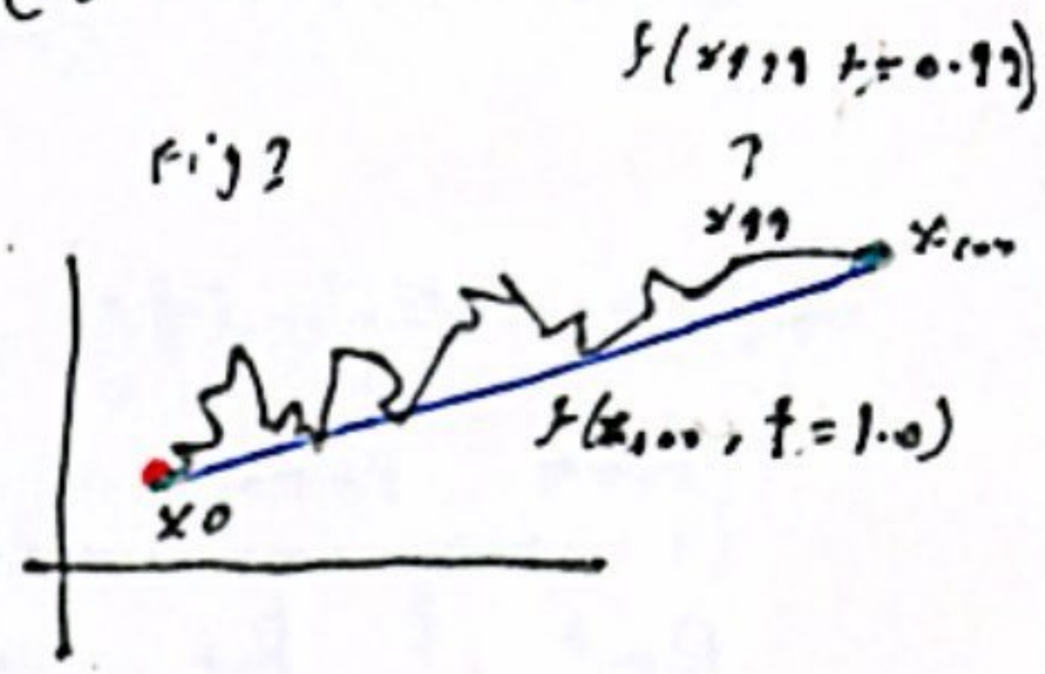
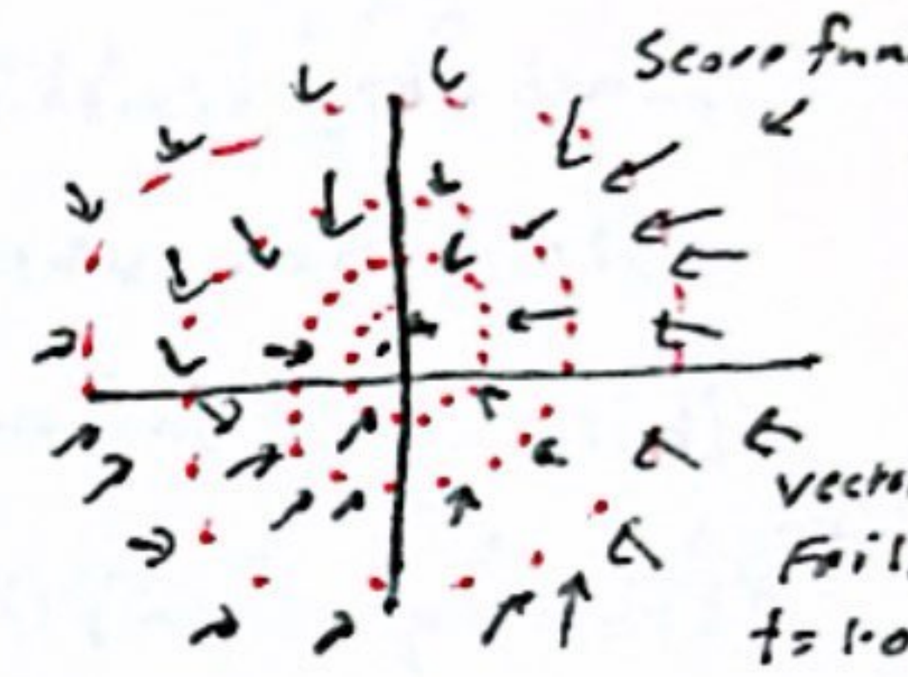
P-2 Vector Feilds (gen ai notes)



- if we consider a 100 step random walk the point at the end in • is the final end of point. here we want to go back to original point • here thats the vector from x_{100} to x_0 (original point) •

$$E[x_{99}-x_{100}|x_{100}] = \frac{E[x_0-x_{100}|x_{100}]}{100}$$

- learning to predict the noise added in the final step of our walk is equvalent to learing to predict the total noise added, divided by the number of steps taken. by training model to predict directly x_0 and not x_{99} we reduce the variance in training examples allowing model to learn efficiently without changing objective



- So foreach point in our space our model learns the direction pointing back towards the original data distribution AKA, Score Function.

- in practice these learned direction depend on how much noise we add to orignal data, at 100 steps most points are far from original point so the model learns to move these points back in the general direction of our spiral ↗ the more traing we do the better the vector feild is at pointing back our noisy point to original data to help this process look at fig 2, instead of just passing cordinates of points to our model we also pass in the time var = # of steps taken in walk this helps our model learn a better vector feild, our equation will now be better at predicting vectors for all t values.

- our img gen process now looks like points starting at random locations are working its way back to form a spiral.

- to visualize the random added noise with no added noise all points converge at the center of the spiral on the inside edge insted of nicly fitting the spiral hence why we add random noise so it fits the distribution nicely. in the space of imgs avgs look blurry, think of different parts of the spiral as parts of img like trees land, desert, etc when we remove noise img ends up being the avg of all possible imgs and looking bad