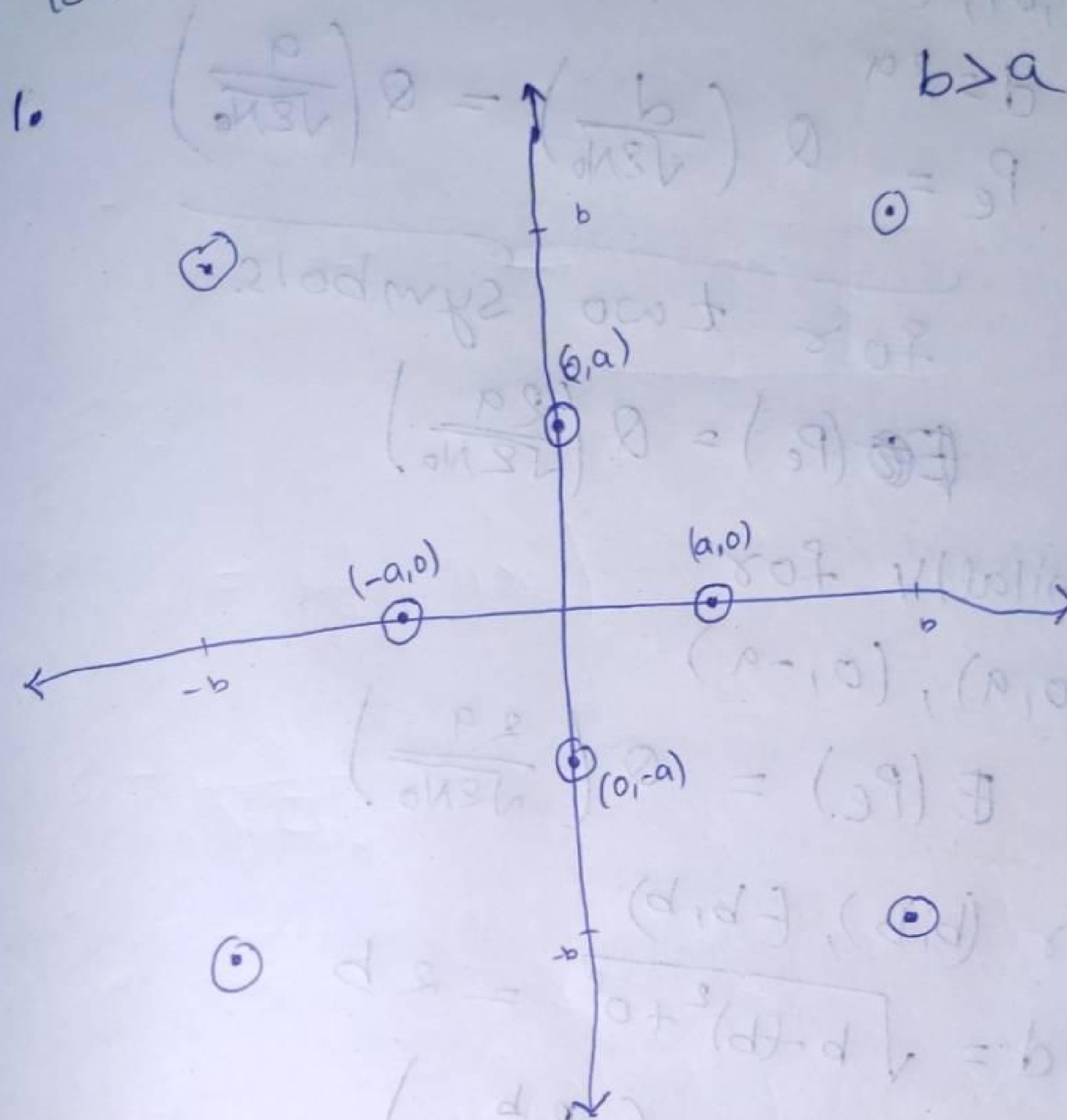


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Total 8-QAM constellations

$M=8$, let $\mathcal{A} = \{a_1, a_2, \dots, a_8\}$

$$P(a_k) = \frac{1}{8} = \frac{1}{M} \leftarrow \text{equally likely}$$

can assume this M-QAM as

4 - 2 PAM's
Binary PAM

for a Binary PAM

$$P_e = Q\left(\frac{A}{\sigma}\right) = Q\left(\frac{d}{\sqrt{2N_0}}\right)$$

$d \rightarrow$ distance b/w constellations

for

$$(-a, 0), (a, 0)$$

$$d = 2a$$

$$P_e = Q\left(\frac{d}{\sqrt{2N_0}}\right) = Q\left(\frac{a}{\sqrt{2N_0}}\right)$$

for two symbols.

$$E(P_e) = Q\left(\frac{2a}{\sqrt{2N_0}}\right)$$

similarly for

$$(0, a), (0, -a)$$

$$E(P_e) = Q\left(\frac{2a}{\sqrt{2N_0}}\right)$$

for $(b, b), (-b, b)$

$$d = \sqrt{b - (-b)^2 + 0^2} = 2b$$

$$E(P_e) = Q\left(\frac{2b}{\sqrt{2N_0}}\right)$$

similarly for other points

$$E(P_T) = 2Q\left(\frac{2a}{\sqrt{2N_0}}\right) + 2Q\left(\frac{2b}{\sqrt{2N_0}}\right)$$

Decision boundary

