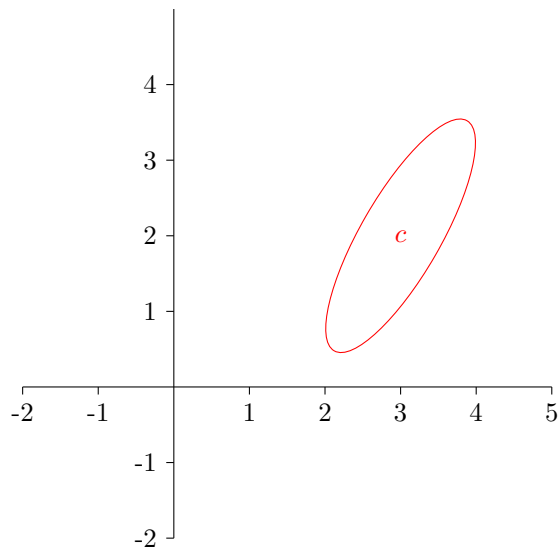

Question 1.

Consider the instance space $X = \mathbb{R}^2$ and a concept $c \subseteq X$ given as



- (a) Name some concept classes \mathcal{C} that contain c .
- (b) Recall the SVM algorithm and decision trees. What hypothesis classes \mathcal{H} do they work with and how do they internally represent their hypotheses? Would they be appropriate to learn the concept c ?

Question 2.

Consider the generalization algorithm for learning conjunctions.

- (a) What is the algorithm's mistake bound? Describe a scenario when we achieve it.
- (b) Assume we work on $n = 4$ logical variables. Assume the sequence of examples

$$x_1 = (1, 0, 0, 1) \text{ with label } y_1 = 1$$

$$x_2 = (1, 1, 0, 0) \text{ with label } y_2 = 0$$

$$x_3 = (0, 1, 1, 1) \text{ with label } y_3 = 1$$

$$x_4 = (1, 1, 1, 0) \text{ with label } y_4 = 0$$

Write the initial (internal) hypothesis as well as how it will gradually change when processing examples above.

Assuming that the concept class is in fact a set of all conjunctions, can we claim that the final hypothesis describes the target concept?

- (c) Adapt the algorithm to learn k -DNF. What is the mistake bound now? Are we still learning efficiently?
- (d) How can we use the new algorithm to learn k -clause CNF? What is *improper* learning?