

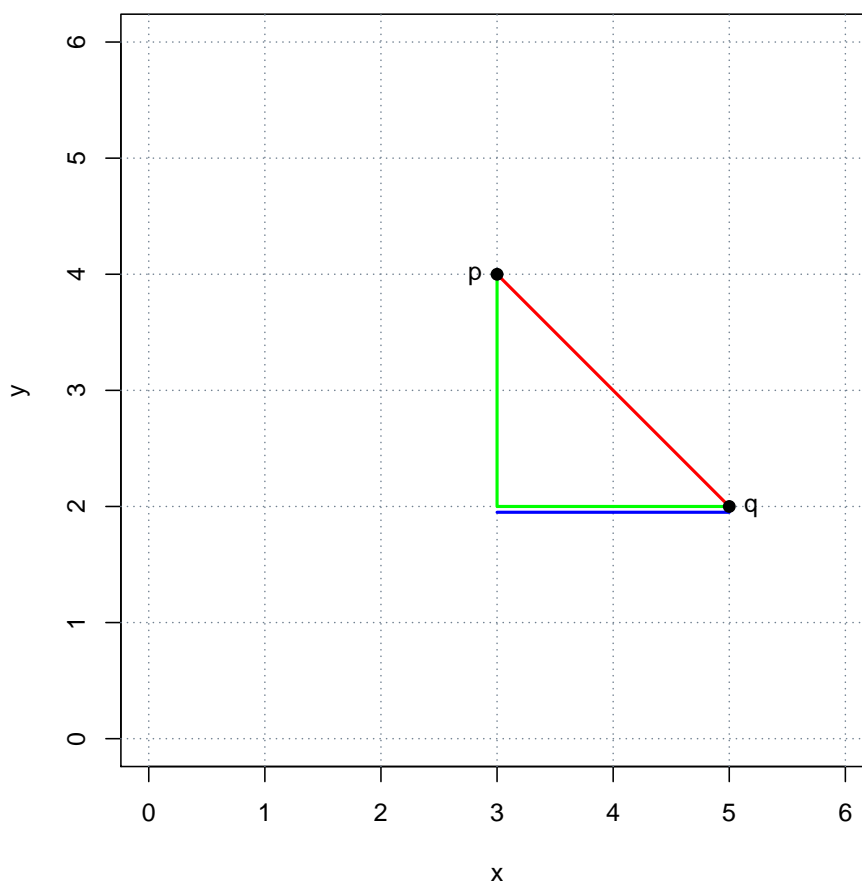
1. Problem

Given two points $p = (3, 4)$ and $q = (5, 2)$ 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) $d_1(p, q) = \sum_i |p_i - q_i| = |3 - 5| + |4 - 2| = 4.$

(b) $d_2(p, q) = \sqrt{\sum_i (p_i - q_i)^2} = \sqrt{(3 - 5)^2 + (4 - 2)^2} = 2.828.$

(c) $d_\infty(p, q) = \max_i |p_i - q_i| = \max(|3 - 5|, |4 - 2|) = 2.$