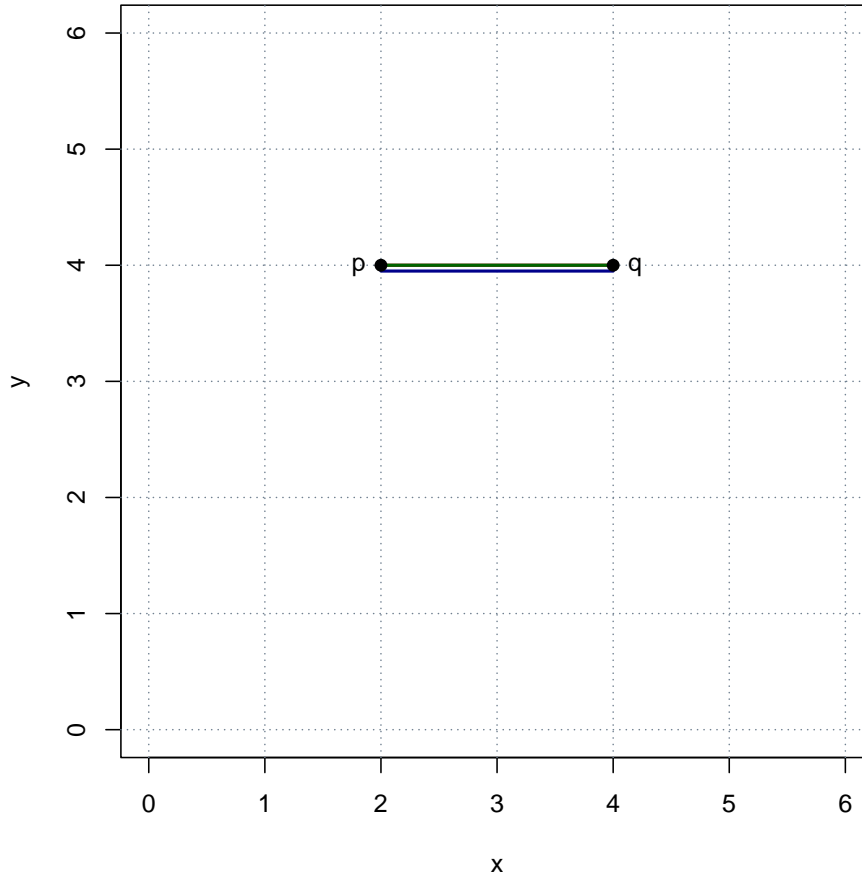1. **Problem**
   Given two points $p = (2, 4)$ and $q = (4, 4)$ in a Cartesian coordinate system:

   (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 ($d_\infty$).



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

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

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