## 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 $\left(d_{1}\right)$, red $\left(d_{2}\right)$, and blue $\left(d_{\infty}\right)$.

(a) $d_{1}(p, q)=\sum_{i}\left|p_{i}-q_{i}\right|=|2-4|+|4-4|=2$.
(b) $d_{2}(p, q)=\sqrt{\sum_{i}\left(p_{i}-q_{i}\right)^{2}}=\sqrt{(2-4)^{2}+(4-4)^{2}}=2$.
(c) $d_{\infty}(p, q)=\max _{i}\left|p_{i}-q_{i}\right|=\max (|2-4|,|4-4|)=2$.

