

Problem Set 5

On what and how to submit

- For this and all future problem sets, questions are from the “Problems” section of the questions at the end of the chapter.
- Due before Lecture 6.
- Name the file “ps05_[lastname].pdf”. For example, my file would be “ps05_brooks.pdf”.
- Turn in via this [google survey](#).
- Make sure your name is at the top of the submission.
- You do not need to type your submission. Any **legible** submission in pdf format is ok. For example, you can write the problem set with hand-drawn graphs, take a picture, make a pdf, and submit the pdf.

1. GLS Question 9, (a) - (c) only

Answer:

- (a) Write utility function, plug in consumption: $U = 4X + 2Y$, where X is pencils and Y is pens
 $U = 4(2) + 2(4) = 16$
- (b) what is marginal utility of an additional pen? and an additional pencil?
Recall that utility with 2 pencils and 4 pens and is 16.
Start with the marginal utility of an additional pen. What is the utility with 2 pencils and 5 pens? $U = 4(2) + 2(5) = 18$.
The marginal utility of a pen is the additional utility from consuming one more pen, or $MU_{4 \text{ to } 5 \text{ pens}} = 18 - 16 = 2$.
Now, find the marginal utility of an additional pencil. What is the utility with 3 pencils and 4 pens? $U = 4(3) + 2(4) = 20$.
The marginal utility of a pencil is the additional utility from consuming one more pencil, or $MU_{2 \text{ to } 3 \text{ pencils}} = 20 - 16 = 4$.
- (c) Find two other bundles that give a utility of 16. Does this curve have a special shape? What does the shape mean?
- Consider 4 pencils and 0 pens: $U = 4(4) + 2(0) = 16$

- Consider 0 pencils and 8 pens: $U = 4(0) + 2(8) = 16$
- See the pictures at the end labeled Q9. A straight line tells us that these goods are perfect substitutes. Were the line at a 45 degree angle, we'd know that they are 1:1 substitutes. Here they are not 1:1 substitutes. Instead, you get equivalent happiness from 1 pencil or two pens.

2. GLS Question 11

- (a) Graph the budget constraint

See figure at end, labeled Q11.

- (b) If Jose spends all his money on music, how much can he afford?

You can write the budget constraint as

$$I = P_M M + P_F F$$

If Jose spends all his money on music, $I = P_M M + P_F(0)$. We know that $P_M = 12$, and $I = 240$, so we can write $240 = 12M$, which implies that $M = 20$. If Jose spends all his money on music, he can buy 20 albums. See the graph for this point.

- (c) Same for fireworks?

If Jose spends all his money on fireworks, $I = P_M(0) + P_F F$. We know that $P_F = 8$, and $I = 240$, so we can write $240 = 8F$, which implies that $F = 30$. If Jose spends all his money on fireworks, he can buy 30 fireworks. See the graph for this point.

- (d) Connect the dots to make the budget constraint. What is the slope?

Two ways to find the slope

- Rise over run $\implies \frac{-20}{30} = \frac{-2}{3}$
- Ratio of the prices $\implies \frac{-8}{12} = \frac{-2}{3}$

- (e) Divide P_F by P_M . Have you seen this before?

$\frac{P_F}{P_M} = \frac{8}{12} = \frac{2}{3}$. Same as previous, but without negative.

- (f) Jose's income is 360. Draw the new budget constraint.

See graph.

- (g) Indicate feasible bundles.

All bundles below the new budget constraint and above the x and y axes.

3. GLS Question 19. Hint: for (a), make sure you write the 2 equations you need. These are the budget constraint and the optimality condition we discussed in class.

1. Optimal number of guitar picks and lures, and what utility does this deliver?

- budget constraint: $I = 2L + G$, where $I = 30$
- optimality condition: $\frac{MU_L}{P_L} = \frac{MU_G}{P_G}$. I simplify the optimality condition:

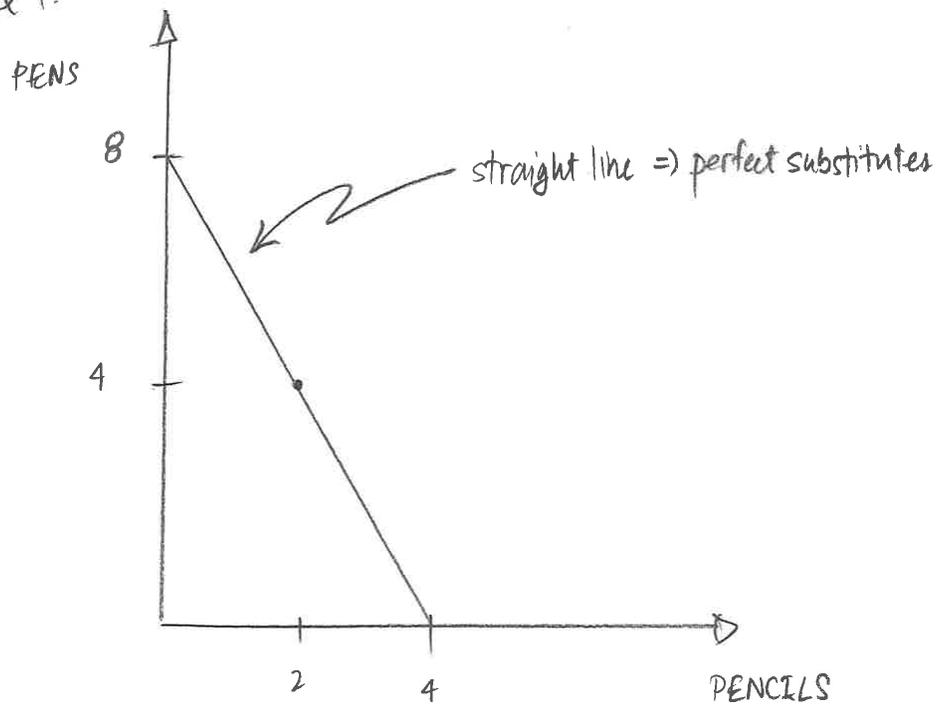
$$\begin{aligned} \frac{MU_L}{P_L} &= \frac{MU_G}{P_G} \\ \frac{0.5L^{-0.5}G^{0.5}}{2} &= \frac{0.5L^{0.5}G^{-0.5}}{1} \\ \left[\frac{G^{0.5}}{2L^{0.5}} \right] G^{0.5} &= \left[\frac{L^{0.5}}{G^{0.5}} \right] G^{0.5} \\ \left[\frac{G}{2L^{0.5}} \right] L^{0.5} &= \left[\frac{L^{0.5}}{1} \right] L^{0.5} \\ \frac{G}{2} &= L \\ G &= 2L \end{aligned}$$

- Combine the two equations to solve for G and L :
 $30 = 2L + G$ and $G = 2L$: $30 = 2L + 2L = 4L$, or $30 = 4L$, which implies $L = 7.5$.
 Since $G = 2L$, then $G = 2(7.5) = 15$.
- How much utility? $U = L^{0.5}G^{0.5} = (7.5)^{0.5}15^{0.5} = 10.6$ utils.

2. If the price of a guitar pick doubles to 2, how much income does she need to keep the same utility?

- Same utility means $G = 15$ and $L = 7.5$ must stay the same.
- If the price of G is now 2, what income does she need?
- Now $I_{\text{new}} = 2L + 2G$, so $I_{\text{new}} = 2(7.5) + 2(15) = 15 + 30 = 45$.

Q9.



Q11

