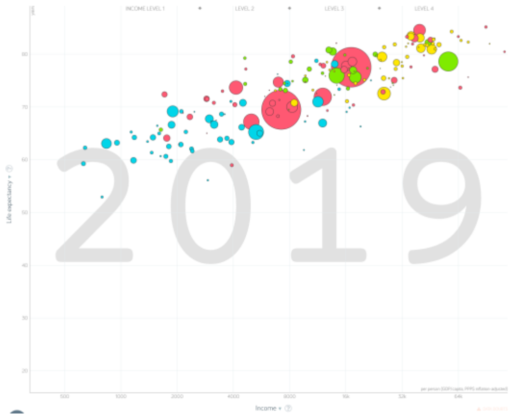
PRINCIPLES OF ECONOMICS I – 2021

PROBLEM SET 1

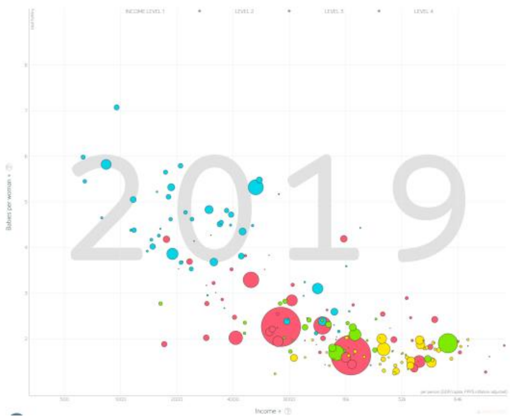
MODEL SOLUTIONS

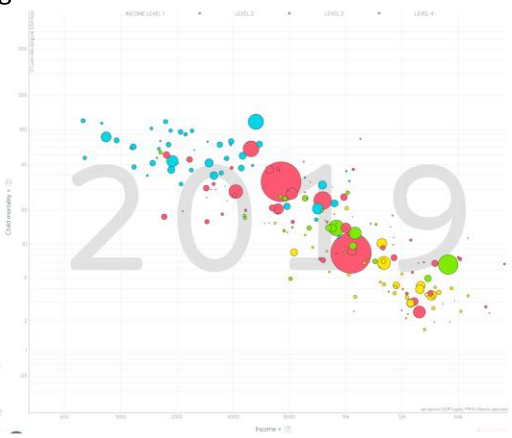
QUESTION 1

A) Life expectancy is **positively** correlated with income.

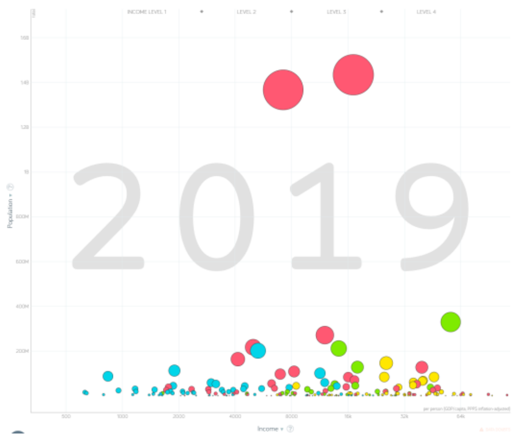


B) Examples of variables negatively correlated with income are: **fertility rate, child mortality**. Other examples are also fine. One is enough.

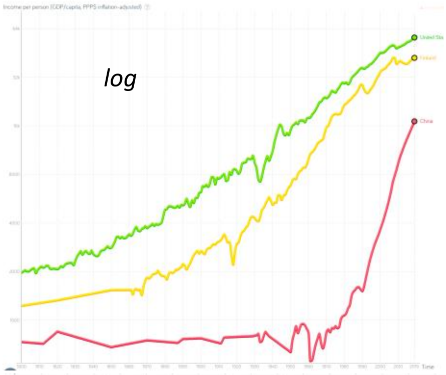


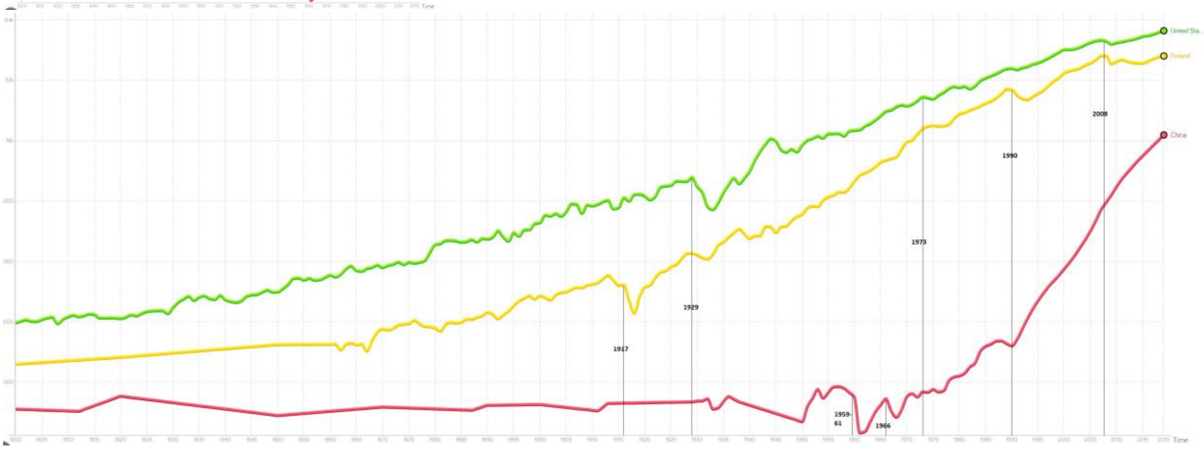


C) There is **not a clear relationship / no correlation** between population size and income across different countries.



D) The **USA** has had a close-to-constant growth rate over time.





1917 civil war in Finland; 1929 Wall Street Crash and Great Depression; 1959-61 Great Famine in China; 1966 Cultural Revolution in China; 1973 Oil Crisis; 1990 depression in Finland; 2008 Great Recession.

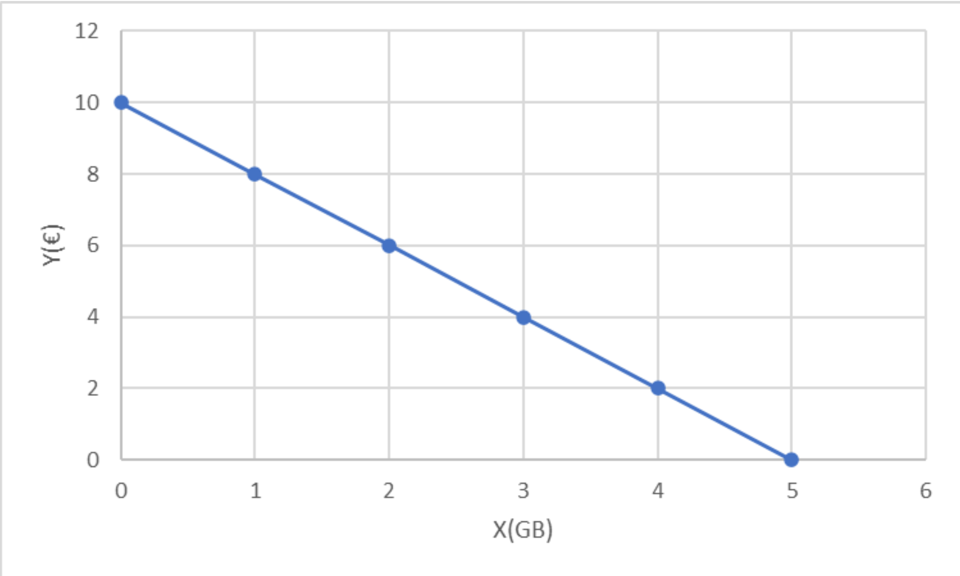
(not all these are needed for full points; it's ok if there are 3 events in the answers)

QUESTION 2

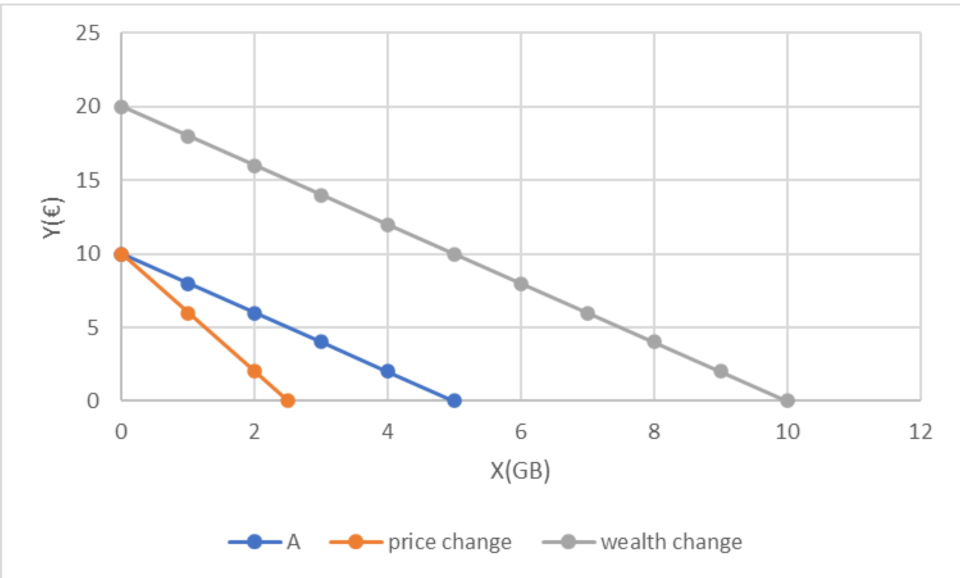
In this question, you have to graph budget lines. It is very important that the graphs are neatly made ***(give at most 2 points if they are not)****. Label both axes. Mark the intercepts with the x- and y-axis (the points at which all budget is spent on good x and good y, respectively).*

It would also be nice (but not essential) to write down the corresponding equation, for example in its simplest form, mapping how the budget is spent on the two goods: $w = p_x \cdot x + p_y \cdot y$*. By rearranging it, we can find the amount of good x and y that we can buy if we spend all our money on that good.*

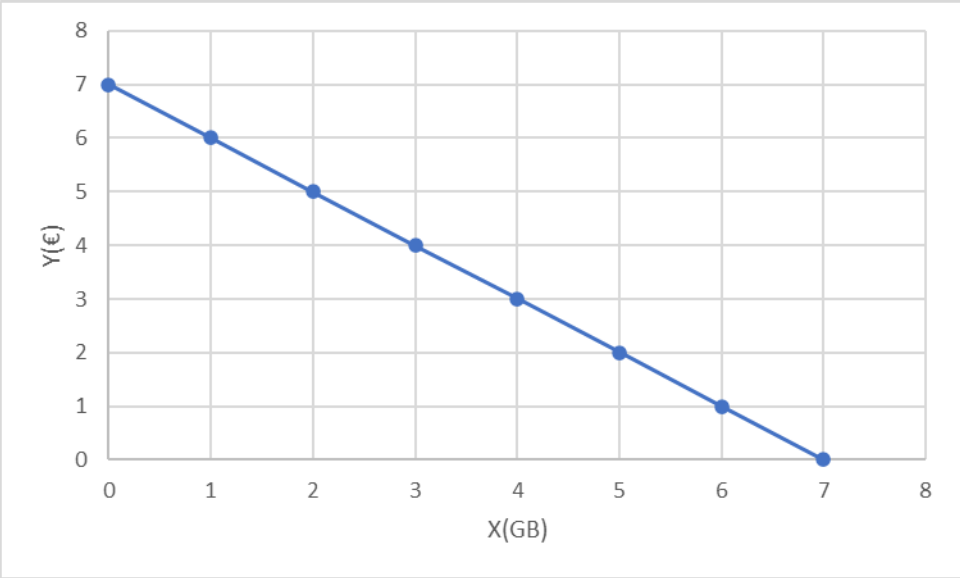
A) Here, it is implied that the price of y $p_y = 1$, because every € of other consumption costs exactly 1.
$10 = 2 \cdot x + y$. If we spend all the 10€ on x (y=0), then we can buy $x = \frac{10}{2} = 5$



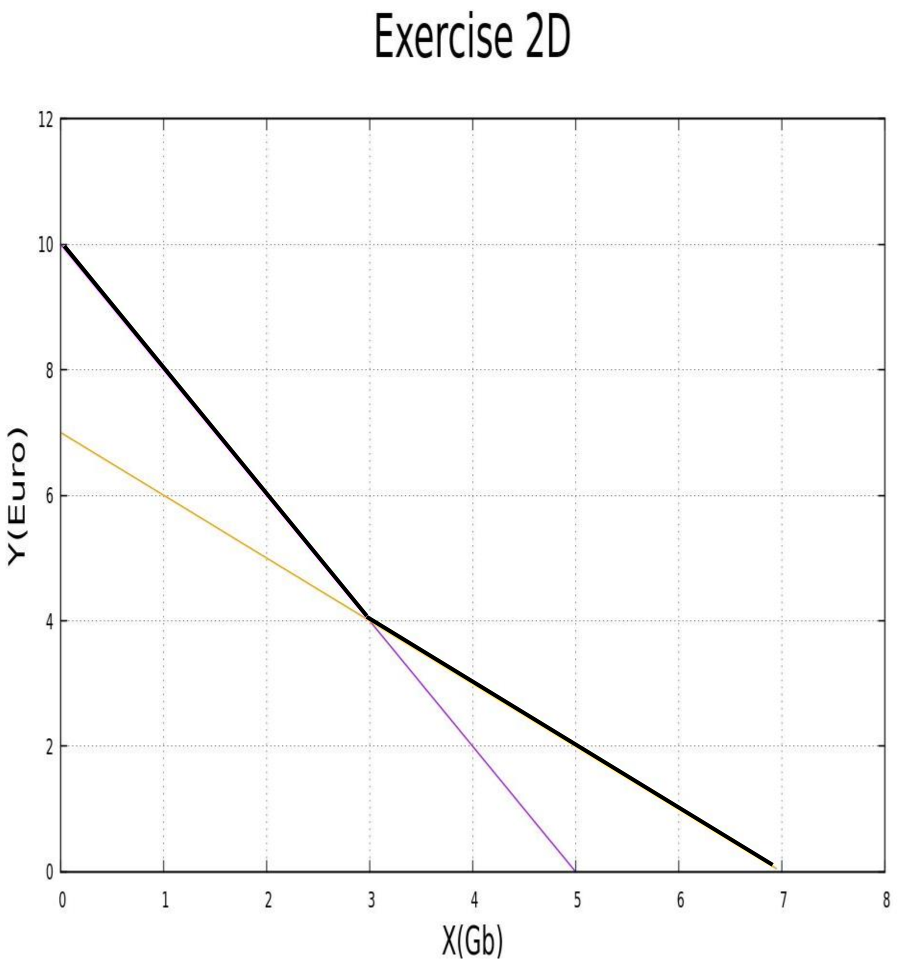
B) A doubling in the price of data implies that the maximum number of GB is 2.5 (if divisible, otherwise 2). Doubling the endowment w also doubles the maximum number of GB from 5 to 10.



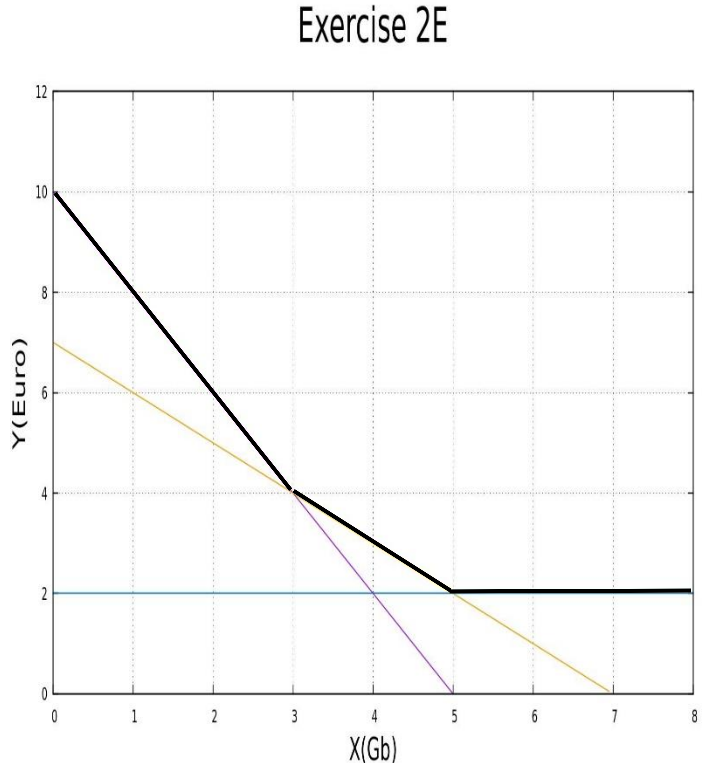
C) The idea of the fixed monthly payment is that it has to be paid even when no data is consumed. It's like if the endowment w became 7 from 10.



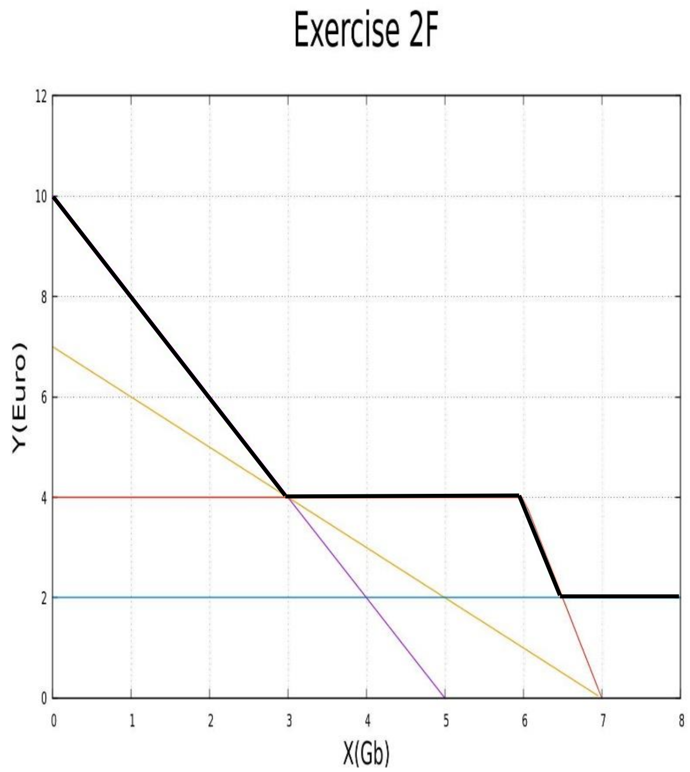
D) The feasible set when you can choose between the two plans basically becomes the black line, as it combines the largest number of GB and the largest amount of other consumption.



E) When there is also an option to pay a fixed fee of 8 and consume infinite number of GB, the feasible set looks like this.

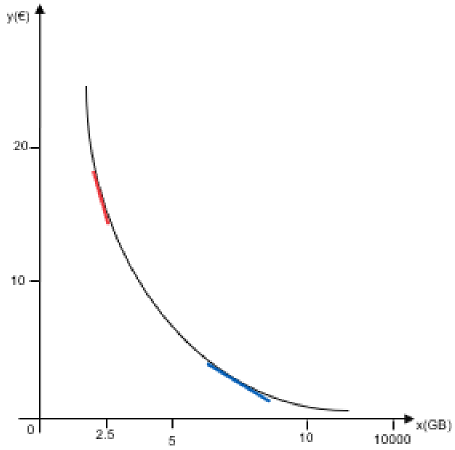


F) Finally, if it is also possible to pay a fixed fee of 6 for up to 6GB of data, and 4 for each subsequent GB, the feasible set will look like this.

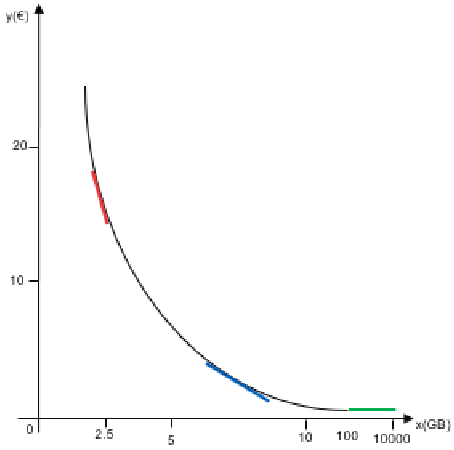


QUESTION 3

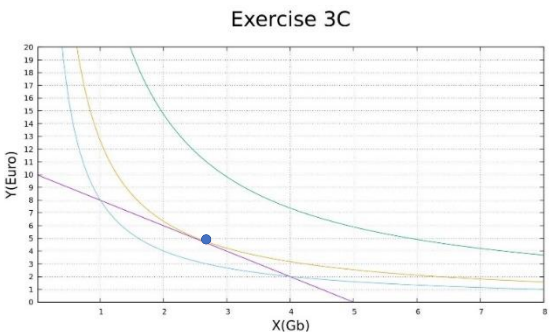
A) Underneath is an example of the shape of a well-behaved indifference curve. Because of **diminishing marginal utility**, at low levels of consumption of good x, we are willing to give up more of good y to be able to consume more of good x. On the opposite, at high levels of consumption of good x, we are willing to give up less of good y to be able to consume more of good x. So **MRS is large at low numbers of GB** (it tends to infinity) and **becomes smaller as you increase the number of GB** (it tends to zero).



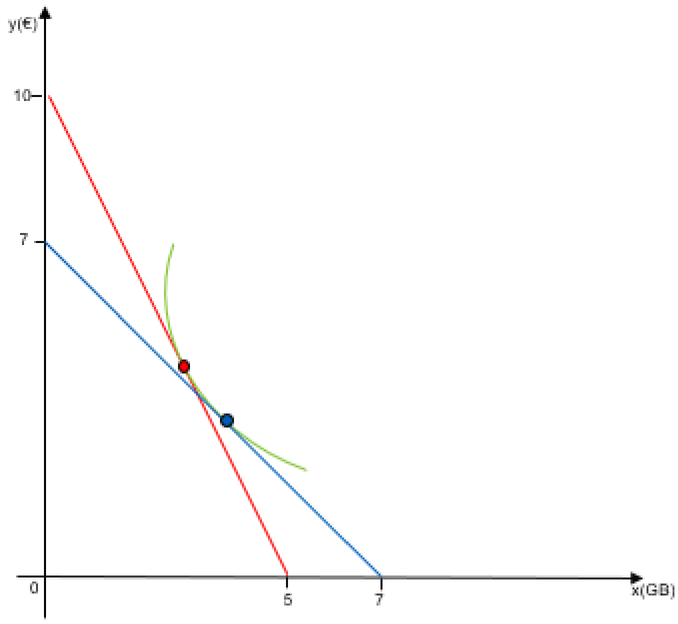
B) When x>100, the MRS is zero (there will be a horizontal line to the right of 100). I don't want to give up any consumption in order to consume more internet.



C) $y = 10 - 2x$. MRT is the slope of the budget constraint -2. Optimal choice: point of tangency between the budget line and the indifference curve. It is the highest indifference curve that I can reach with the given money and prices.



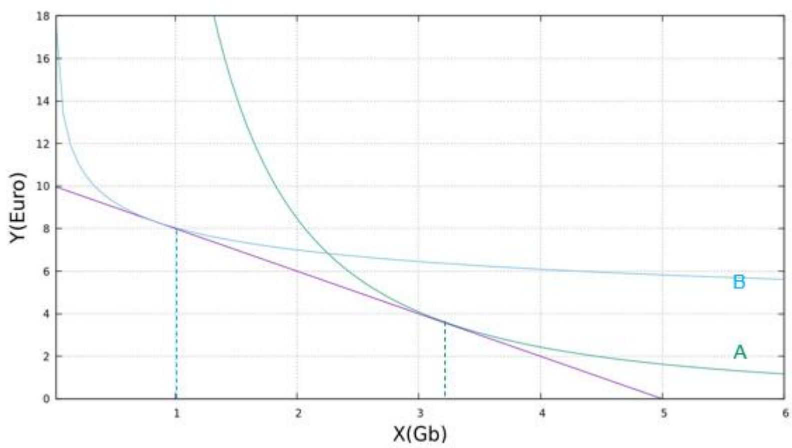
D) Here we are comparing the red plan where p=2, and the blue plan where f=3 and p=1.



The consumer can be indifferent between the two plans, because he can reach the same level of satisfaction (be on the same green indifference curve) by buying either the blue plan and choosing a combination of GB and other consumption (at blue point) or buying the red plan and consuming a combination of GB and other consumption (at the red point).
At the red point, the slope of the indifference curve is 2 (it is tangent to the budget curve with MRT=2), whereas at the blue point, the slope of the indifference curve is 1 (it is tangent to the budget curve with MRT=1).

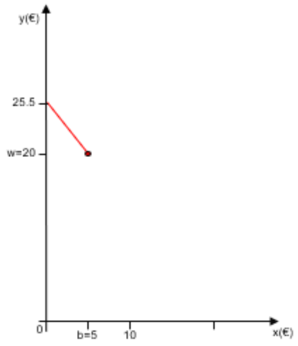
NB: the consumer **cannot be indifferent between the two plans at the point of intersection**, even though it is tempting to say so since the amount of GB and other consumption is the same in the two plans. *[assign 2 points if this is given as the answer; 1 point if the answer is only "yes", but no explanation is given]*
Think about optimal consumption. At the optimal bundle, MRS=MRT. So optimal bundle on blue line is MRS=MRTb=2. Optimal bundle on red line is MRS=MRTr=1.
If the point where the consumer is indifferent between the two plans is the one of intersection, it must be that MRS=MRTb=MRTr, which is impossible, considering that 2≠1.

E) Ann likes data more than Bob: MRS^A is higher than MRS^B at all *(x,y).* The green line is steeper at every point: Ann is willing to sacrifice a lot more money to increase her amount of GB.

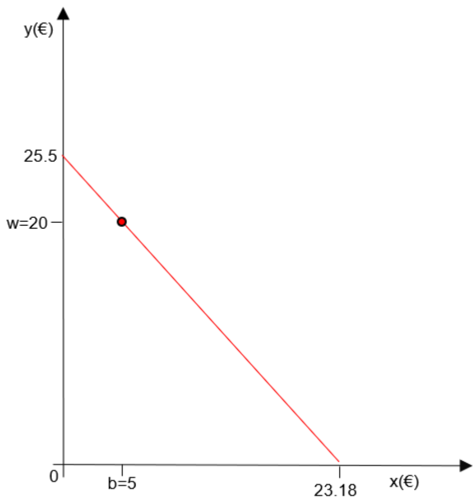


QUESTION 4

A) Cecilia can consume what she earns in each period: red point *(5,20)*. As she cannot borrow from future earnings, 5 is the maximum that she can consume when young. However, she can save for future consumption. If she consumes nothing when young $(x = 0)$, then when she is old she can consume $y = 20 + 1.1 \cdot 5 = 25.5$ and that's the intercept on the y axis. The MRT is the absolute value of the slope of the budget line 1.1, that is 1+r.



B) Cecilia can consume what she earns in each period: red point *(5,20)*. As she can now borrow from future earnings, she can borrow all that she is able to repay when she is old and consume nothing in the future. If $y = 0, x = 5 + \frac{20}{1.1} = 23.18$, and that's the intercept on the x axis.



C) It is not optimal to consume the same amount in the two periods (i.e. y=x). Remember that optimum consumption requires MRT=MRS. In part a, we figured out that the slope of the budget line is *MRT=1.1*. The slope of the indifference curve at the point where it intersects the line *y=x* is 1 (MRS=1). **MRT=1.1 ≠ 1**.

D) This is a bit tricky. With the information given (including that she has symmetric preferences over consumption when young and when old), all we know is that the optimal consumption bundle for Cecilia will be on the left of the point where y=x, meaning that **we know that she will consume more when she is a worker than when she is a student, ie. x*<y***.
Knowing that MRS=1 when x=y is not enough to determine the exact shape of the indifference curve and where the optimum will be when MRT=1.1. And therefore, **we do not know if she will borrow or save.** *[give 1 point if the answer is yes or no; you may give 3 points directly for any answer that gets the first part right (x*<y*) and goes further saying that we do not have enough information to say if she will borrow or save]*

QUESTION 5

Budget constraint: $y = w + (1 + r)(b - x)$
Slope of the budget constraint: $MRT = 1.1$

$$w = 20$$
$$b = 5$$
$$r = 0.1$$

Symmetric preferences over present and future consumption, which means: $MRS = y/x$
TASK: Find optimal consumption bundle x* and y*.

$$y = w + (1 + r)(b - x)$$

- Let's substitute in the values for w, r, b.

$$y = 20 + 1.1(5 - x)$$
$$y = 25.5 - 1.1 \cdot x$$

- Optimal consumption requires: $MRT = MRS$

$$MRT = 1.1\ ;\ MRS = y/x$$

- Therefore, at the optimal consumption: $1.1 = y^*/x^* \rightarrow y^* = 1.1 \cdot x^*$

Let's substitute the expression $y^* = 1.1 \cdot x^*$ into the expression for the budget constraint $(y = 25.5 - 1.1 \cdot x)$

$$1.1 \cdot x^* = 25.5 - 1.1 \cdot x^*$$
$$2.2 \cdot x^* = 25.5 \rightarrow x^* = 25.5/2.2 = 11.591$$

Then, we substitute the value for x^* into the expression for y^* obtained above

$$y^* = 1.1 \cdot x^* = 1.1 \cdot 11.591 = 12.75$$

So optimal consumption when working is $y^* = 12.75$; optimal consumption as a student is $x^* = 11.591$
Therefore, is optimal to borrow $11.59 - 5 = 6.59$ as a student.