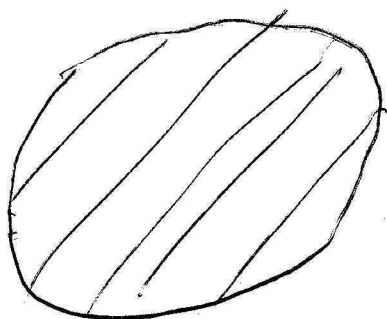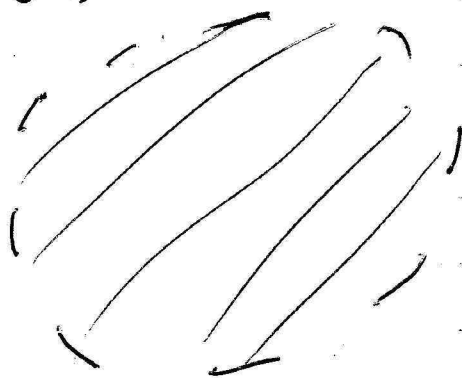# Topology terms (2D)

<u>open region</u>: a set of points in the plane that excludes it · boundary set.
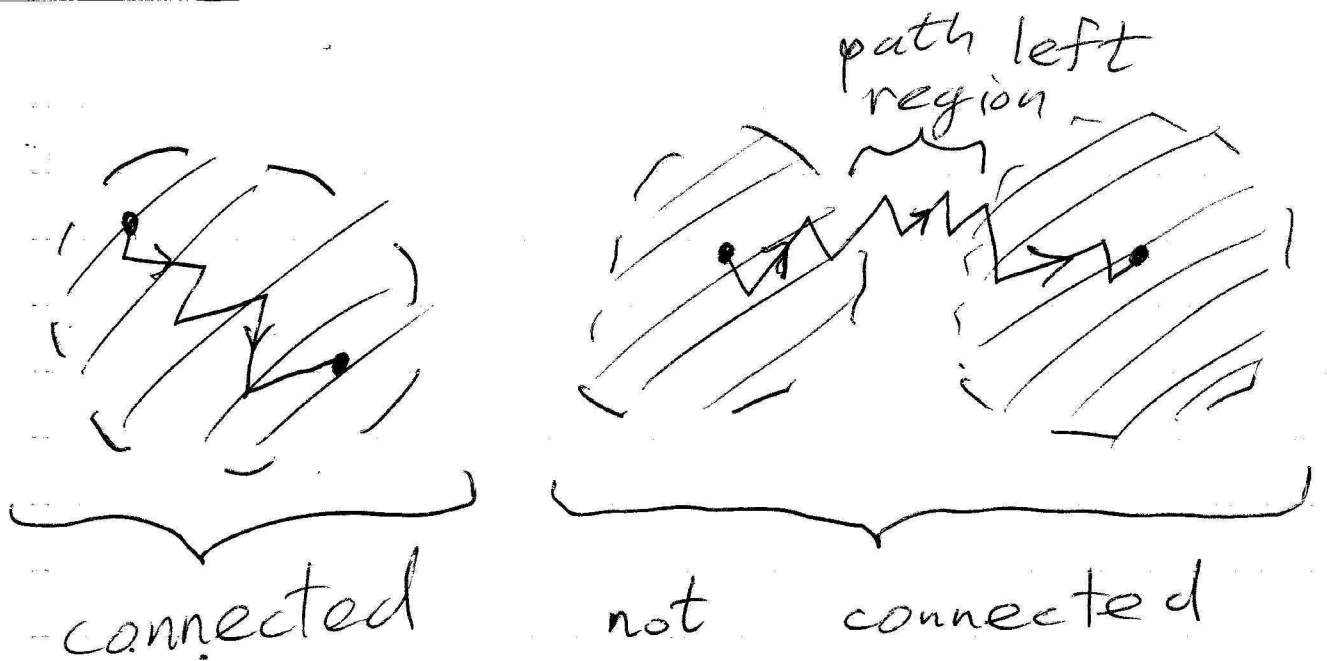

not open

open
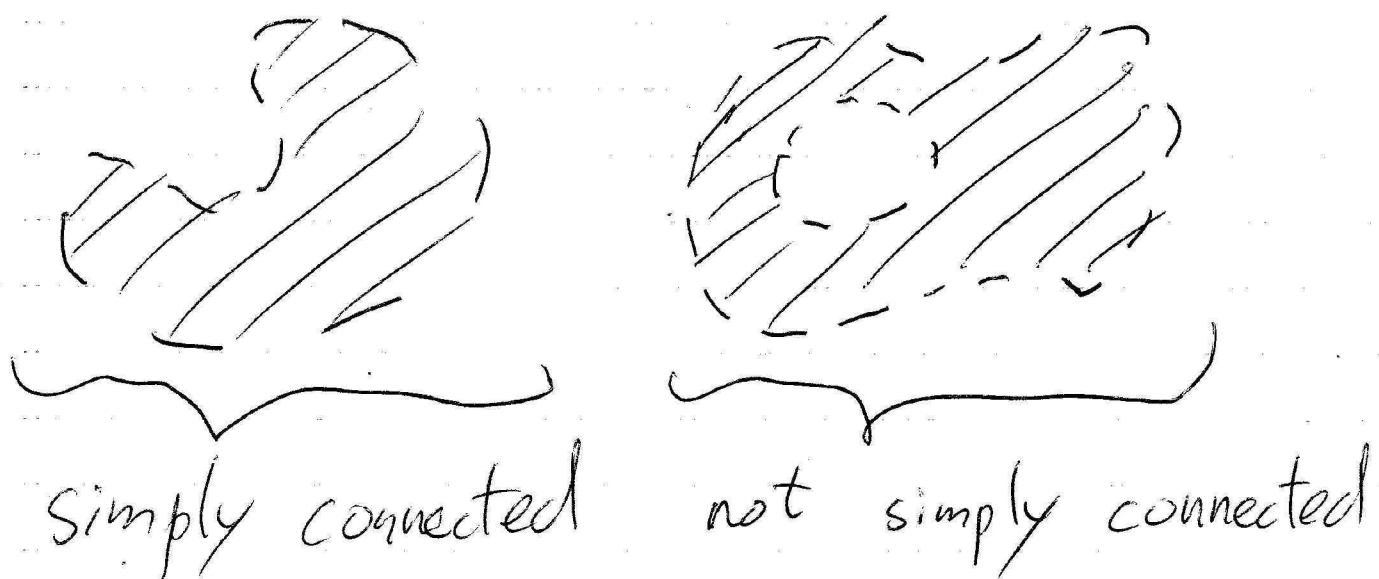
- $\{(x,y) \mid x^2+y^2 \leq 1\}$ is not open
- $\{(x,y) \mid x^2+y^2 < 1\}$ is open
- $R^2 - \{(0,0)\} = \{(x,y) \mid (x,y) \neq (0,0)\}$ is open.

An open region is <u>connected</u> if there is, between any two points, a path from one to the other that stays inside the region

path left
region

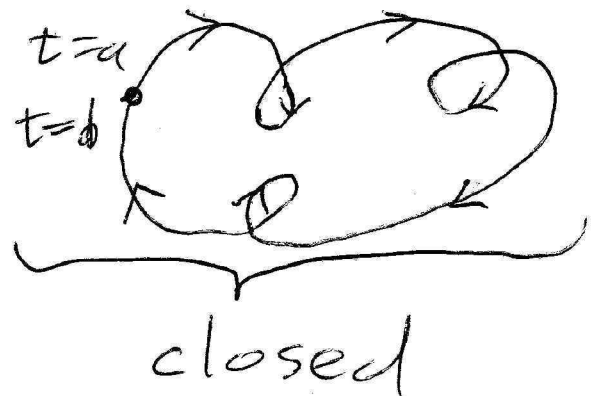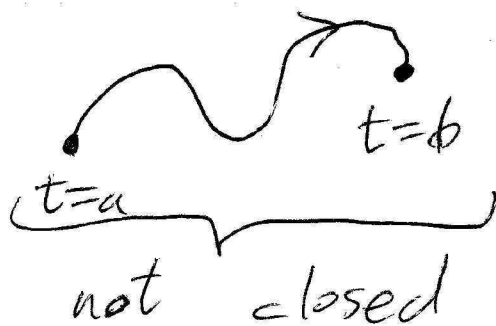connected   not   connected

A connected open region is
simply connected if it has
no holes.   (Warning: the 3D
version of simply connected is different.)

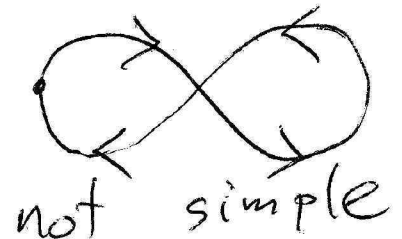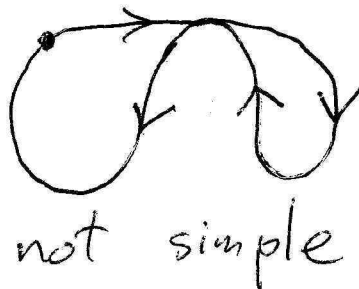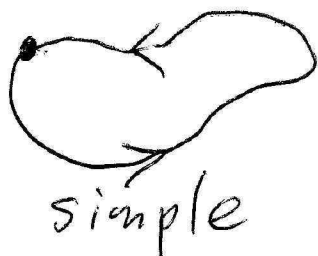

simply connected   not simply connected

• $\mathbb{R}^2 - \{(0,0)\}$ is not simply connected.

- A <u>closed curve</u> is a curve parametrized by continuous functions $x(t)$, $y(t)$, $a \leq t \leq b$ such that $\vec{r}(a) = \vec{r}(b)$

not closed

closed

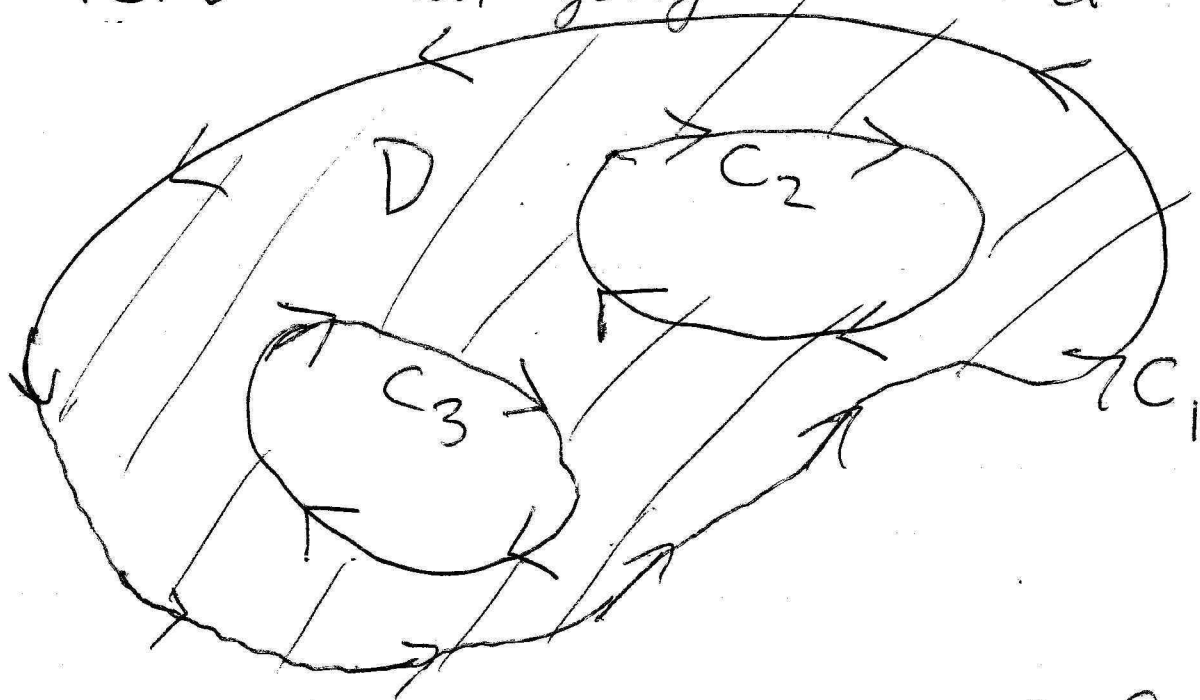- A curve is <u>smooth</u> if it has a parametrization where $x'(t)$ & $y'(t)$ are continuous.

- A closed curve is <u>simple</u> if it does not cross itself.

simple

not simple

not simple

The <u>positively oriented</u>
<u>boundary</u> ∂D of an open region
D is the union of its boundary
curves each oriented so
that "inside" is to the
"left" when going "forward"

$$\partial D = C_1 + C_2 + C_3 + C_4$$