

## Sorting between lines

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Let  $N$  be a positive integer and define the sequence  $T_N = \{t_n : n = 1, 2, \dots, N\}$ , where each  $t_n$  is chosen at random (uniformly distributed) in the interval  $[n, 2n]$ . Let  $S_N = \{s_n : n = 1, 2, \dots, N\}$  denote the sequence of sorted values of  $T_N$  (in increasing order). For large  $N$ , when the points  $\{(n, s_n) : n = 1, 2, \dots, N\}$  are plotted in the plane, a smooth curve seems to emerge. Prove that this is indeed the case by showing that the set of normalized points

$$\left\{ \left( \frac{n}{N}, \frac{s_n}{N} \right) : n = 1, 2, \dots, N \right\}$$

converges to points of the graph  $y = g(x)$  of a smooth function  $g : [0, 1] \rightarrow [0, 2]$ .

