

**Name:**

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A convex function  $f(x) : \mathbb{R}^n \rightarrow \mathbb{R}$  is convex if and only if it satisfies the following condition

$$f(\alpha x + (1 - \alpha)y) \leq \alpha f(x) + (1 - \alpha)f(y)$$

for any two vectors  $x$  and  $y$  in  $\mathbb{R}^n$  and all  $\alpha \in [0, 1]$ .

Prove that these two functions  $f(x) : \mathbb{R}^2 \rightarrow \mathbb{R}$  are convex for vectors  $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$  and  $y = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$ :

- $f(x) = x_1^2 + x_2^2$
- $f(x) = 3x_1 + 7x_2 + 8$