Microeconomics for Public Policy
Fall 2023

Problem Set 4

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 5 to your Box folder
- Name the file "ps04_[lastname].[extension]". For example, my file would be "ps04_brooks.pdf".
- You do not need to type your submission. Any **legible** submission is ok. For example, you can write the problem set with hand-drawn graphs, take a picture, and submit the picture.

1. GLS Chapter 4, Question 8 (omit (d))

See pictures at end of problem.

(a) Utility when $Y = 3$:

X	Y	$U = 4XY$	MU
2	3	24	
3	3	36	36 - 24 = 12
10	3	120	
11	3	132	132-120 = 12

For a given level of Y, does good X display diminishing marginal utility? No. Each additional unit of X, with Y held constant, increases utility by 12 units.

(b) Utility when $X = 3$:

X	Y	$U = 4XY$	MU
3	2	24	
3	3	36	36 - 24 = 12
3	10	120	
3	11	132	132-120 = 12

These values are the same as in (a), and the answer to the question about the marginal utility is the same as in (a).

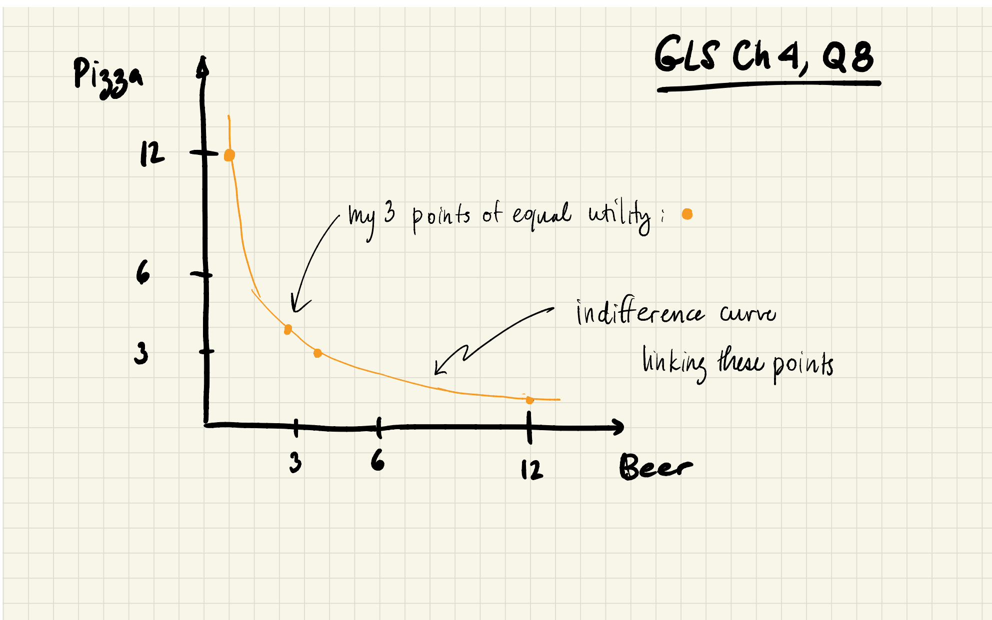
(c) Three bundles that give satisfaction of 48 utils are $(3, 4), (4, 3), (12, 1)$. See plot below.

Is the marginal rate of substitution higher as the consumption of X increases?

The marginal rate of substitution is

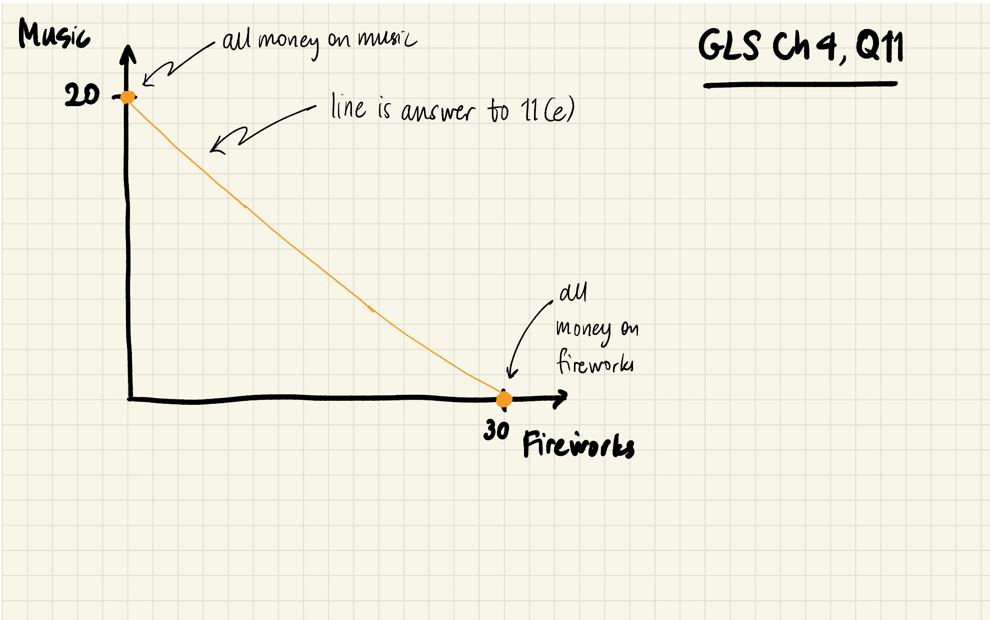
$$\text{MRS}_{XY} = \frac{MU_X}{MU_Y} \ .$$

As the consumption of X increases, MU_X decreases or stays the same. But if you are purchasing more X, you must be purchasing less of Y. As the consumption of Y decreases, MU_y increases (or stays the same). Therefore, as consumption of X increases, $MRS_{X,Y}$ decreases – the numerator gets smaller and the denominator gets bigger.



2. GLS Chapter 4, Question 11

(a) Graph the budget constraint.



(b) If Jose spends all his money on music, how much music can he buy? See point in graph above.

11(b)

Income is \$240

$P_{music} = 12$

$P_{fireworks} = 8$

If you spend all income on music,

$Q_{music} = \frac{Income}{P_{music}}$

$Q_{music} = 240/12$

$= 20$

11(c)

If he spends all his money on fireworks

$Q_{fireworks} = \frac{I}{P_{fireworks}}$

$= \frac{240}{8}$

$= 30$

(c) If Jose spends all his money on fireworks, how much fireworks can he buy? See point in graph above.

(d) Plot the point of spending half the income on fireworks and half on music.

This point is $(10, 15)$.

11(d)

He spends \$120 on fireworks and on music (\$240/2).

$$Q_m = \frac{120}{P_m} = \frac{120}{12} = 10$$

$$Q_f = \frac{120}{P_f} = \frac{120}{8} = 15$$

11(e)

see figure

Slope of line is rise/run = 20/30 = 2/3

11(f)

$$\frac{P_f}{P_m} = \frac{8}{12} = \frac{2}{3}$$

See (e)

(e) Connect the dots to see the budget constraint. What is the slope of the budget constraint?

Use rise over run formulation to find the slope:

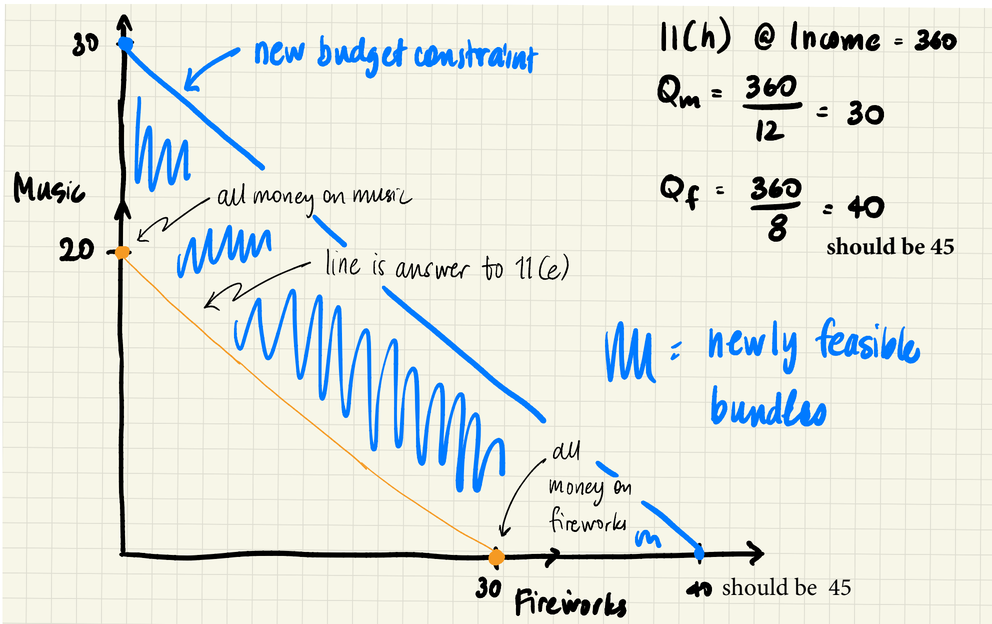
$$-\frac{8}{12} = -\frac{2}{3}$$

(f) Divide the price of fireworks by the price of music. Have you seen this number before in this problem? If so, where?

$$\frac{p_{\text{fireworks}}}{p_{\text{music}}} = \frac{8}{12} = \frac{2}{3}$$

This is the answer to point (e), without the negative sign.

(g) Jose's income is now \$360. Draw the new budget constraint.



(h) Indicate the new feasible bundles.

See figure above.

3. GLS Chapter 4, Question 19 **But only part (a), and with changes as below.

Let $P_{\text{lures}} = 3$, $P_{\text{guitars}} = 1$, and income be \$60. Let $U(L, G) = L^{1/3}G^{2/3}$. Then $MU_L = \frac{G^{2/3}}{3L^{2/3}}$, and $MU_G = \frac{2L^{1/3}}{3G^{1/3}}$.

(a) Find the optimal number of lures and guitar picks. How much utility does this deliver?

There are two key equations to finding optimal consumption. The first is the budget constraint:

$$I = P_L L + P_G G$$

Plugging in values for I and prices, this is

$$60 = 3L + G$$

The second key equation is consumption such that

$$\frac{MU_L}{MU_G} = \frac{P_L}{P_G}$$

which we know is true when Chrissy is consuming optimally.

Plugging in for prices and marginal utilities

$$\begin{aligned}
\frac{\frac{G^{2/3}}{3L^{2/3}}}{\frac{2L^{1/3}}{3G^{1/3}}} &= \frac{3}{1} \\
\frac{G^{2/3}3G^{1/3}}{3L^{2/3}2L^{1/3}} &= 3 \\
\frac{G}{2L} &= 3 \\
\frac{G}{2L} &= 3 \\
G &= 6L
\end{aligned}$$

Given this, you can substitute one equation into the other. I choose to substitute the second equation into the first:

$$\begin{aligned}
60 &= 3L + G \\
60 &= 3L + 6L \\
60 &= 9L \\
L &= \frac{60}{9} \\
L^* &= 6\frac{2}{3}
\end{aligned}$$

And we find the optimal G with either equation.

$$\begin{aligned}
G^* &= 6L^* \\
&= 6\left(6\frac{2}{3}\right) \\
&= 40
\end{aligned}$$

Utility for this combination is

$$\begin{aligned}
U(L^*, G^*) &= L^{*1/3}G^{*2/3} \\
&= (6.66^{1/3}) * (40^{2/3}) \\
&\sim 22
\end{aligned}$$