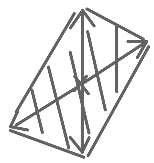
(a) $y_1 \cdot \vec{a}_1 + y_2 \cdot \vec{a}_2 = \vec{x}$. $(x \in \mathbb{R}^n)$

$(-1 \le y_1 \le 1)$ $(-1 \le y_2 \le 1)$

$\therefore$ polyhedra (o).



(b)
$$\left.\begin{aligned} \mathbf{1}^T \cdot \vec{x} &= 1 \\ \vec{a}_1^T \cdot \vec{x} &= b_1 \\ \vec{a}_2^T \cdot \vec{x} &= b_2 \\ (-I)\vec{x} &\preceq 0 \end{aligned}\right\} \therefore \text{polyhedra (o)}$$

(c) $(-I)\vec{x} \preceq 0$.

$$\underbrace{\vec{y}^T \cdot \vec{x} \le 1 \qquad \|\vec{y}\|_2 = 1}_{\text{not linear.}} \rightarrow \underbrace{\|\vec{x}\|_2 \le 1}_{\text{L2 Norm Ball}}$$

$\therefore$ Polyhedra (x)

2.8 Which of the following sets S are polyhedra? If possible, express S in the form $S = \{x \mid Ax \preceq b,\ Fx = g\}$.

(a) $S = \{y_1a_1 + y_2a_2 \mid -1 \le y_1 \le 1,\ -1 \le y_2 \le 1\}$, where $a_1, a_2 \in \mathbf{R}^n$. (o)

(b) $S = \{x \in \mathbf{R}^n \mid x \succeq 0,\ \mathbf{1}^Tx = 1,\ \sum_{i=1}^n x_ia_i = b_1,\ \sum_{i=1}^n x_ia_i^2 = b_2\}$, where $a_1, \ldots, a_n \in \mathbf{R}$ and $b_1, b_2 \in \mathbf{R}$. (o)

(c) $S = \{x \in \mathbf{R}^n \mid x \succeq 0,\ x^Ty \le 1$ for all y with $\|y\|_2 = 1\}$. (x)

(d) $S = \{x \in \mathbf{R}^n \mid x \succeq 0,\ \underbrace{x^Ty \le 1 \text{ for all } y \text{ with } \textstyle\sum_{i=1}^n |y_i| = 1}_{\text{L1 Norm Ball. (no curvature)}}\}$. (o)