Homework #9

The height (in cm) and weight (in kg) of 21 young girls are given in the table below.

Height x	166	160	163	165	155	169	171	160	162	165	153
Weight y	59	57	56	58	54	60	61	53	54	56	51
Height x	158	176	168	150	167	164	166	161	158	170	
Weight y	56	62	57	49	58	57	56	56	55	64	

1. Show these data as a scatter plot with height on the x-axis and weight on the y-axis. The scale will be 2cm for 5 units on both axes and the origin point will be $(145, 40)$.
2. Compute independently the median height h_0 and the median weight w_0 of the 21 girls. Then, place the point G with coordinates $(h_0; w_0)$.
3. The points on the scatter plot seem to be roughly collinear. In this question, we will find the formula of a linear function whose graph is a good approximation of the scatter plot. This is the *median-median line*, also referred to as the *median fit line*.
   (a) To fit a median-median line to the points, divide the points into three groups. Do this by taking the set of one-third of the points consisting of those with the smallest x-values, a middle group and a set of one-third of the points with the largest x-values.
   (b) Consider each group of data separately and order the values of both variables. Ignore the data pairings at this point.
   (c) Now create a summary point for each group of the data by using the median x-value and the median y-value, and combining them to create an ordered pair. We have three summary points : G_L for the leftmost data, G_M for the middle group, and G_R for the right hand group. These summary points may, or may not, be actual data points.
   (d) Now use the two outer summary points to determine the slope-intercept equation of the line $(G_L G_R)$.
   (e) Construct the line parallel to this line that is one-third of the way to the middle summary point. This is the *median-median line* $\mathscr{M}$. To do this :
   - Find the y-coordinate of the point P on the line with the same x-coordinate as the middle summary point G_M.
   - Find the vertical distance between the middle summary point and the line by subtracting y-values.
   - Find the coordinates of the point Q, one third of the way from the line to the middle summary point.
   - Find the slope-intercept equation of the line parallel to $(G_L G_R)$ passing through Q.
4. Is the point G on the line $\mathscr{M}$? Answer the question graphically and with a computation.
5. In this question, we use the median-median line to estimate some values.
   (a) What should be the weight of a girl whose height is 1.80m ?
   (b) What should be the height of a girl whose weight is 55 kg ?

6. The Lorenz law establishes a relation between the weight W and the height H for women :

$$W = H - 100 - \frac{H - 150}{2}$$

   (a) Draw the line representing this function.

   (b) What do you notice about this line compared to $\mathscr{M}$?