* Interior point, Boundary point, Open Region, Closed Region, not open not closed region, bounded region, Unbounded region :

- Interior Point :

. A point is said to be interior point if this point is a center of a circle that lies completely on the region "R"

- Boundary Point :

. A point is said to be bounded if every solid ball centred at that point contains points from "R" and points from outside "R"

- Open Region :

. A region is open if it consists of interior points only

- Closed Region :

. A region is closed if it contains all interior and boundary points

- Neither open nor closed region:

. A region is neither open nor closed if its made of interior points and some (not all) boundary points

- Bounded Region:

. A region is bounded if it lies inside a disk of fixed radius

- Unbounded Region:

. A region is unbounded if it cant lie inside a disk of fixed radius

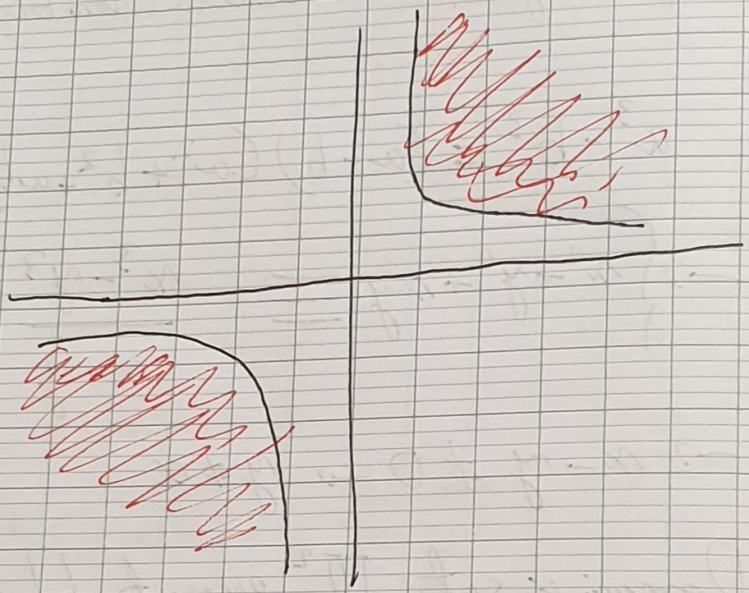
- Both open and closed:

. The (X/Y) - Region has all its points as interior and all its points as boundary since no points is excluded.

* $f(x,y) = \sqrt{xy-1}$

- Domain: $xy - 1 \geq 0 \rightarrow \boxed{xy \geq 1}$

- The domain is a hyperbola (sketch it randomly)



- Closed or Open ??: To determine if its closed or open ask yourself if the boundary is included in domain looks at the equation, then you can notice we have "or equal" sign, then $xy = 1$ is included hence its closed.

Bounded or not ??: To determine if its bounded or not ask yourself if we can draw a circle that would include the entire figure. Here it is impossible to do fit a hyperbola inside a circle because, the hyperbola never ends, so we cant have a circle of infinite radius. Hence Not bounded

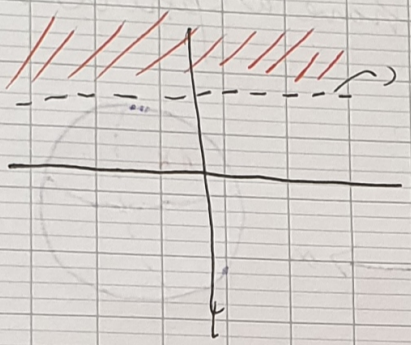
* Note: if the "orequal" sign is not present, then the sketch should be dotted since the "boundary" is not included (> or <) (≥ or ≤)
* Note: if we have a sphere or a ball, we can draw a circle that would fit the sphere or ball inside it
* Note: if the domain is the (x y)-plane, then the "boundary is empty"

* $f(x,y) = x^2 - y^2$

- Domain: Entire (xy)-Plane
- Boundary: Since domain is xy-plane, then the boundary is empty.
- Bounded or Not bounded?: Since we can't fit the 2 lines $y=x$ and $y=-x$ inside a circle then it is unbounded
- Open or Closed or,,,,,??: in this case we have no "inequality" (no $>, \geq, <, \leq$), but WE KNOW that the domain is the ENTIRE (xy) plane this means:
- Since domain is ~~included~~ (xy) plane then all points are considered interior points,
- Since NO Point is EXCLUDED (Since domain is xy-plane) then all points are also boundary points ∴ Both open and closed

* Boundary vs Bounded:

- "Boundary" and "Bounded" are completely {NOT related}
- Bounded: if all points that form the figure of the domain can fit inside a circle then it is bounded
- Boundary: it is what "borders" the region ex;



$y > 1$, the straight line $y = 1$ is what bounds the region from bottom so we consider it as a boundary. However, we can't fit this line of infinite length inside a circle of fixed radius.

∴ Not bounded