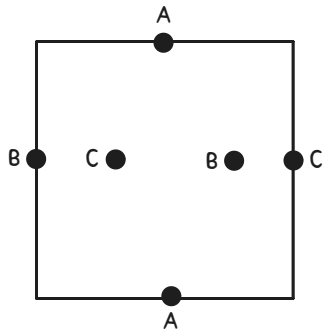
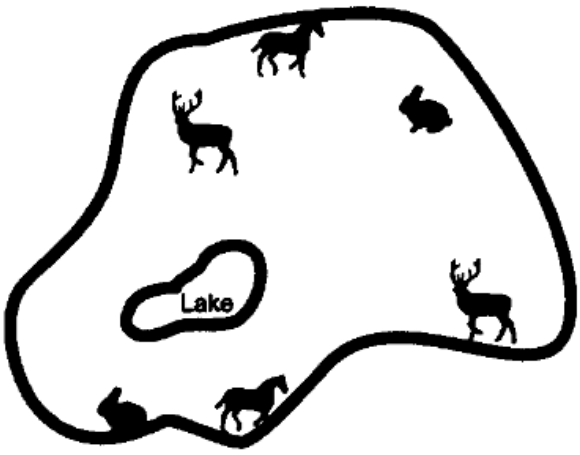
Lesson 12 — Deforming things

Problem 1

Can you connect A to A, B to B, and C to C by curves within the square so that the curves don't intersect?



Problem 2



4.18
A simple graph? Draw lines to connect animal pairs without crossing lines and without drawing a line through the animals or the boundaries.

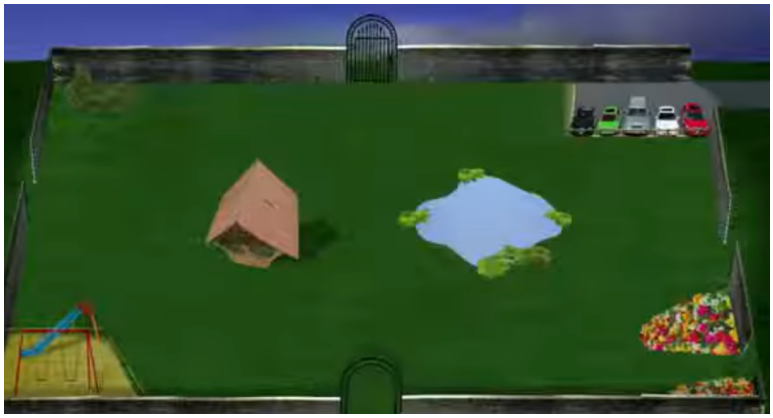
Problem 3

In a park, a man entered through the flower beds and was found dead between the pavilion and the lake. By the muddy boot marks left behind, we know that:

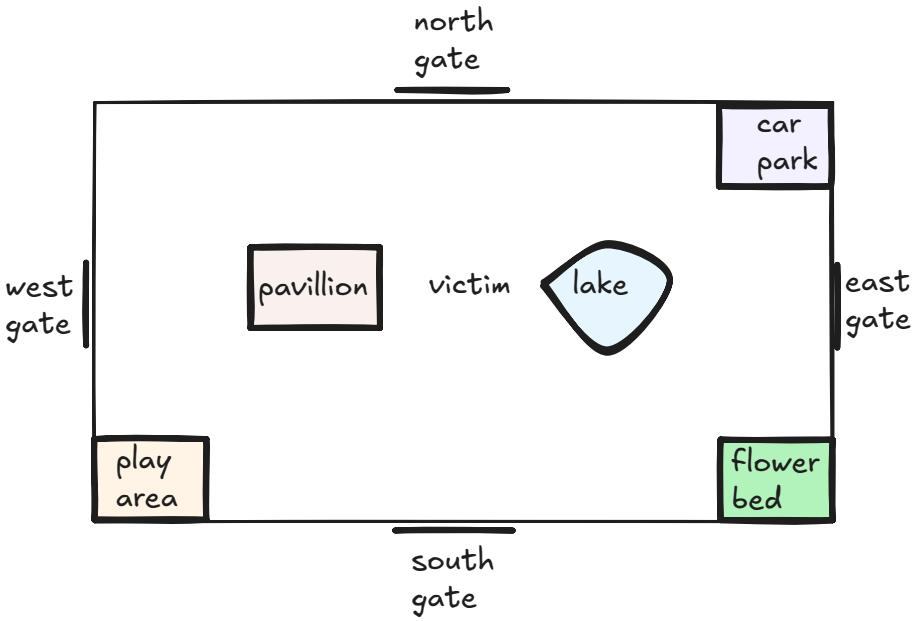
- A dog walker entered through the west gate, and left through the car park.
- A parent with their toddler entered through the east gate, and left by visiting the play area.
- A jogger entered through the south gate, went around the north side of the pavilion, wrapped once around the lake, and went back around the north side of the pavilion, and back out the south gate. He is the only one who has an alibi. His path does not cross the victim's path.
- The park keeper entered through the north gate, and entered the pavilion.
- None of these paths (dog walker, parent with toddler, jogger, park keeper) crossed each other.

Who of these (dog walker, parent with toddler, park keeper) must have crossed paths with the victim?

Picture:

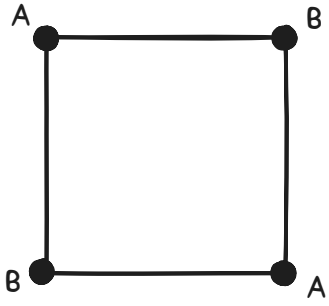


Schematic:



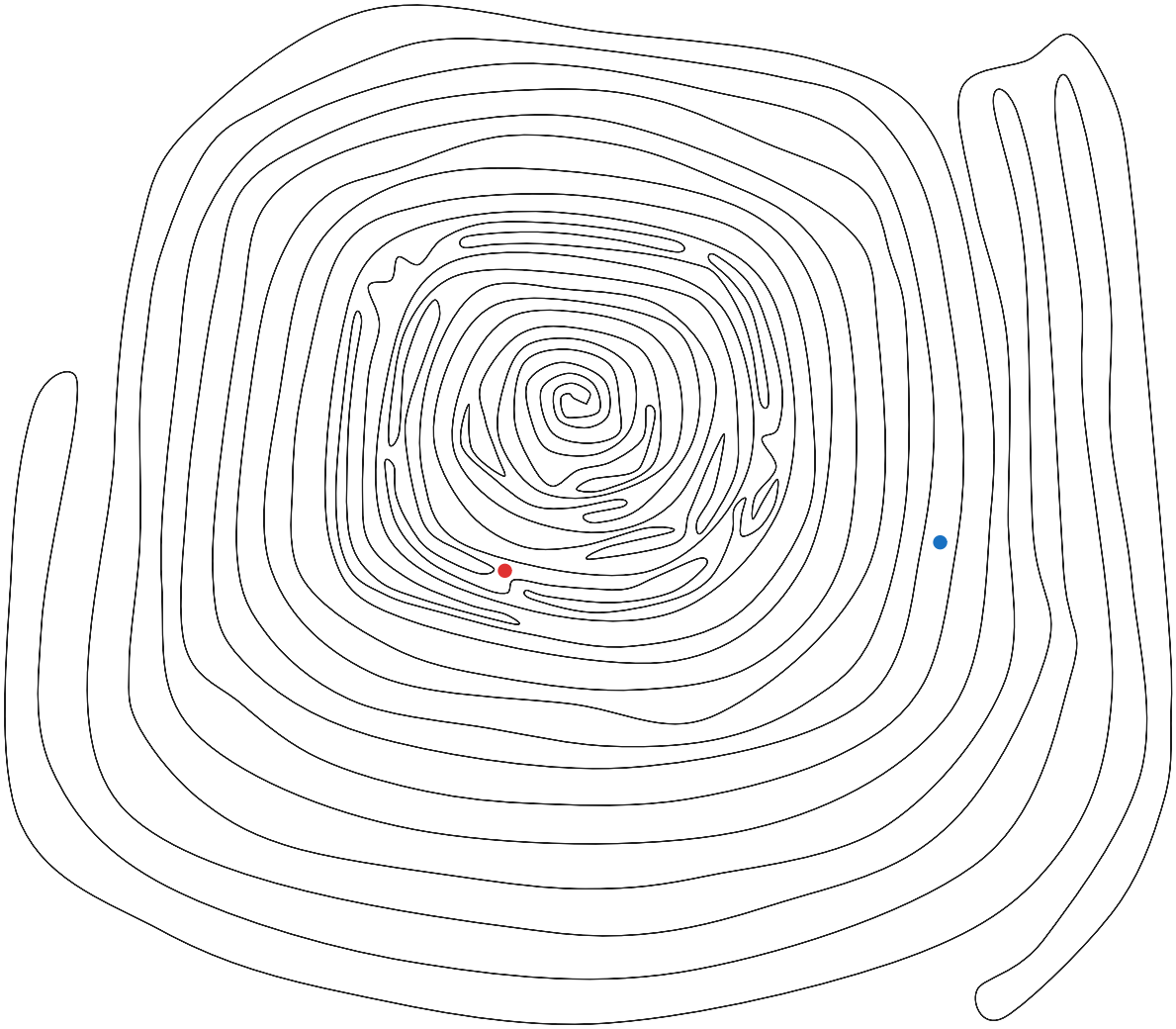
Problem 4

Can you connect A to A, and B to B by curves within the square so that the curves don't intersect?



Problem 5

(a) Is the blue dot is on the inside or the outside of the curve shown?
(b) Is the red dot is on the inside or the outside of the curve shown?



Problem 6

Tomasz has had only one passport in his life so far. His passport has exactly three stamps from Canada and six stamps from Mexico. Assuming that Tomasz has never done anything illegal in his life and that Tomasz is Polish by nationality only (and is of no other nationality), which country is Tomasz in right now?

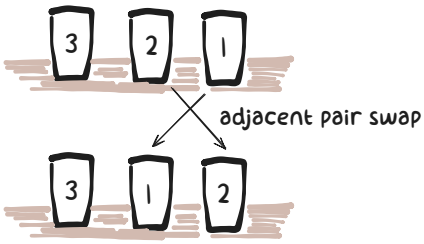
Note that a passport is stamped once upon entry and once upon departure from a country.

Problem 7

Consider three cups arranged in a row on a table and labelled in order as 3, 2, 1.

1. What's the minimum number of adjacent swaps needed to reorder them into the order 1, 2, 3?
2. Can you use exactly an even number of adjacent pair swaps to accomplish this reordering?

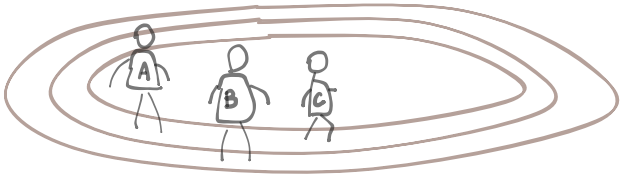
(Hint: Draw what is happening through _____.)



Problem 8 (extra credit)

Persons A, B, and C are running on a circular track in that order. If, at some time later, they (the persons A, B, and C) are in positions A, C, B, must one of them have passed by another one of them on the circular track?

Initially:



Later: