

$df =$	X	Y	Z
	4	5	
	6	8	
-2	-4		
.	.		
.	.		

données numériques

X, Y

$X = \text{Temp}$

$Y = \text{Prison}$

X, Y

sont elles
correlées ?

X, Y sont corrélées si

les grandes valeurs de X vont avec
les grandes val de Y

ET les petits

les petits

X

Y

X	Y
100	235
-1000	-5000

X, Y sont corrélées si

les grands val de X vont avec les petites val de Y

X	Y
1	4
2	5
3	6

Product Scalaire

$$\langle X | Y \rangle = 1 \times 4 + 2 \times 5 + 3 \times 6 = 32$$

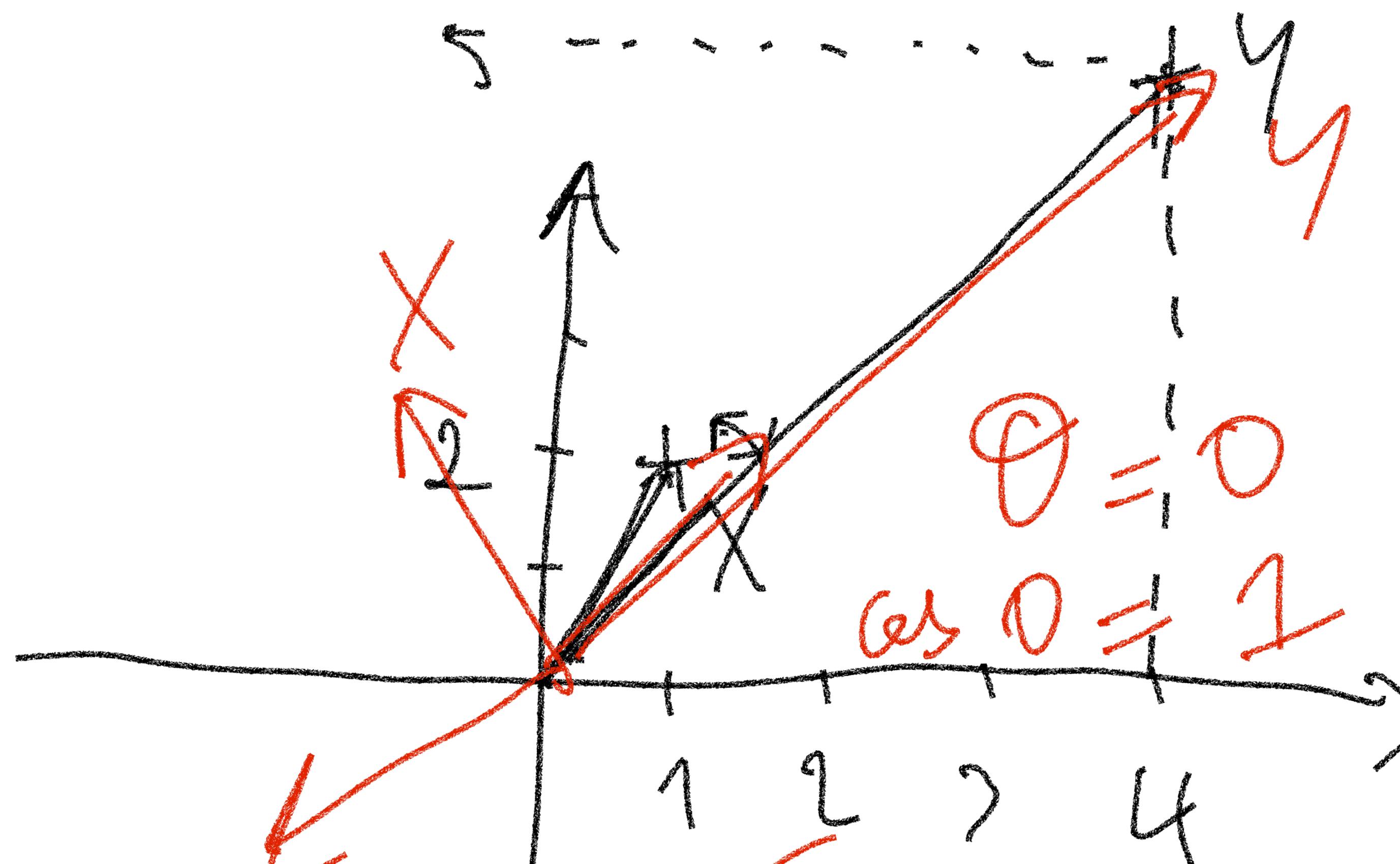
$$\langle X | Y \rangle < 32$$

-1 et 1

$$||X|| ||Y||$$

$$-1 < s < 1$$

$$s = 0$$



X	Y
1	4
2	5

$$\theta = 0$$

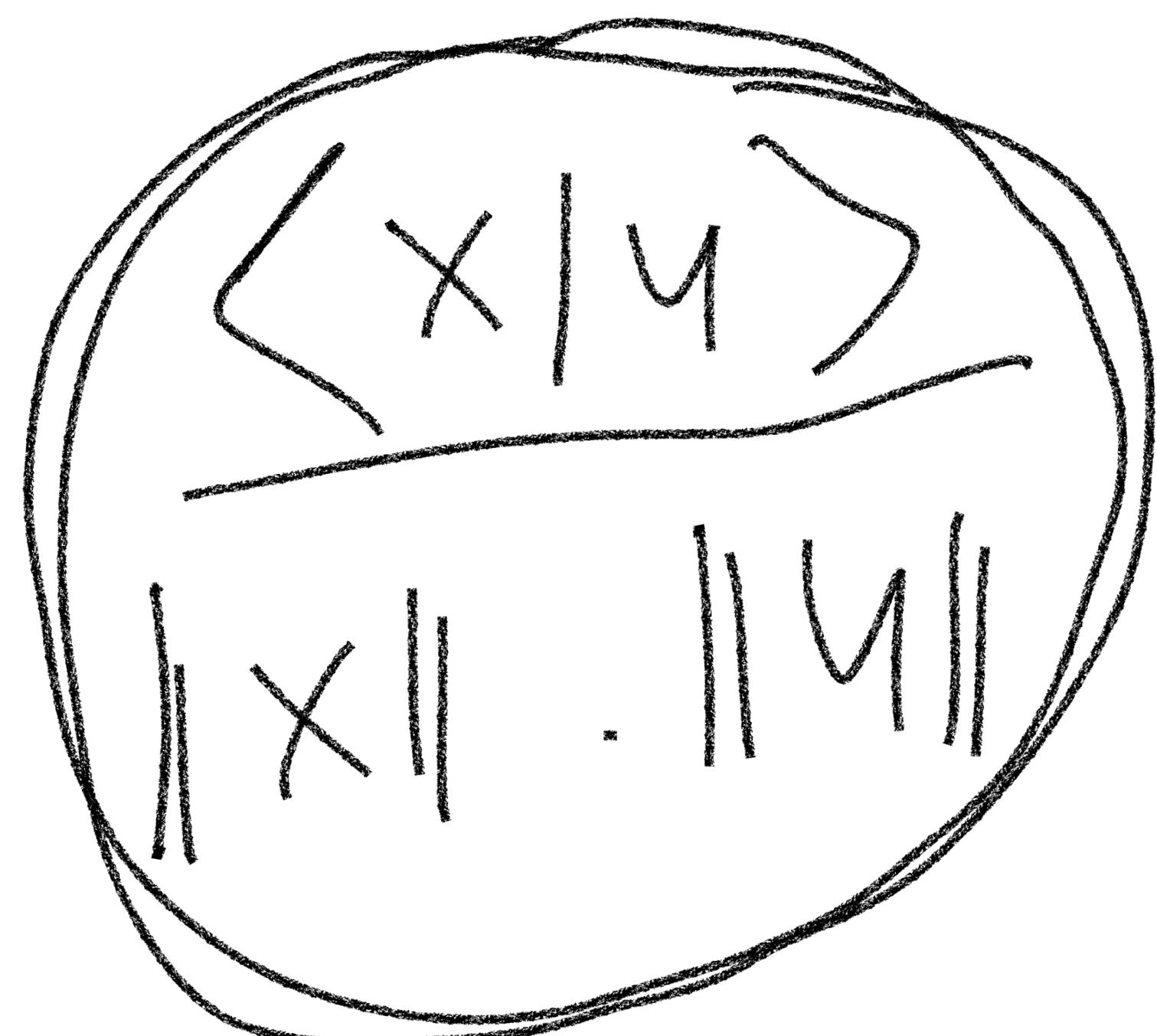
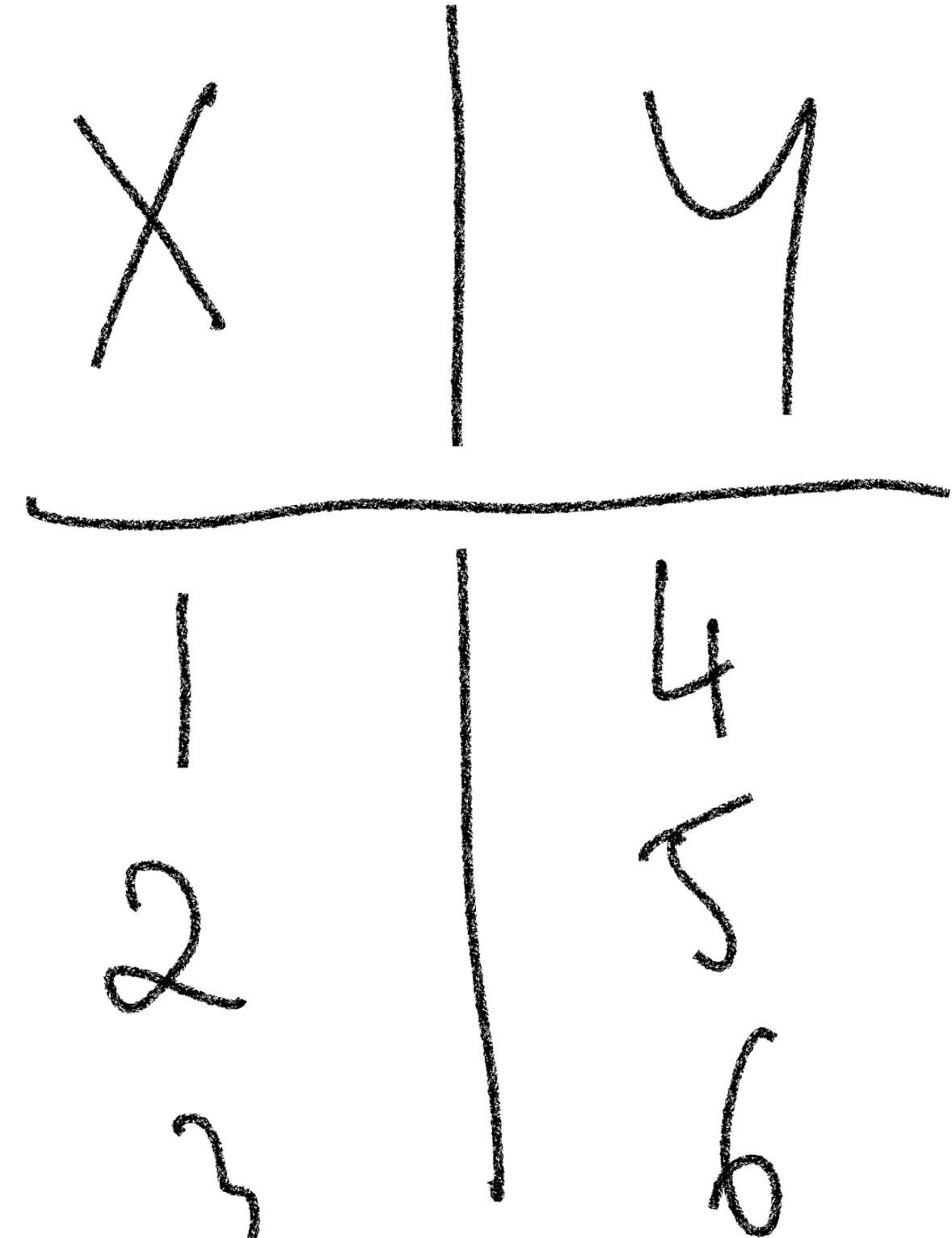
$$\cos \theta = 1$$

$$\theta = \pi$$

$$\cos \theta = -1$$

$$\cos \theta = \frac{\langle x, y \rangle}{\|x\| \|y\|} \in [-1, 1]$$

$$\cos \theta = 0$$



$$\frac{1}{3}(1+2+3) = \frac{6}{3} = 2$$

A hand-drawn equation showing the calculation of the average of the numbers 1, 2, and 3. The sum of the numbers is 6, and dividing by 3 gives the result 2.

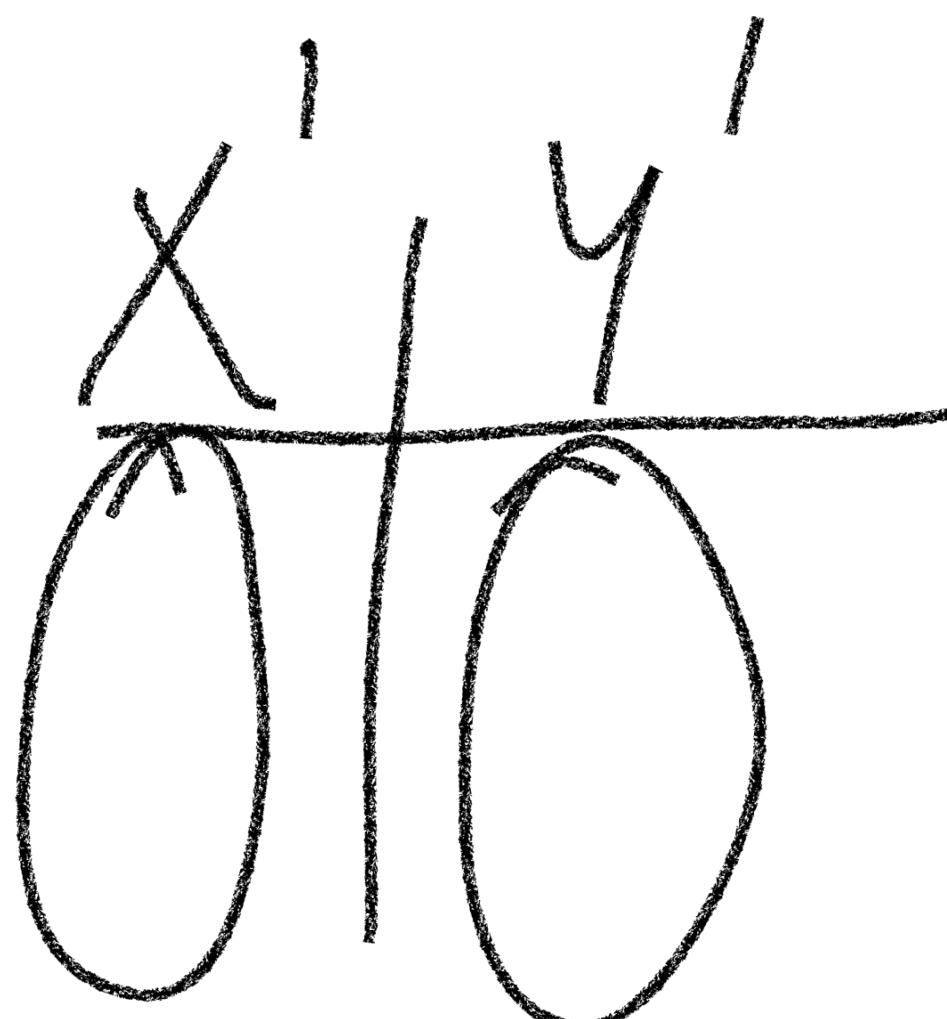
$$\|X\| = \sqrt{1^2 + 2^2 + 3^2}$$

$$\|Y\| = \sqrt{4^2 + 5^2 + 6^2}$$

Handwritten formulas for the magnitude (norm) of vectors X and XY . The formula for X is $\|X\| = \sqrt{1^2 + 2^2 + 3^2}$. The formula for XY is $\|XY\| = \sqrt{4^2 + 5^2 + 6^2}$.

Standardisation

$$X \rightarrow \frac{X - \text{moyenne}(x)}{\text{écart-type}(x)}$$



$$\text{moyenne}(x')/(y') = D$$
$$\text{écart-type}' = \underline{1}$$

$$\left(\sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y}) \right) / \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}} \cdot \sqrt{\frac{\sum_{i=1}^N (y_i - \bar{y})^2}{N-1}}$$

Score de corrélation
de PEARSON

X	Y
1	4
2	5
3	6

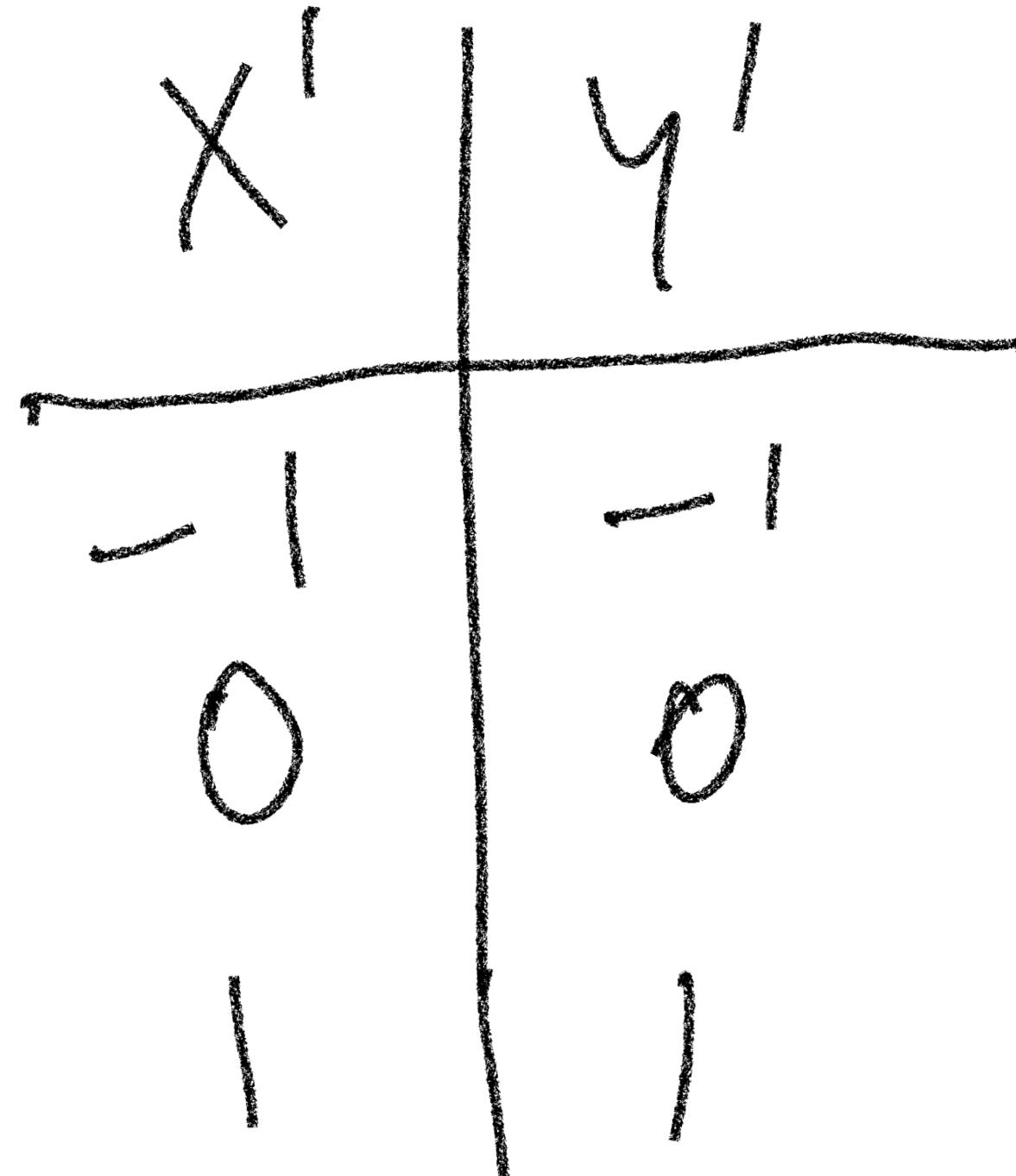
$$\bar{x} = \frac{1+2+3}{3} = \frac{6}{3} = 2$$

$$\bar{y} = \frac{4+5+6}{3} = 5$$

$$\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2$$

$$\sigma_x = \sqrt{\text{Var}_x} = \sqrt{\frac{(1-2)^2 + (2-2)^2 + (3-2)^2}{2}} = 1$$

$$\sigma_y = 1$$



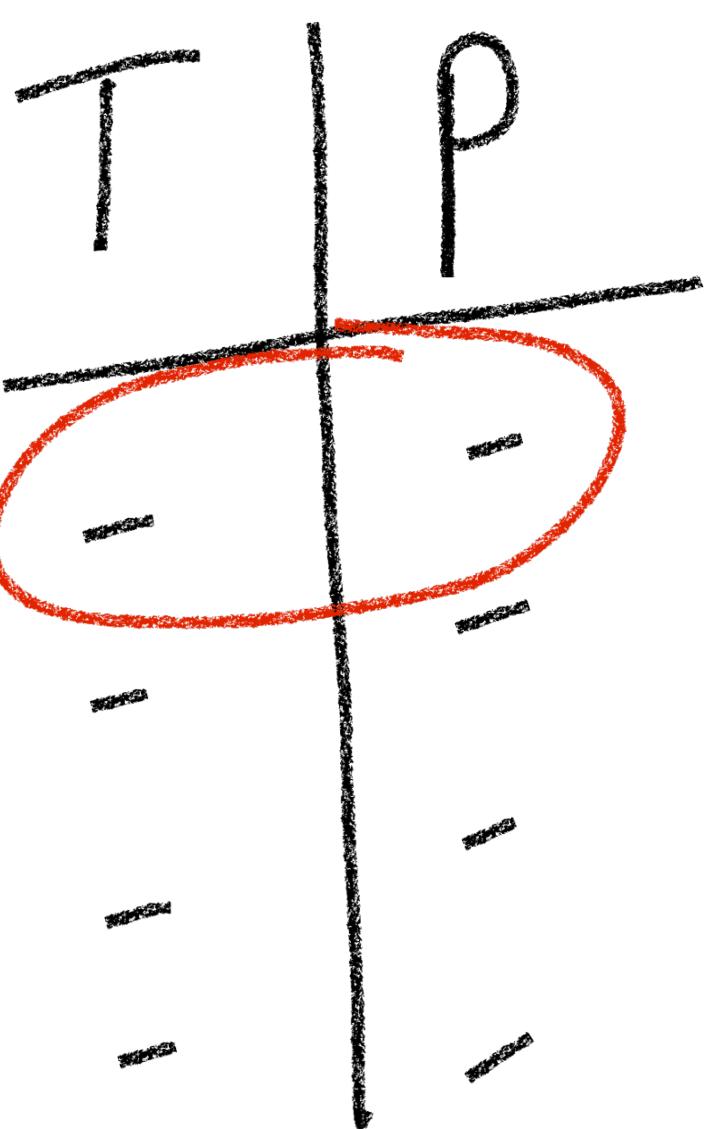
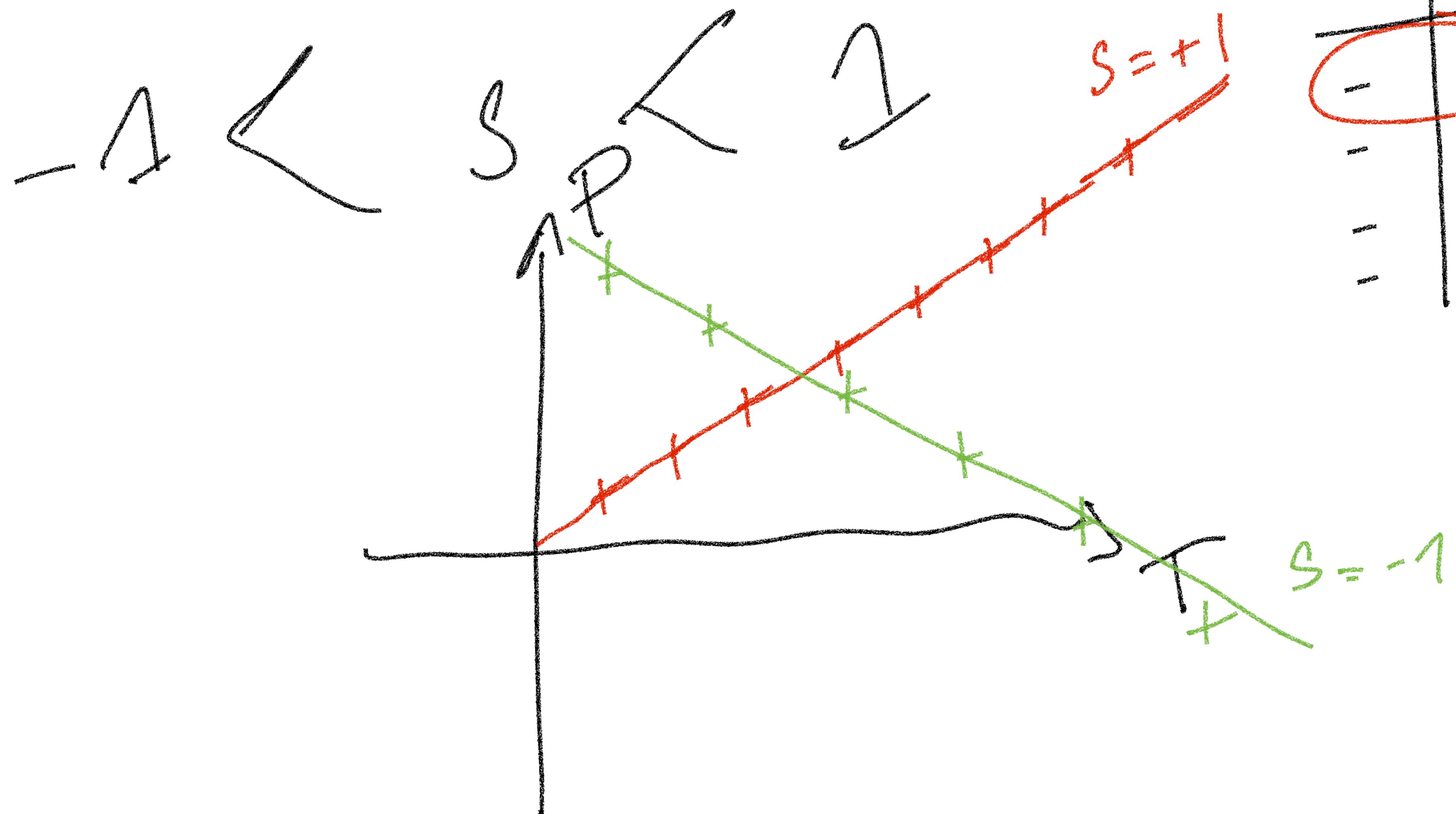
$$x \leq \bar{x} \quad x - \bar{x}$$

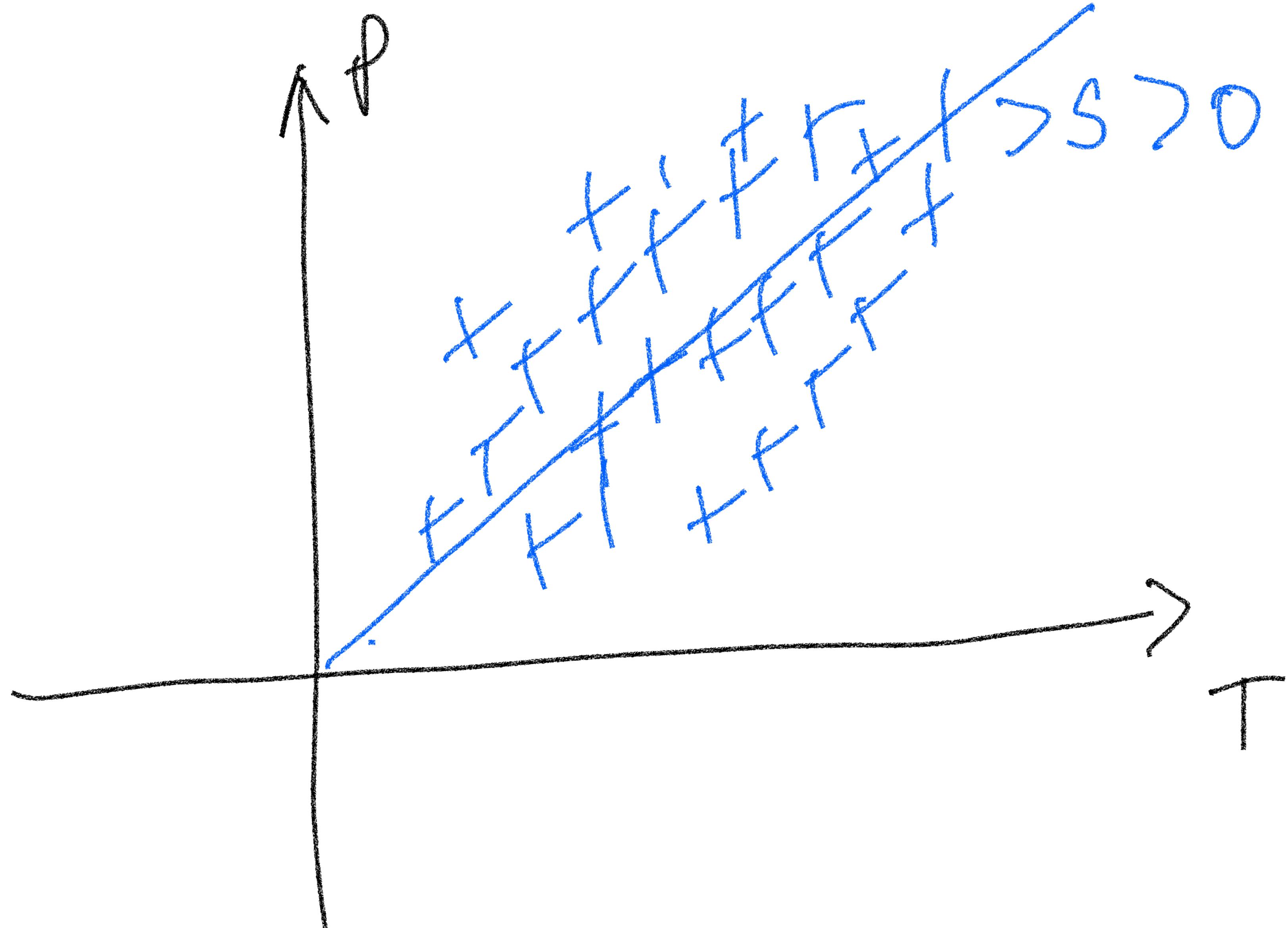
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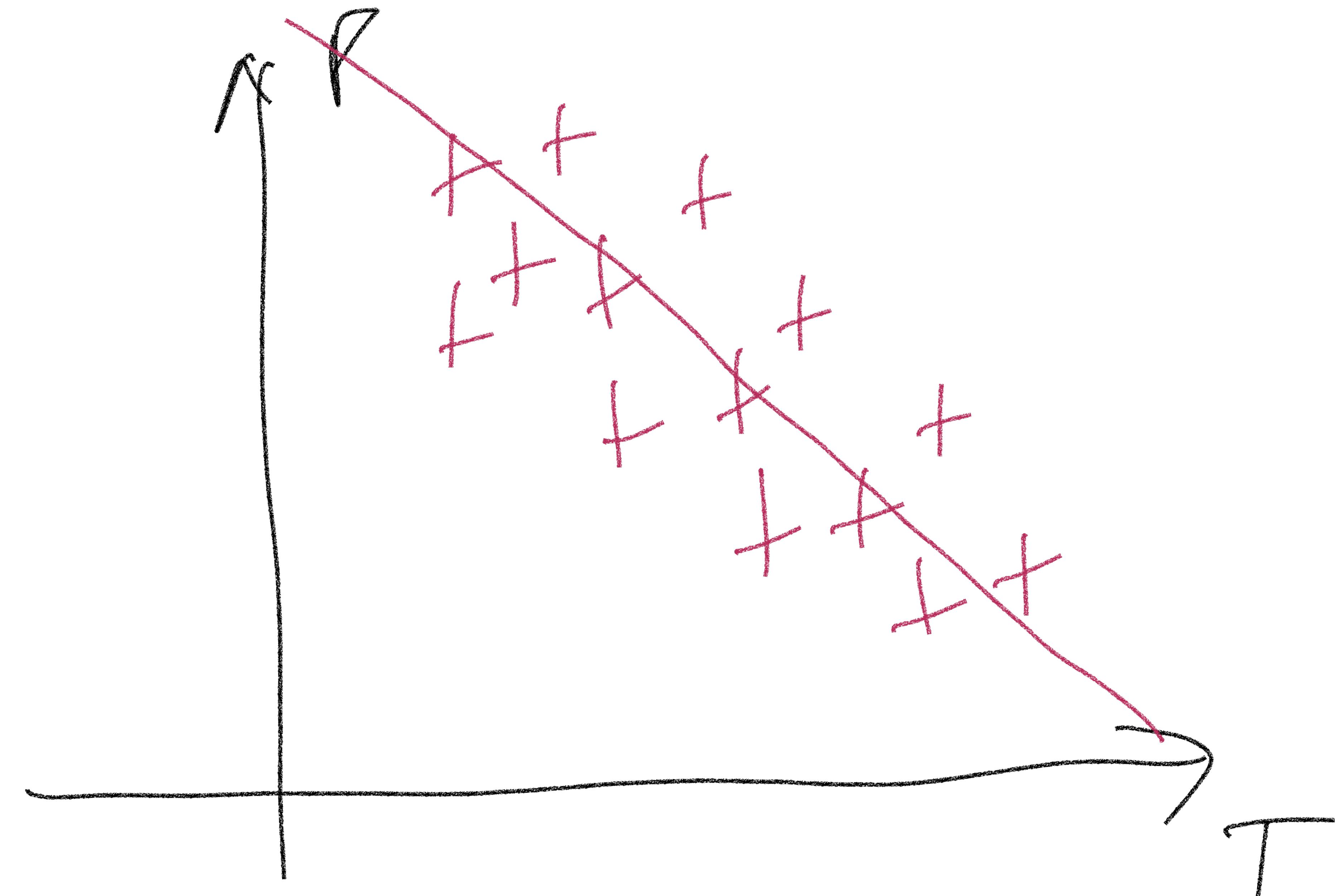
$$\langle x' | y' \rangle = (-1 \times -1) + 0 \times 0 \\ + 1 \times 1 = 2$$

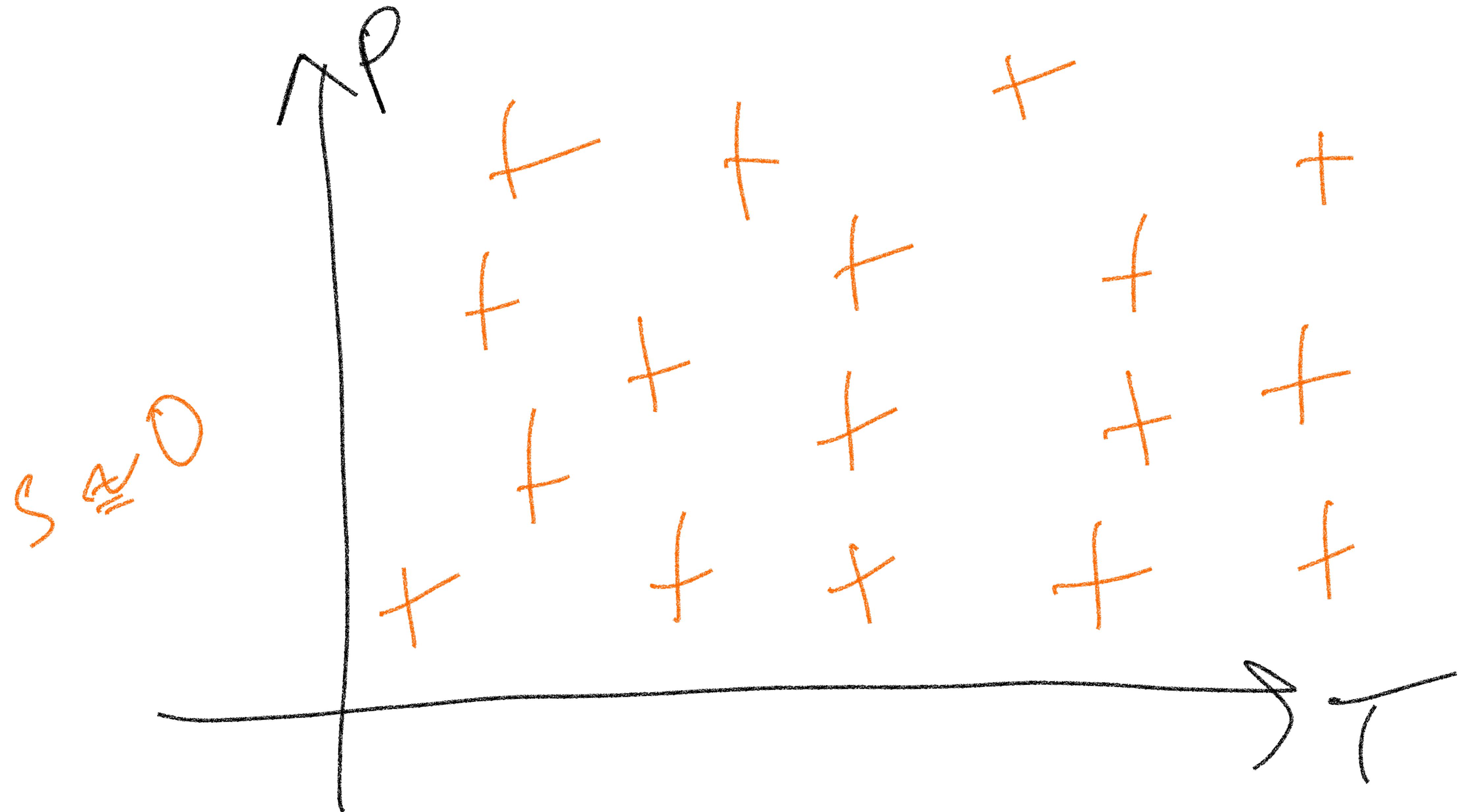
$$s_{\text{Pearson}} = \frac{2}{2} = 1$$

x, y sont
positivement
correlées









X, Y

relation non linéaire

$$X = \alpha Y + \beta$$

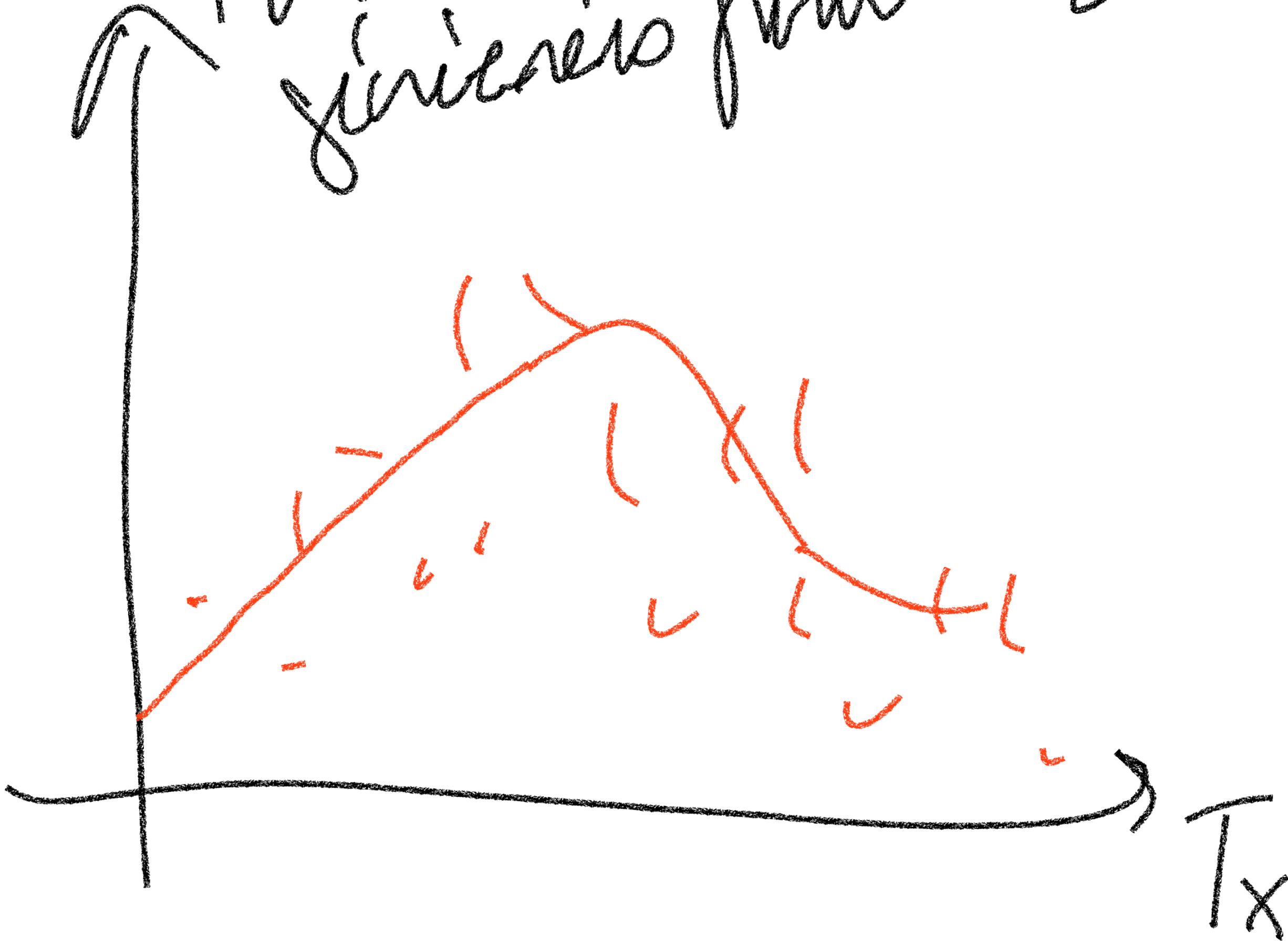
$$X = y^2$$

$$X = y^3$$

...

$$S \geq 0$$

Taux générés par l'Etat



$$S \geq 0$$

diminution

Table
de Corrélation

$$df = \begin{array}{|c|c|c|} \hline & A & B & C \\ \hline A & | & | & | \\ B & | & | & | \\ C & | & | & | \\ \hline \end{array}$$

Moyenne
écart-type, etc.

df. cor()

	A	B	C
A	1,0	0,3	-0,7
B	0,3	1,0	0,1
C	-0,7	0,1	1,0

Spearman

Kendall

X | Y

