P1:

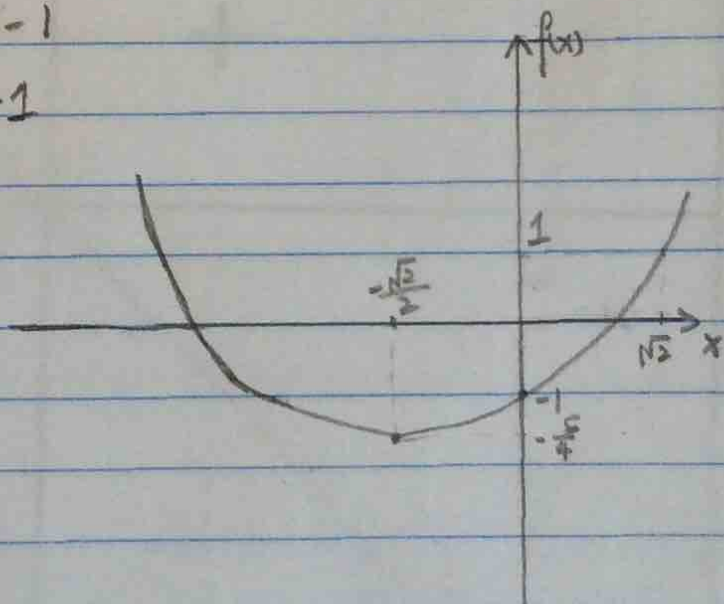①. $\vec{w} = 0\hat{i} + \hat{j} + \hat{k}$ $(\vec{a} = 0\hat{i} + 2\hat{j} + 2\hat{k})$

②. $\gamma = \frac{1}{2} \cdot \sqrt{0^2 + 2^2 + 2^2} = \sqrt{2}$

③. $\gamma = \frac{1}{\|w\|} \Rightarrow w_1^2 + w_2^2 + w_3^2 = (\frac{1}{\gamma})^2 = (\frac{1}{\sqrt{2}})^2$

$\quad w_2 = w_3 = \frac{1}{2}$ $w_1 = 0$· $\hat{w} = [0 \ \frac{1}{2} \ \frac{1}{2}]^T$

④ $\begin{cases} \hat{w}_0 \leq -1 - w^T \phi(x_1) = -1 \\ \hat{w}_0 \geq 1 - w^T \phi(x_2) = -1 \end{cases}$

$\quad \therefore \hat{w}_0 = -1$

5. $f(x) = -1 + \frac{\sqrt{2}}{2}x + \frac{1}{2}x^2$
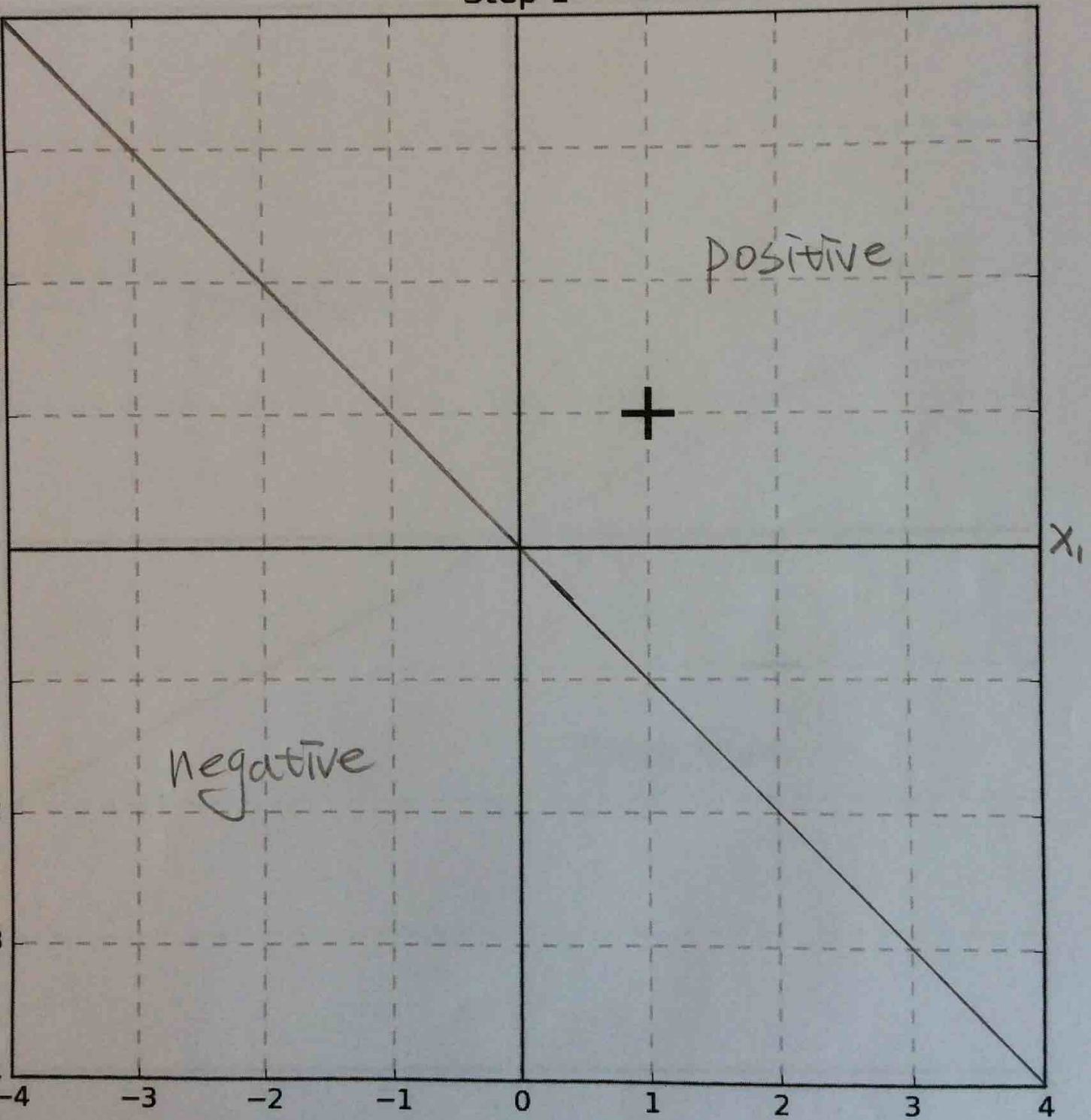$\qquad = \frac{1}{2}(x + \frac{\sqrt{2}}{2})^2 - \frac{5}{4}$

P2: ① ② on next page

③ mistakes $\leq \frac{R^2}{\gamma^2} = \frac{25}{0.5^2} = 100$·

$100 - 4 = 96$
96 mistakes allowed for future data

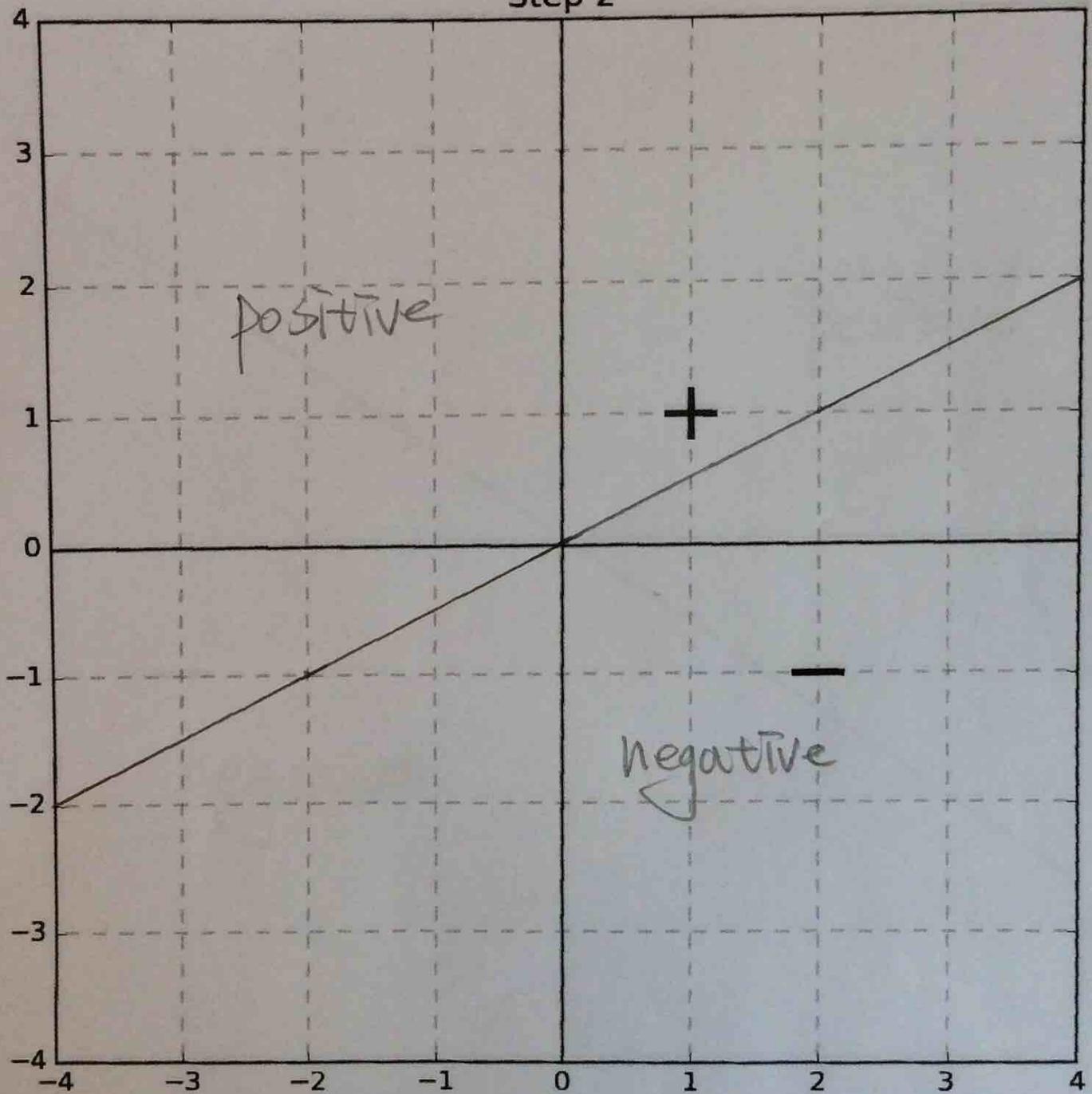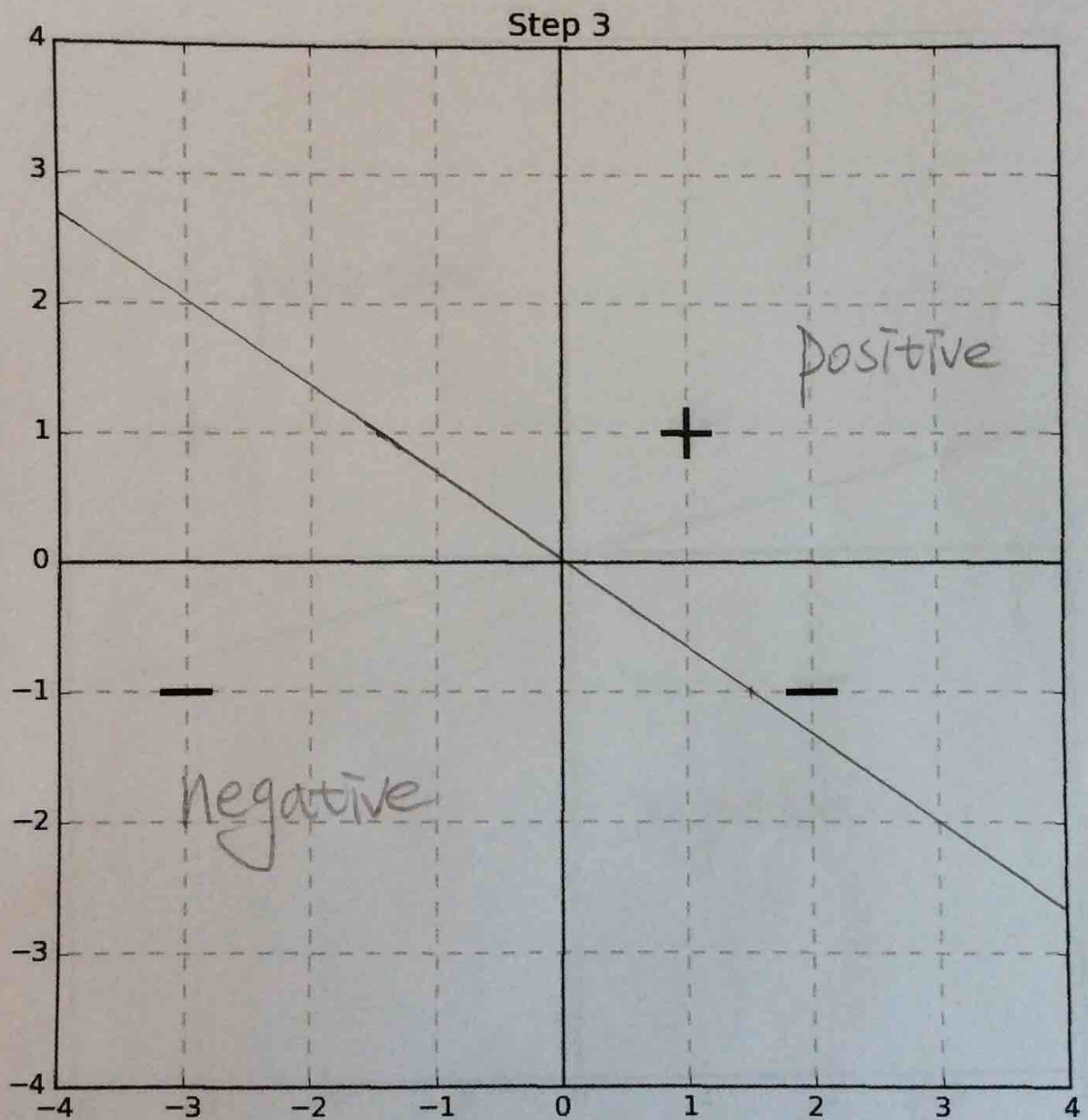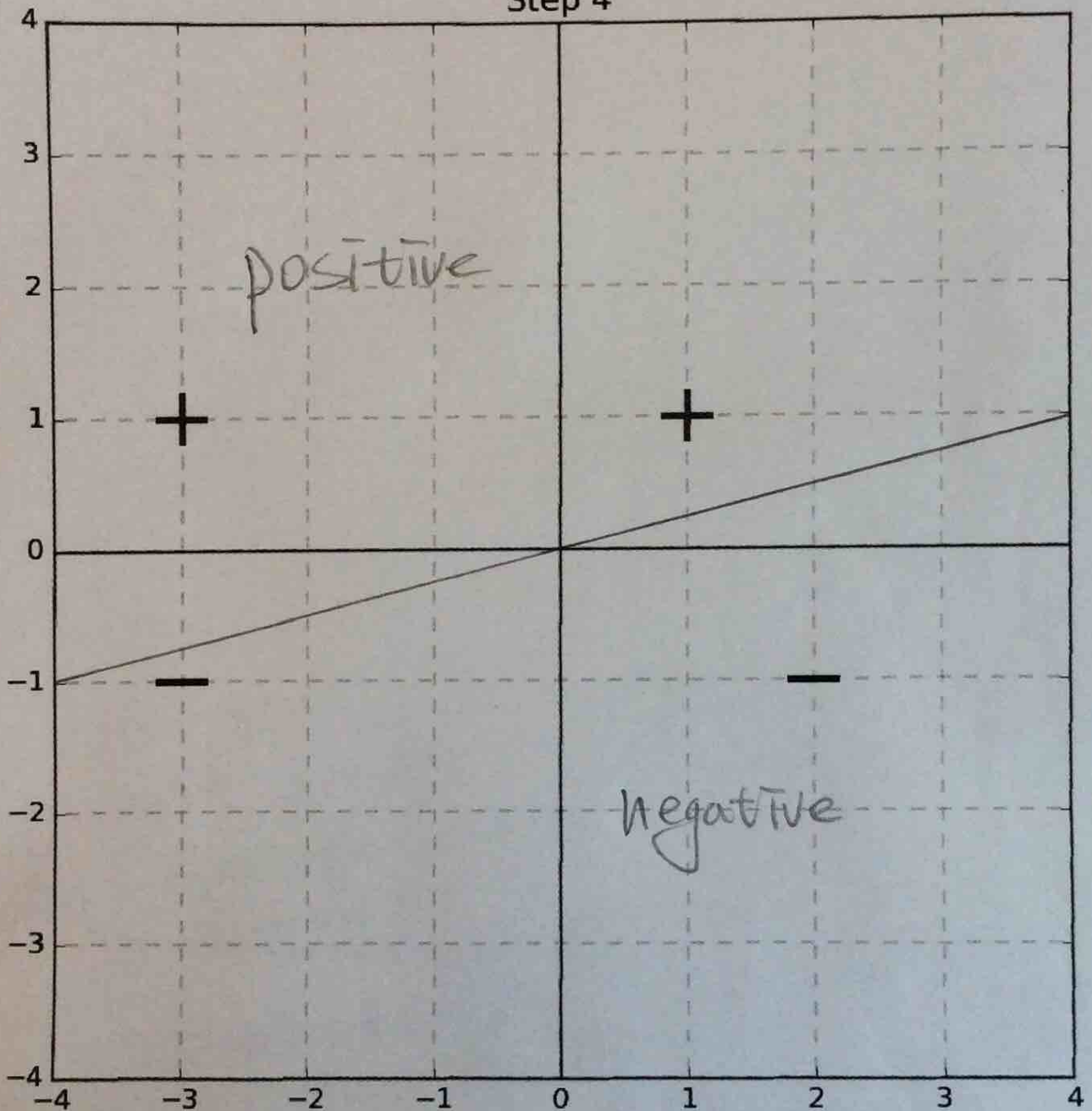Equation: $X_1 + X_2 = 0$

Step 1

X_2

X_1

positive

negative

+

-4   -3   -2   -1   0   1   2   3   4

Equation: $X_1 - 2X_2 = 0$

Step 2

positive

$+$

$-$

negative

Equation: $2X_1 + 3X_2 = 0$

Step 3

positive

$+$

negative

$-$

$-$

Equation: $X_1 - 4X_2 = 0$

Step 4

part 1 does not maximize the margin

Equation: $X_2 = 0$

Step 4