* represents all the affordable (x_1, x_2) combinations (anything less than or equal to \$100). The budget *line* represents the (x_1, x_2) combinations that cost exactly \$100, so the equation representing the budget line is $2x_1 + 5x_2 = 100$.

(b) The real income in terms of French Fries (which is the portions of French Fries Murphy could consume if he spent all his income on French Fries) is

$$\frac{m}{p_1} = \frac{100}{2} = 50\,.$$

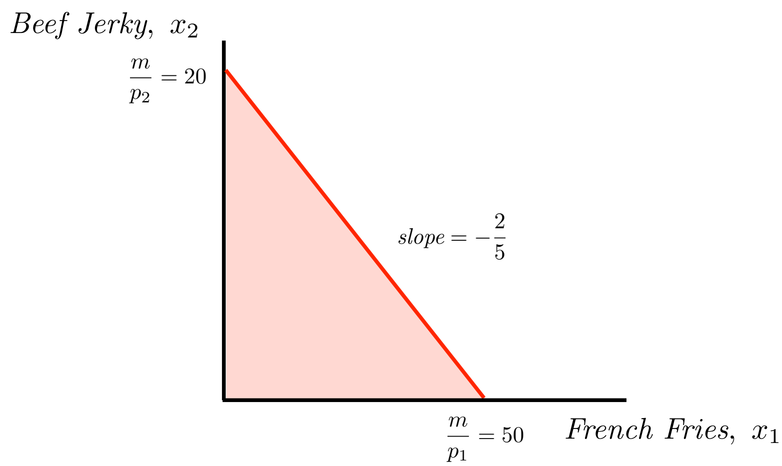
Thinking of what this means graphically, we just found the x_1-intercept of budget line.

(c) The real income in terms of Beef Jerky (which is the packs of Beef Jerky Murphy could consume if he were to consume only Beef Jerky) is

$$\frac{m}{p_2} = \frac{100}{5} = 20\,.$$

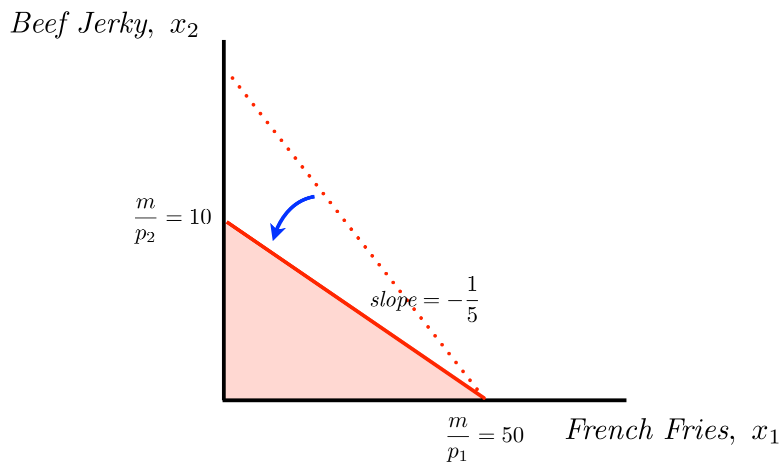
This tells us the x_2-intercept of budget line. Notice that, accordingly, this is coming directly from the budget line: If we set $x_1 = 0$ (no French Fries consumed) in the budget line formula and solve for x_2, we have $p_1 \cdot 0 + p_2 x_2 = m \implies x_2 = \frac{m}{p_2}$, telling us how much Beef Jerky can be consumed if of French Fries are consumed.

(d) The red budget line (given by $p_1 x_1 + p_2 x_2 = m$) and the pink budget set area (all of the combinations of x_1 and x_2 that are affordable $p_1 x_1 + p_2 x_2 \le m$.) are shown below. Notice that the quantities we found in **(b)** and **(c)** are indeed the x_1- and x_2-intercepts.

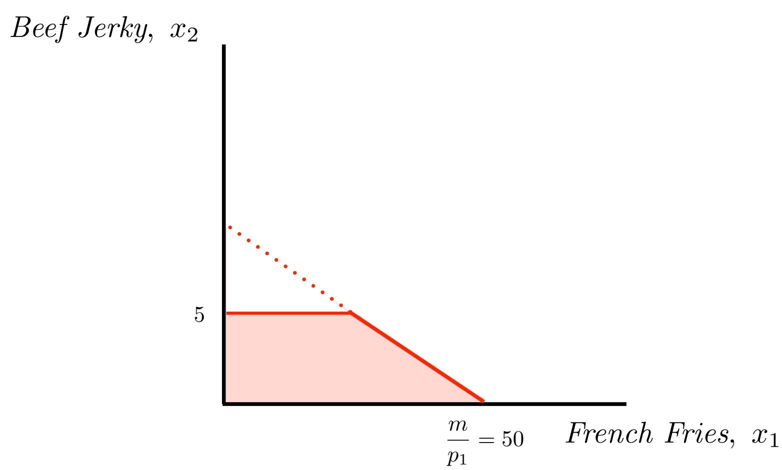


(e) The slope of the budget line is $-\frac{p_1}{p_2} = -\frac{2}{5}$. (Thinking way back to Algebra, just put the budget line in "slope-intercept form" to see this.) The economic interpretation is that this is the real price of French Fries in terms of Beef Jerky. I.e., to get one more portion of French Fries, you would have to consume 2/5 fewer packs of Beef Jerky to afford that extra portion of Fries.

(f) With the new, higher price of Beef Jerky, Murphy's total income in terms of Beef Jerky has fallen from 20 packs to 10 packs (so the new x_2-intercept is now 10). His real income in terms of Fries has not changed (therefore the x_1-intercept is still 50). We can think of his budget line as rotating down as seen below. Notice that the new slope of the budget line (the relative price) is $-\frac{p_1}{p_2} = -\frac{2}{10} = -\frac{1}{5}$. (While the actual price of Fries has not changed, Fries are *relatively* cheaper compared to Beef Jerky than they were before.)



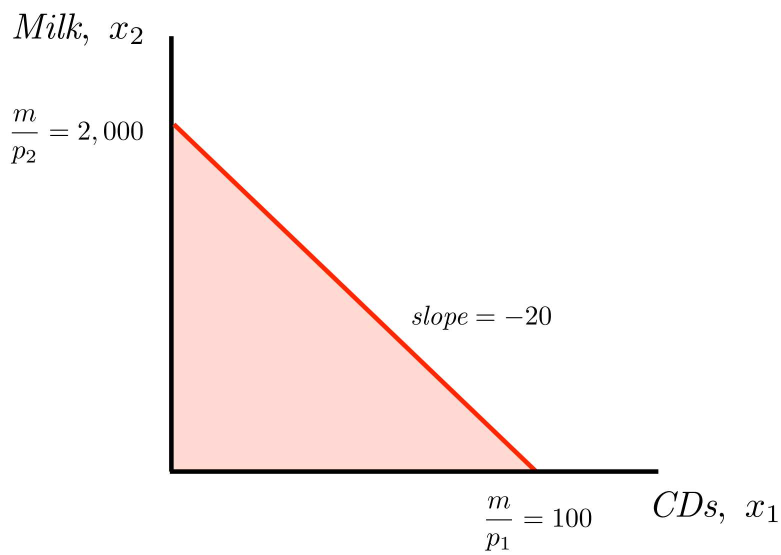
(g) The "Jerky" Bill essentially prohibits Murphy from consuming any combination (x_1, x_2) combination of French Fries and Beef Jerky with $x_2 > 5$. So the area of this budget constraint set that overlaps with the part of the graph where $x_2 > 5$ is off limits. Notice that this does not change the slope of the budget line exactly; it rather forces him to choose among only the affordable bundles for which $x_2 \leq 5$.



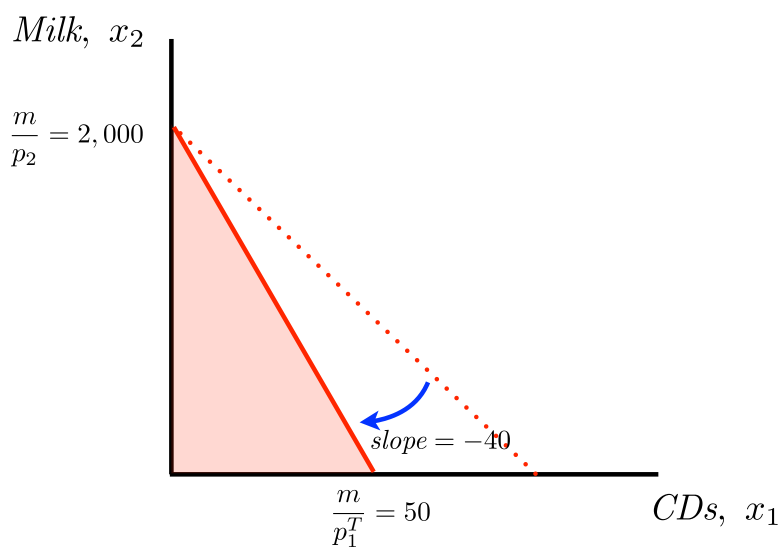
Problem 3 (Budget Set with Taxes)

(a) The relative price of a CD (x_1) in terms milk (x_2) is: $\frac{p_1}{p_2} = \frac{20}{1} = 20$. So, along the budget line, to purchase one more CD, Amy must forego 20 bottles of milk. (Remember that *analytically* the slope of the budget line still has that negative sign: $-\frac{p_1}{p_2}$. It's just that when we talk *economically* about the relative price of something—like how much we have to *give up* of one thing to get another—the negative is implied by the "give up" part.)

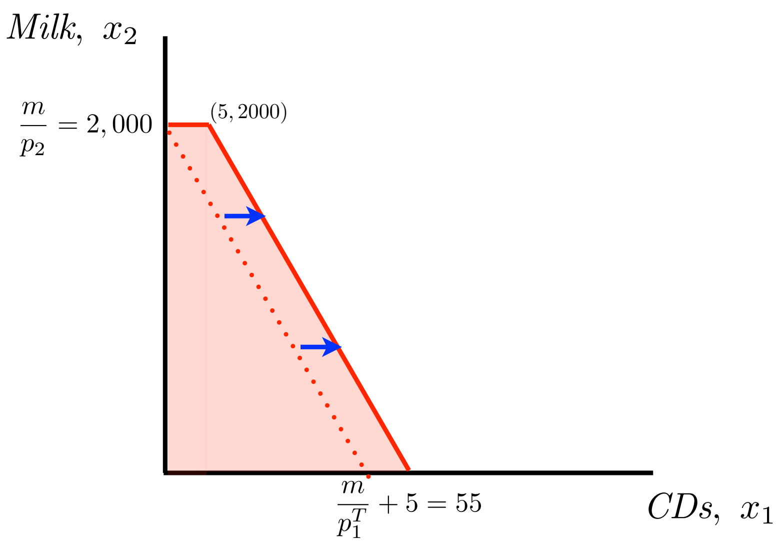
(b) Amy's budget set:



(c) An *ad valorem* tax here on the CDs is equivalent to a change in the price of CDs to $p_1^T = (1 + tax) \cdot p_1$, so $p_1^T = (1 + 1) \cdot 20 = 40$. The new relative price of a CD in terms of bottles of milk is $\frac{p_1^T}{p_2} = \frac{40}{1} = 40$. Her new budget line and budget set are shown graphically below:

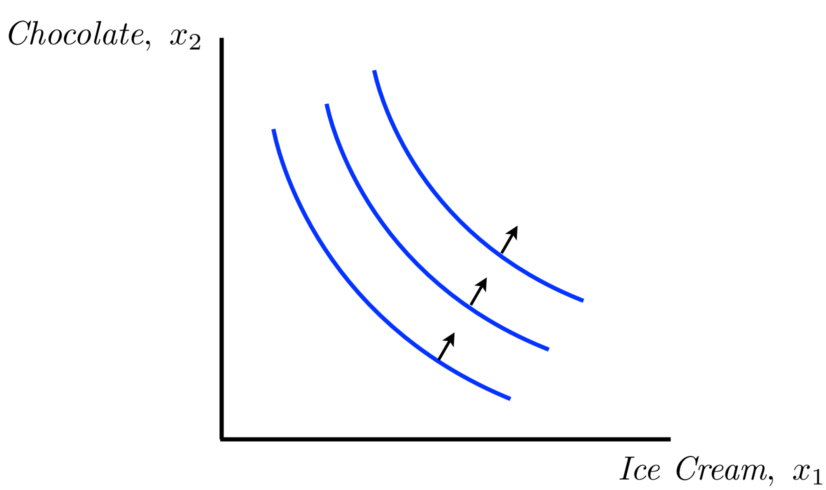


(d) If Amy is sent 5 CDs, then her new budget set includes the budget set shown in **(c)** plus up to 5 more CDs at any point, shifting the budget line to the right by 5 units. The maximum number of CDs she can consume has increased by 5 everywhere, including the x_1-intercept, which is now 55 instead of 50 ($m/p_1^T + 5 = 55$). The x_2-intercept, however, has not changed, since she can still only purchase 2,000 bottles of milk (i.e., we still have $m/p_2 = 2,000$). There is a kink in the budget line at (5, 2,000), which represents the bundle where 5 CDs (given to her) and 2,000 bottles of milk (all of which she purchased using her entire income).

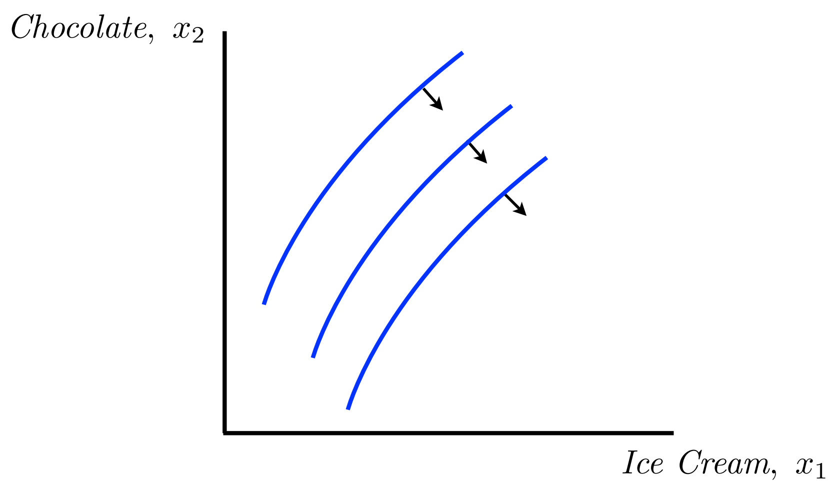


Problem 4 (Indifference Curves)

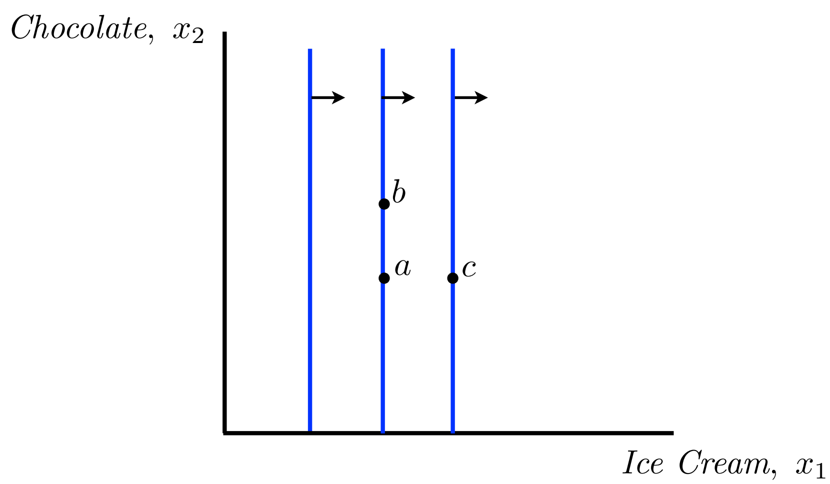
(a) If you like ice cream and chocolate a lot, then the indifference curves must be downward sloping with utility increasing as we move away from the origin. (There's not enough information here to determine whether the indifference curves are convex; we only know for sure that they have a negative slope.)



(b) If you like ice cream and hate chocolate, chocolate is a "bad" and the less you have of it, the better off you are. To see this, one way is to take any point in the consumption space and compare utility to the right, left, above, and below to determine the direction of increasing utility. (Just like in **(a)**, we can't tell whether the MRS is constant or not as we move along an indifference curve, we only know that the slope is positive.)



(c) In this case, all that matters is ice cream, the more the better; the amount of chocolate does not matter. Here, you are indifferent between points a and b, but you like c better than a (and b).



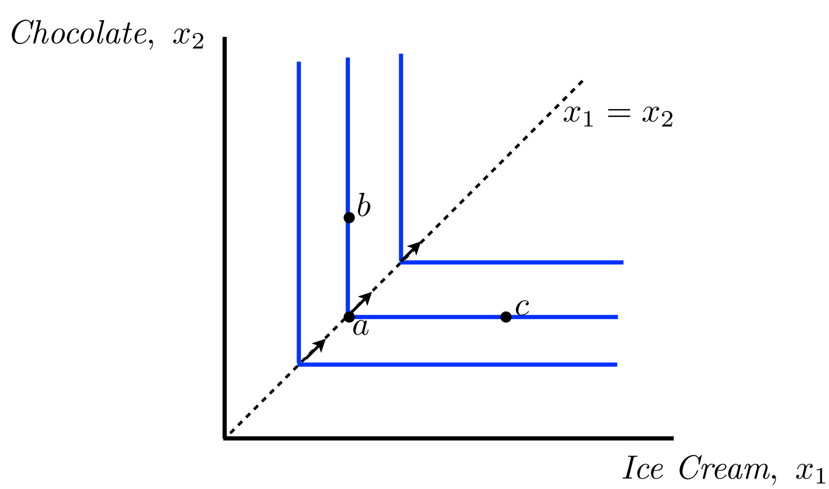
(d) The sign of the MRS for the three preferences above (i.e., the slope of the indifference curves):

- **(a)**: Negative. (You would *give up* some chocolate to get more ice cream to maintain the same level of utility.)

- **(b)**: Positive. (You would have to *get* more chocolate, which you dislike, in order to get more ice cream and be indifferent to the change.)

- **(c)**: Infinite. (Given a certain amount of ice cream, your utility level is the same whether you were to consume infinitely less or infinitely more chocolate.)

(e) If you must eat ice cream and chocolate in the same proportion (i.e., the two goods are *perfect complements*), then moving away from the origin along the dotted line where this is true (where $x_1 = x_2$), you are better off. However, if we move off the dotted line, say from point a to b, or from a to c, we are not any better off; we're just indifferent.



Problem 5 (Convexity and Monotonicity)

(a) The preferences depicted in Figure 3.4 in Varian are monotone (but not strictly monotone) and convex (but not strictly convex). They are monotone because having more of left and right shoes will increase utility; however the preferences are not strictly monotone since, for example, holding the number of right shoes fixed, getting more left shoes does not make one better off (it simply does not make him worse off).

(b) The preferences in Figure 3.7 are not monotone but they are strictly convex. To see that they are not monotone, compare points a and b below. Bundle b has more of both goods x_1 and x_2, however a is preferred to b, so it's not always true that "more is preferred to less" with these preferences. (Note that there are some other points in the space where more is preferred to less, but we only need to show one point where that's not the case to show that the preferences are not monotonic). To see that these preferences are strictly convex, consider points a and c. Any bundle that is a linear combination of the two (along the dotted line) is strictly preferred to both a and c. Since this is true everywhere (i.e., we won't be able to find any point where this is not the case), these preferences are strictly convex.