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$$\text{conv}(C) = \left\{ \sum_{i=1}^k \theta_i x_i : \begin{array}{l} k \geq 1 \text{ and} \\ x_1, \dots, x_k \in C \\ \theta_1, \dots, \theta_k \geq 0 \\ \sum \theta_i = 1 \end{array} \right\}$$



$$\|tx + (1-t)y\| \leq t\|x\| + (1-t)\|y\| \leq r$$

$$Cx = d \Leftrightarrow \begin{array}{l} Cx \leq d \\ I - Cx \leq -d \end{array}$$

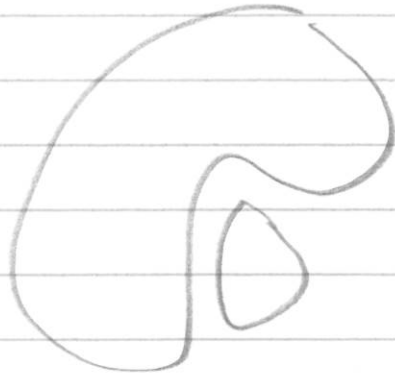
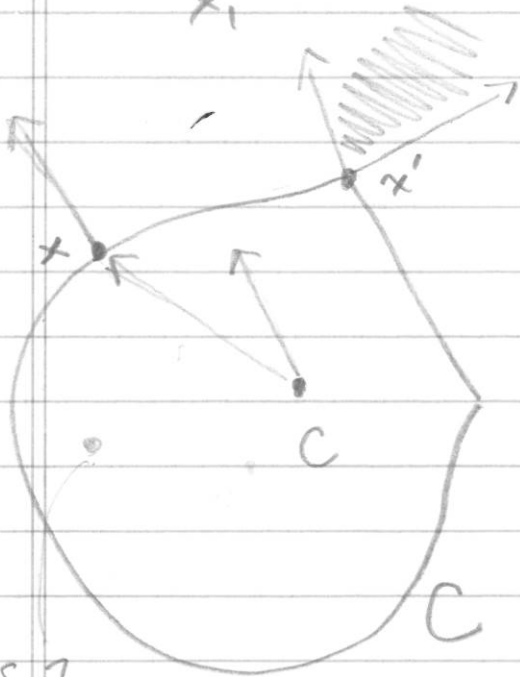
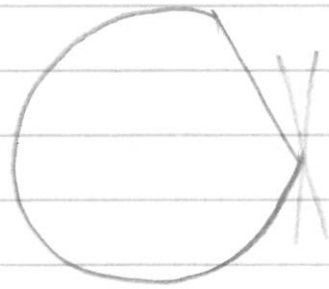
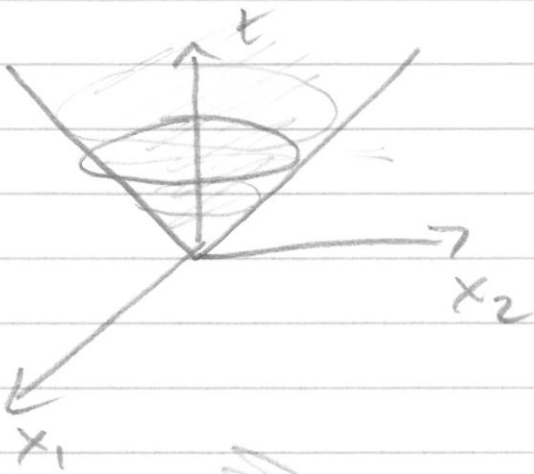
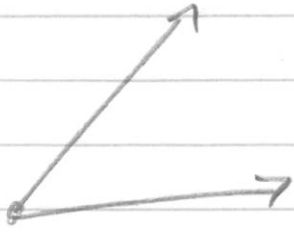
$$Ax \leq b \Leftrightarrow a_i^T x \leq b_i \text{ all } i=1, \dots, m$$

$x_0, \dots, x_k$  affine independent

$\Leftrightarrow$

$x_1 - x_0, \dots, x_k - x_0$  linearly indep.

①



{0}

$$B - (x_1 A_1 + \dots + x_k A_k) \succeq 0$$

$\Leftrightarrow$  is p.s.d

$$C = \{x : x_1 A_1 + \dots + x_k A_k \preceq B\}$$

$$x, y \in C$$

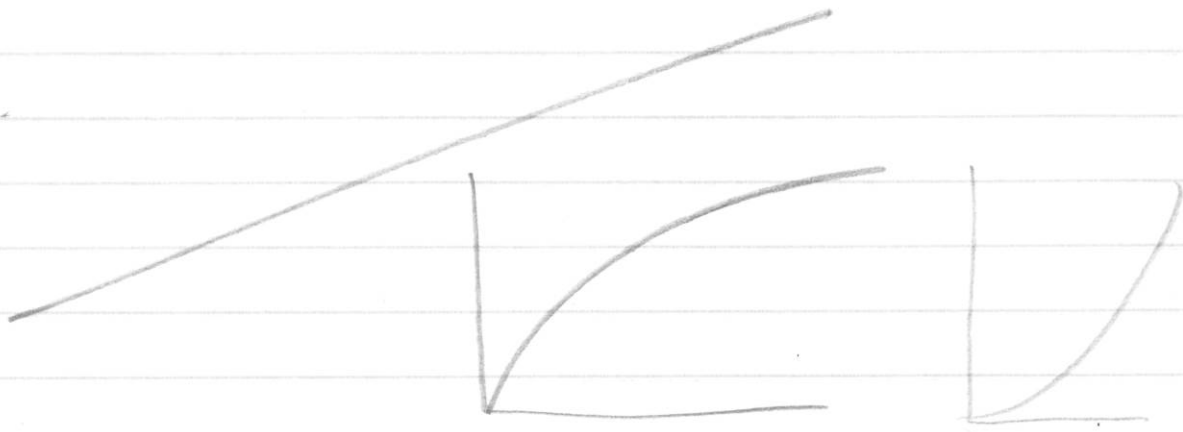
$$z = tx + (1-t)y$$

$$B - (z_1 A_1 + \dots + z_k A_k) \succeq 0$$

$$a^T (B - (z_1 A_1 + \dots + z_k A_k)) a \geq 0 \quad \text{all } a$$

$$= t a^T (B - x_1 A_1 - \dots - x_k A_k) a \\ + (1-t) a^T (B - y_1 A_1 - \dots - y_k A_k) a \\ \geq 0. \quad \checkmark$$

$$D = \{x : x \succeq 0\}$$



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$x, y$

$$I_c(tx + (1-t)y) \leq tI_c(x) + (1-t)I_c(y)$$

$x, y \in C$

0

$\leq$

0

✓

$x \notin C, y \notin C$

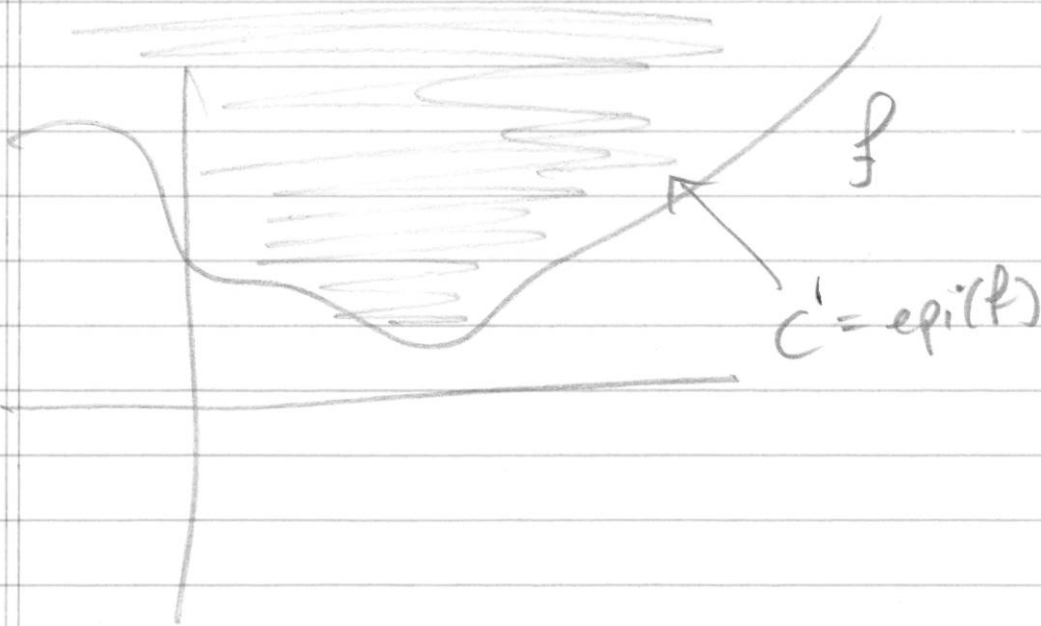
doesn't  
matter

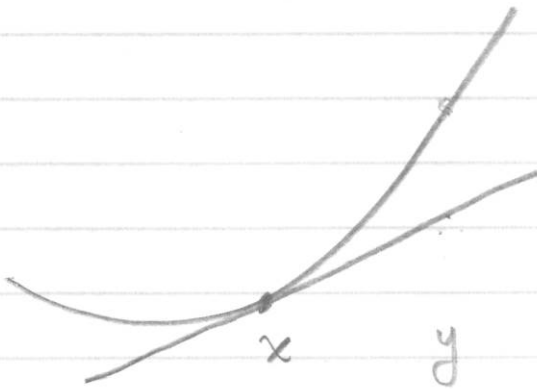
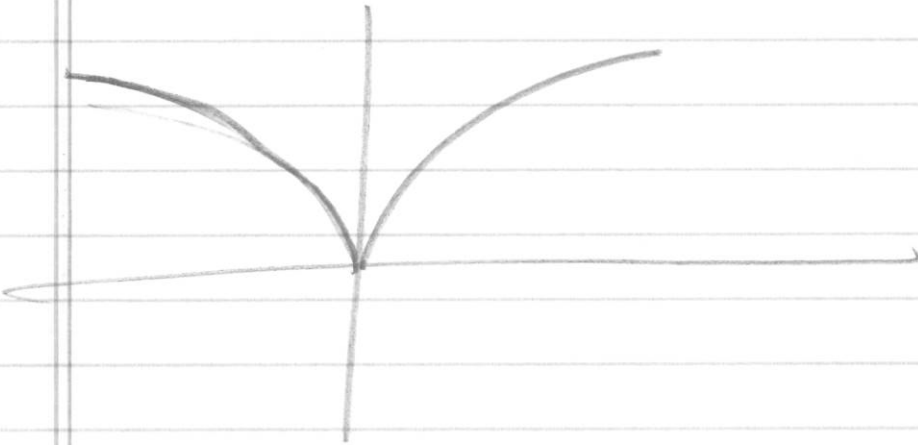
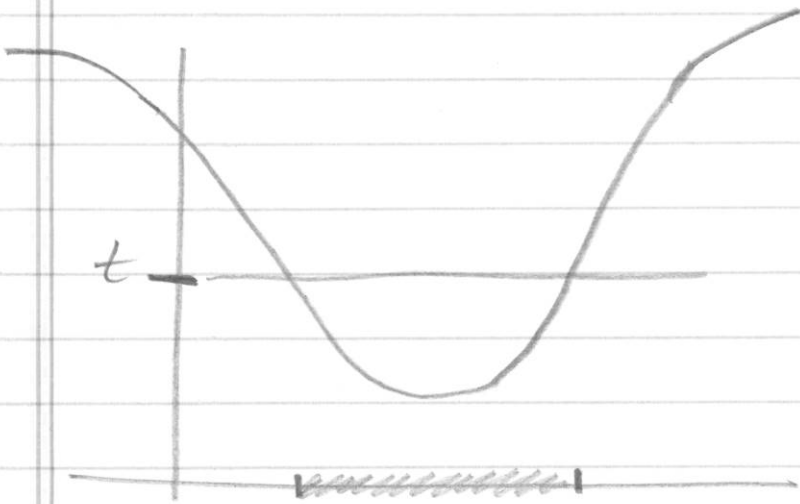
$\leq$

$\infty$

$$f: \mathbb{R}^n \rightarrow \mathbb{R}$$

$$g(t) = f(x_0 + ta), \quad t \in \mathbb{R}$$





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