

## Exercises

1. Consider the map  $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  defined by  $f(x, y) = (x + y, x - y)$ . Compute the Jacobian matrix of  $f$  at the point  $(1, 2)$ .

2. Let  $f: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be defined by  $f(x, y, z) = (x^2 + y^2 + z^2, x^2 - y^2, x^2 + y^2 - z^2)$ . Compute the Jacobian matrix of  $f$  at the point  $(1, 1, 1)$ .

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3. Let  $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be defined by  $f(x, y) = (x^2 + y^2, x^2 - y^2)$ . Compute the Jacobian matrix of  $f$  at the point  $(1, 1)$ . Use the Jacobian matrix to approximate the value of  $f(1.1, 1.1)$ .

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4. Let  $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be defined by  $f(x, y) = (x^2 + y^2, x^2 - y^2)$ . Compute the Jacobian matrix of  $f$  at the point  $(1, 1)$ .

- 1. Compute the Jacobian matrix of  $f$  at the point  $(1, 1)$ .
- 2. Use the Jacobian matrix to approximate the value of  $f(1.1, 1.1)$ .
- 3. Compute the value of  $f(1.1, 1.1)$ .

5. Let  $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be defined by  $f(x, y) = (x^2 + y^2, x^2 - y^2)$ .