

E: Egocentric Expedition

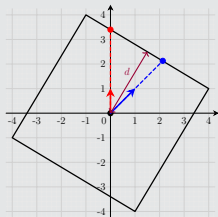
Problem author: Michael Zündorf

Problem

- Find the area of a hidden arbitrarily rotated square.
- Ask two query directions and receive the distances from square center to edge.

Solution

- Query two directions 45 degrees apart, i.e. $(1, 0)$ and $(1, 1)$.
- Assume the two points in those directions lie on one side of the square.
- Calculate minimum distance d to that side (line), the answer is $(2d)^2$.
- Why is this correct?

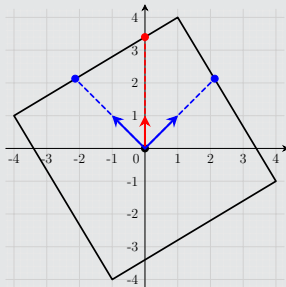


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Solution

- Why is this correct?
- Note that a square has 90 degree rotation symmetry.
- Specifically, direction $(-1, 1)$ gives the same distance as $(1, 1)$.
- Notice that either $(0, 0)$ and $(1, 1)$ lie on the same side, or $(0, 0)$ and $(-1, 1)$.
- So assuming $(0, 0)$ and $(1, 1)$ on same side results in correct area.



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Wrong Solution

- Just using two very close directions does not work, with given constraints, there can always be a corner in between.