

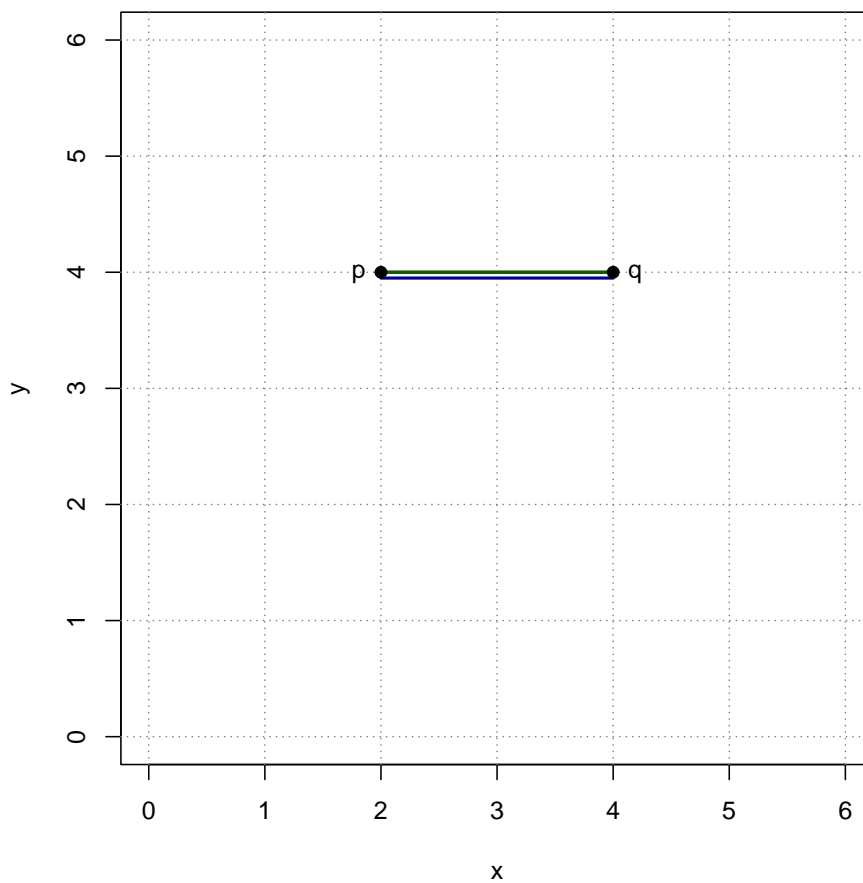
1. Problem

Given two points $p = (2, 4)$ and $q = (4, 4)$ in a Cartesian coordinate system:

- (a) What is the Manhattan distance $d_1(p, q)$?
- (b) What is the Euclidean distance $d_2(p, q)$?
- (c) What is the maximum distance $d_\infty(p, q)$?

Solution

The distances are visualized below in green (d_1), red (d_2), and blue (d_∞).



$$(a) \quad d_1(p, q) = \sum_i |p_i - q_i| = |2 - 4| + |4 - 4| = 2.$$

$$(b) \quad d_2(p, q) = \sqrt{\sum_i (p_i - q_i)^2} = \sqrt{(2 - 4)^2 + (4 - 4)^2} = 2.$$

$$(c) \quad d_\infty(p, q) = \max_i |p_i - q_i| = \max(|2 - 4|, |4 - 4|) = 2.$$