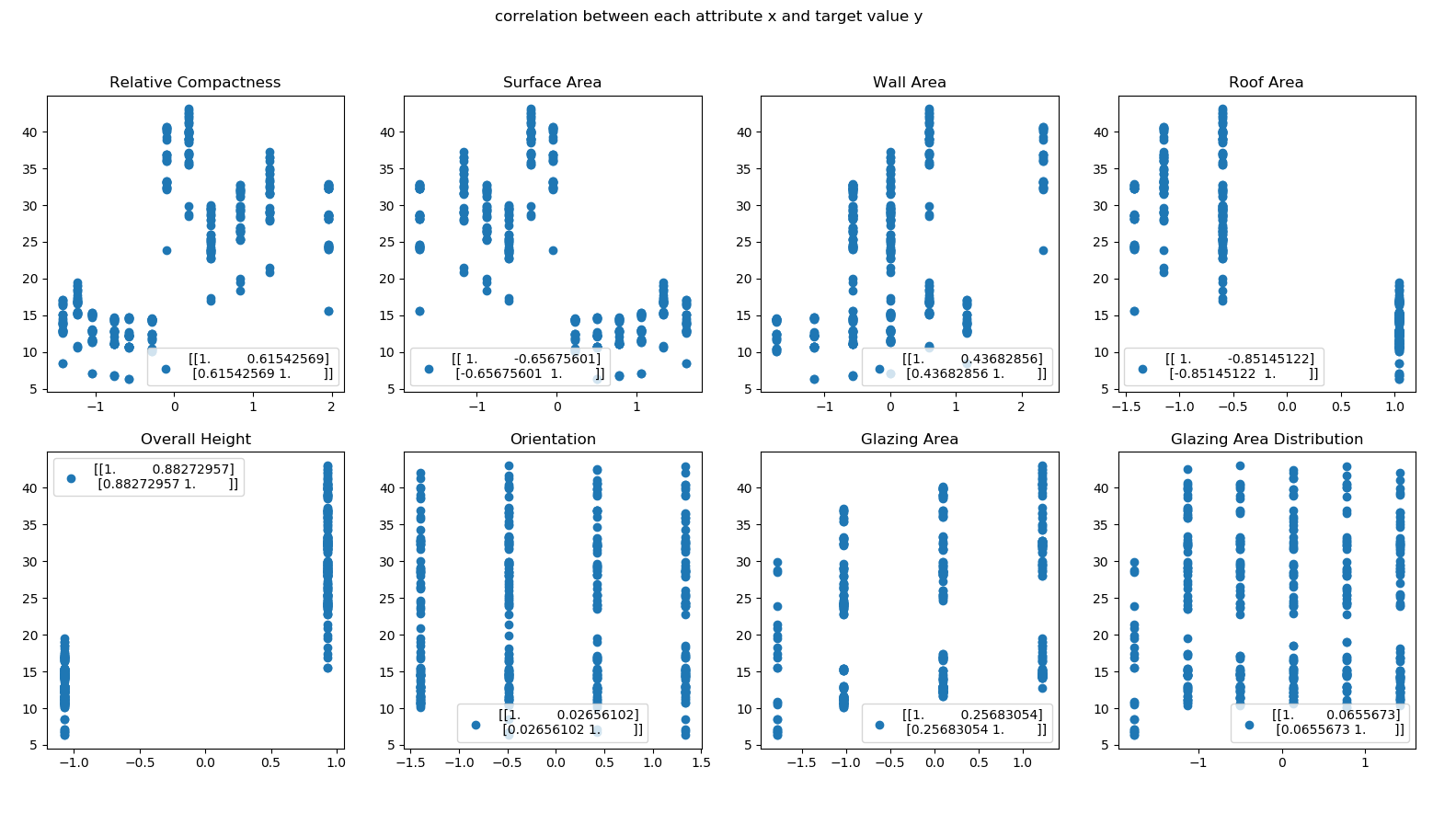
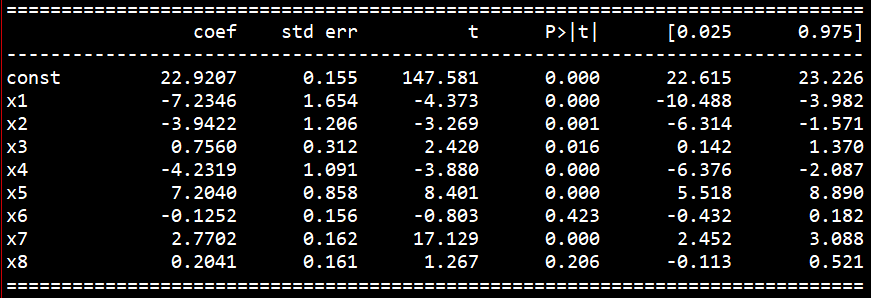
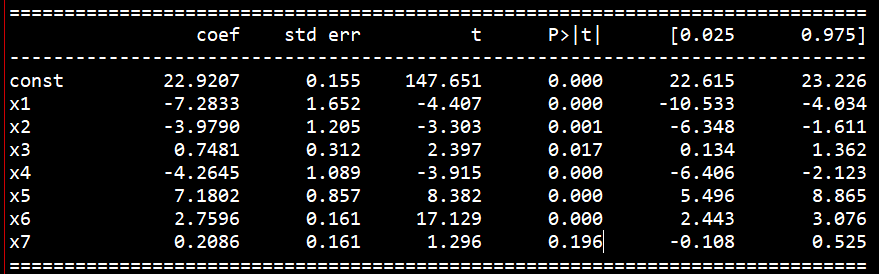
**Task 1**

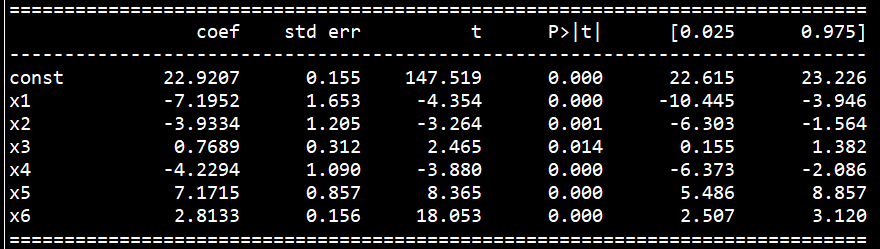
**Correlation plot**



**Backward elimination (significant level of 0.05)**



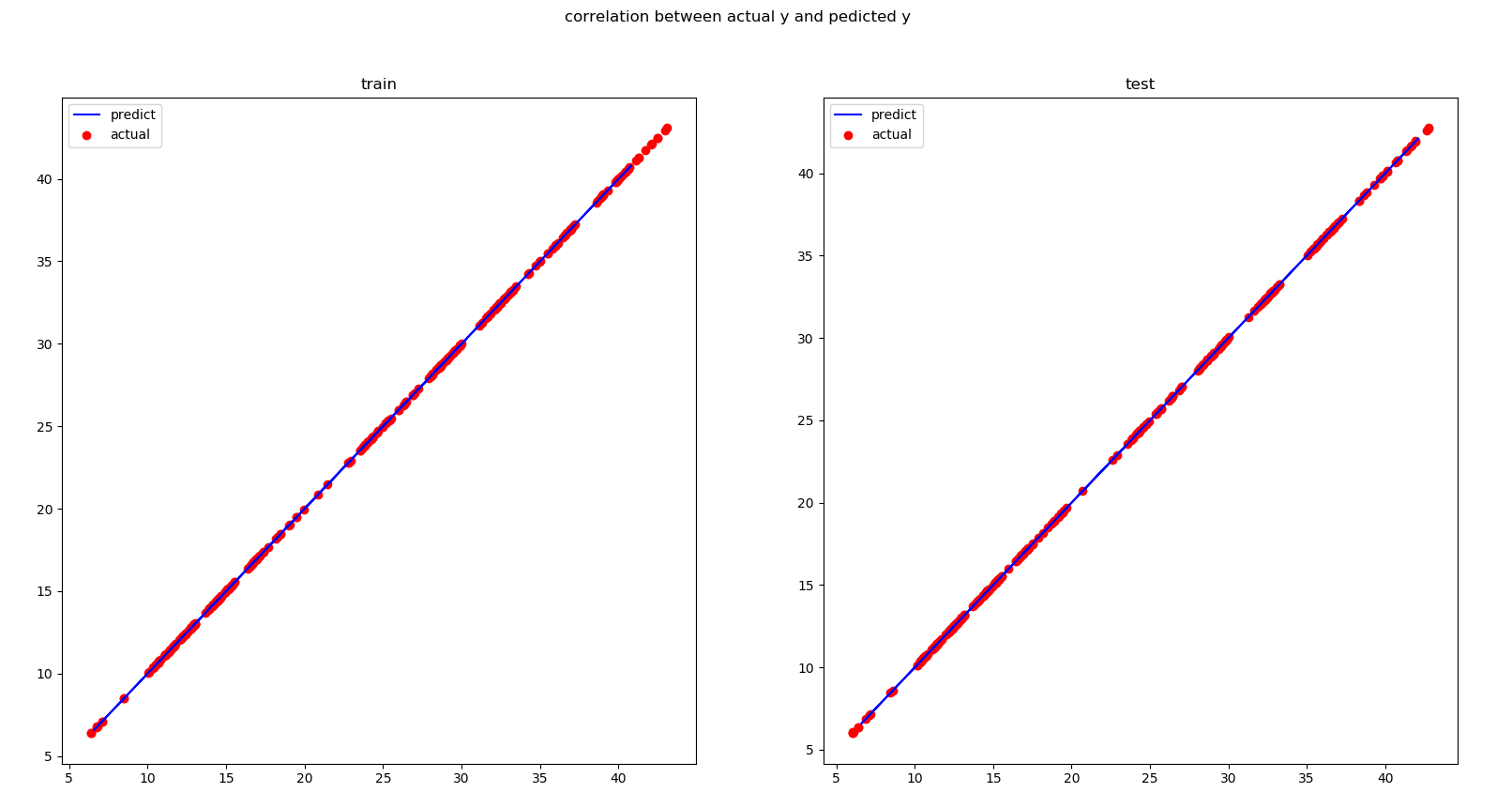




**Regression result (consider all input variable)**

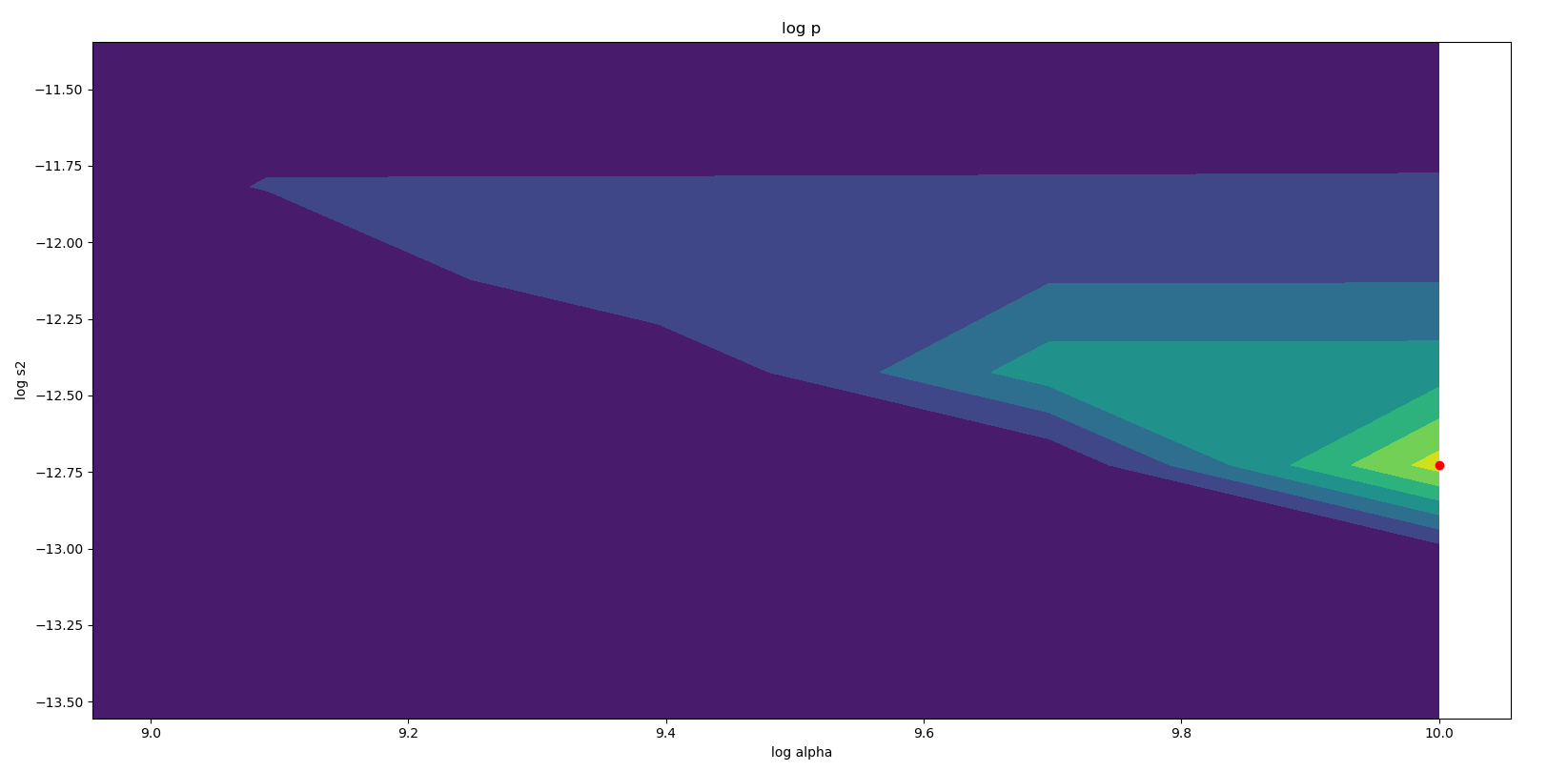
train error : 3.0115517876503612

test error : 3.0958865845448686



**Task 2**

**Type 2 maximum likelihood**



RMSE train : 3.049863814741146

RMSE test : 2.883094591217404

Best log alpha : 10.0

Best log s2 : -12.727272727272727

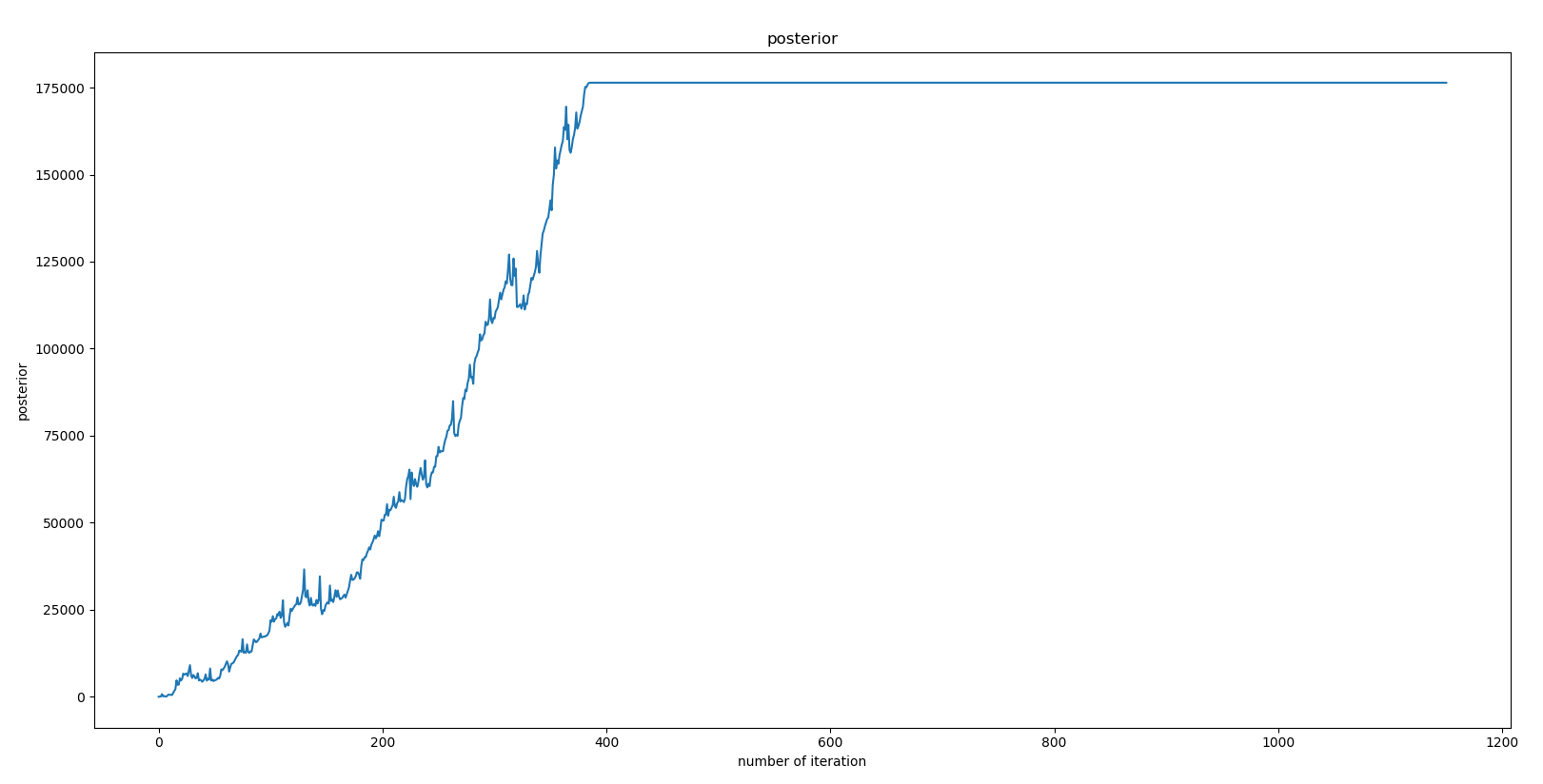
**Variational inference**

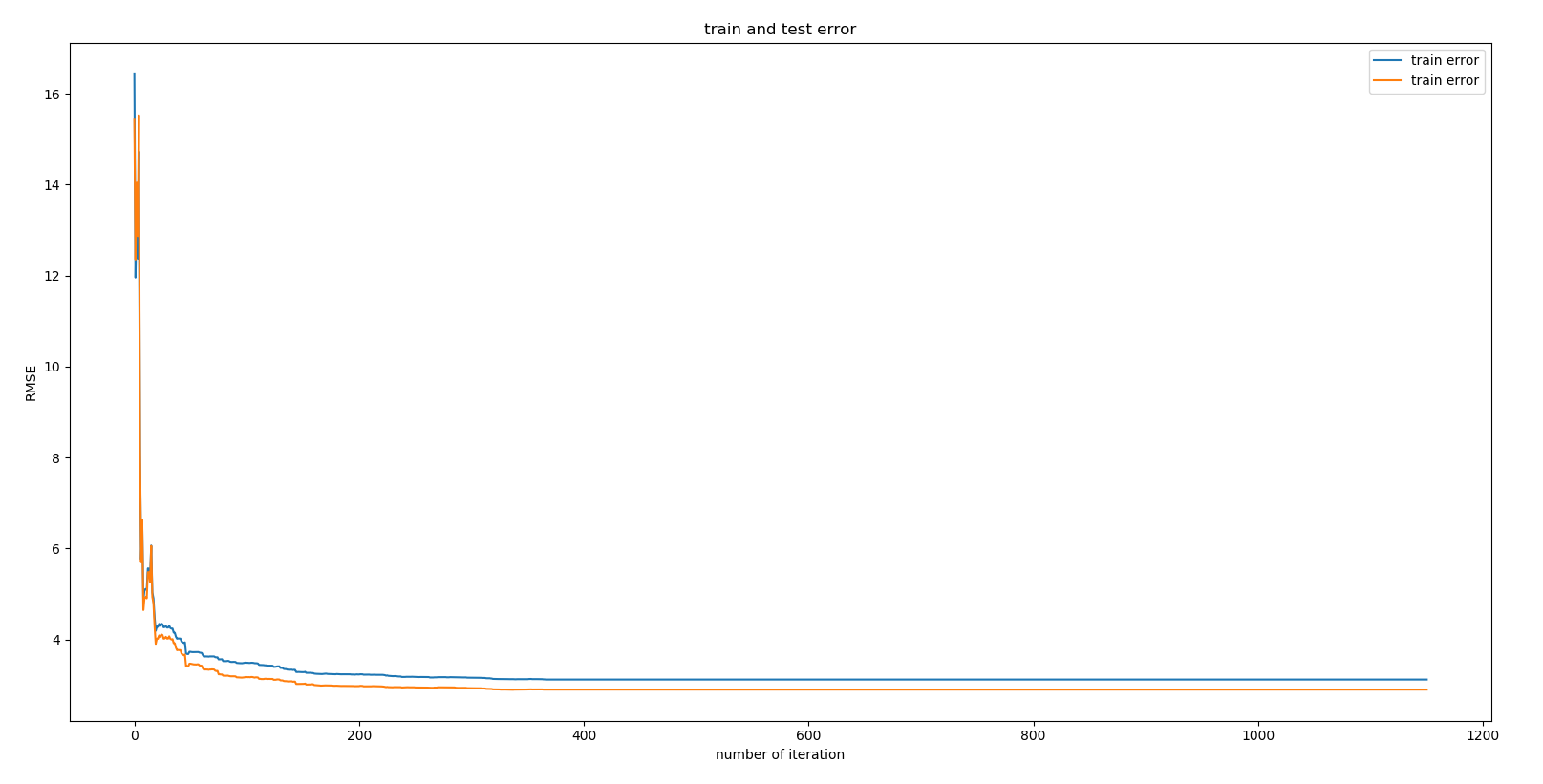
MSE train : 3.1184503170879347

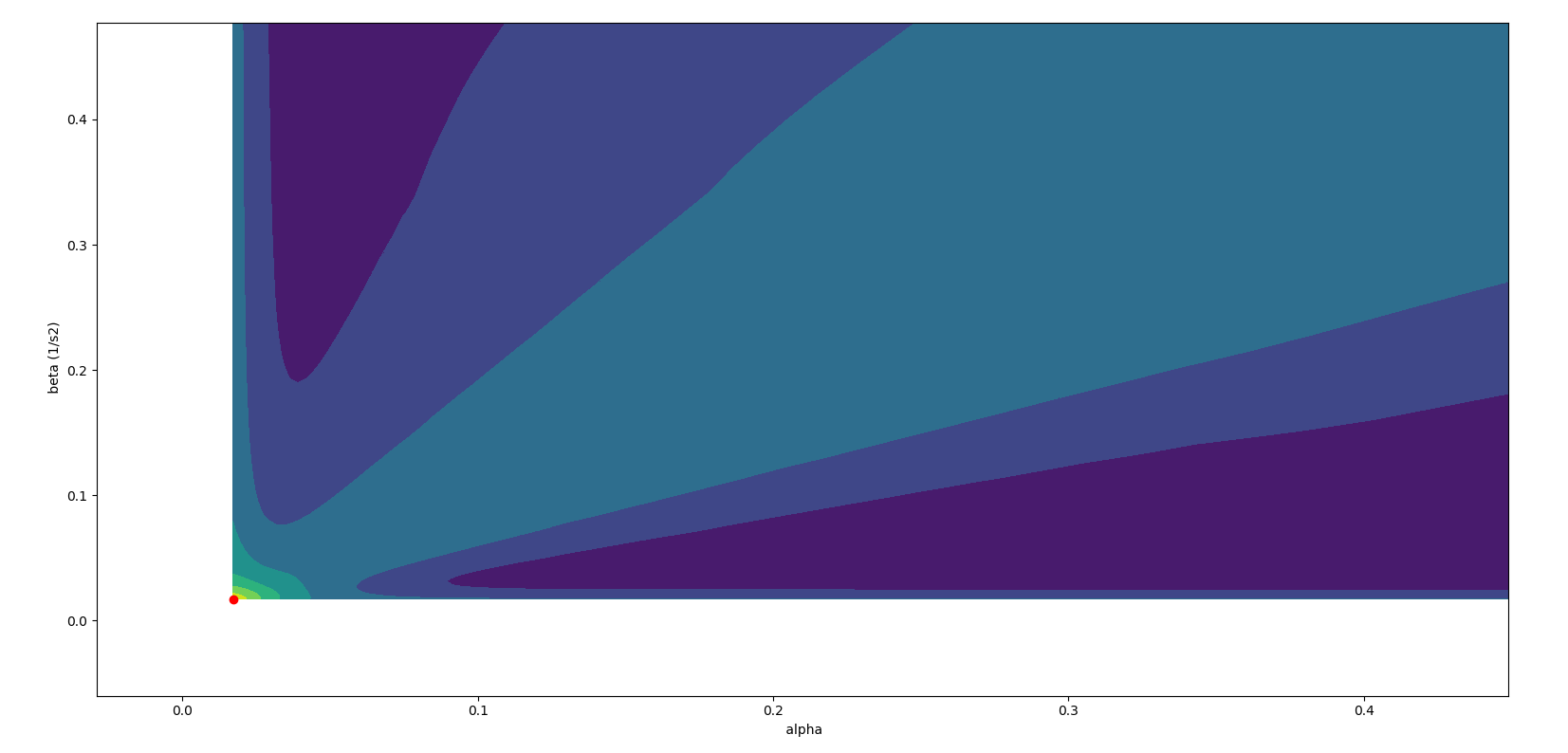
RMSE test : 2.897192908948821

Best alpha : 0.01717282815682375

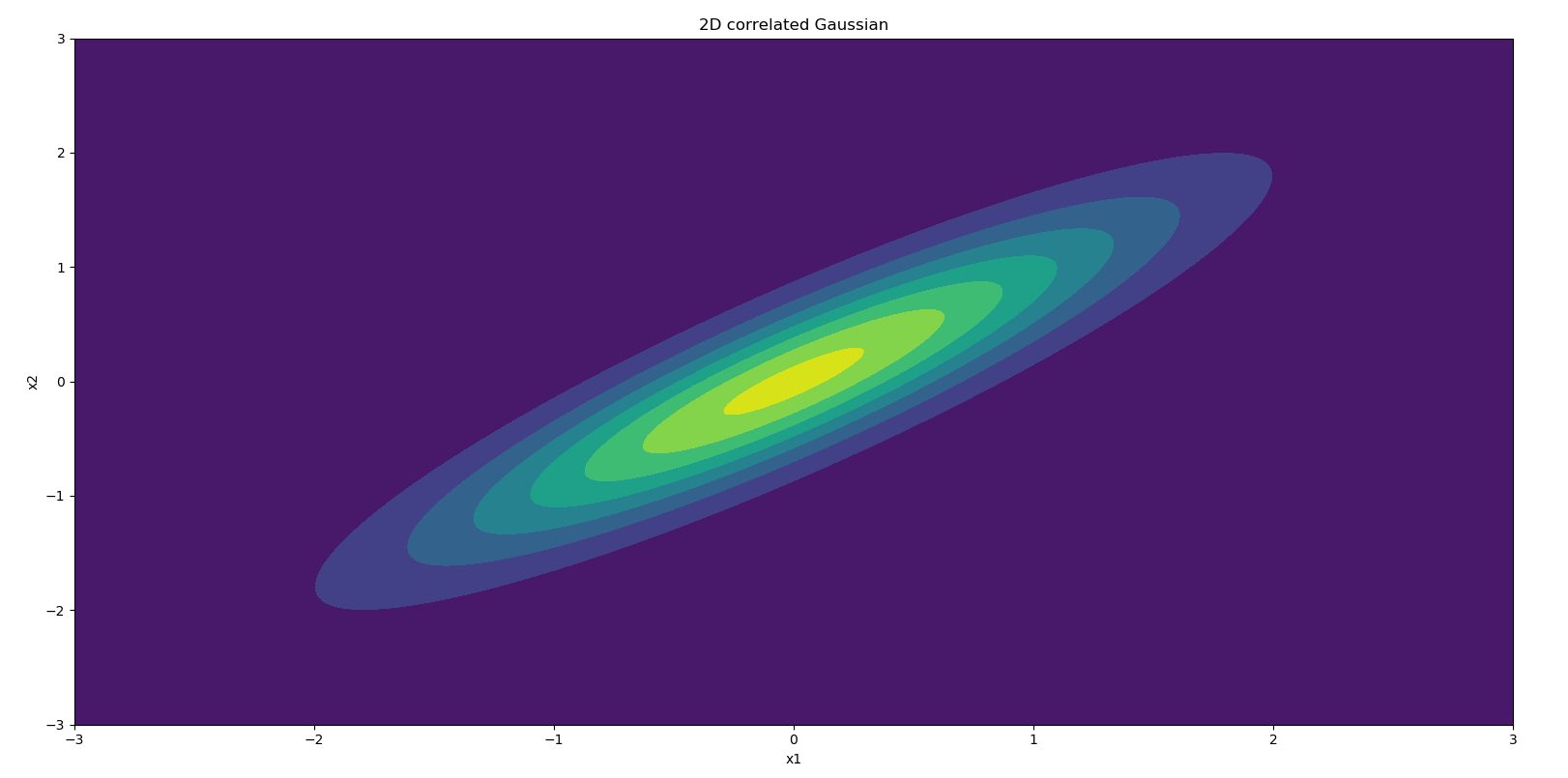
Best beta : 0.01717282815682375







**Task 3**



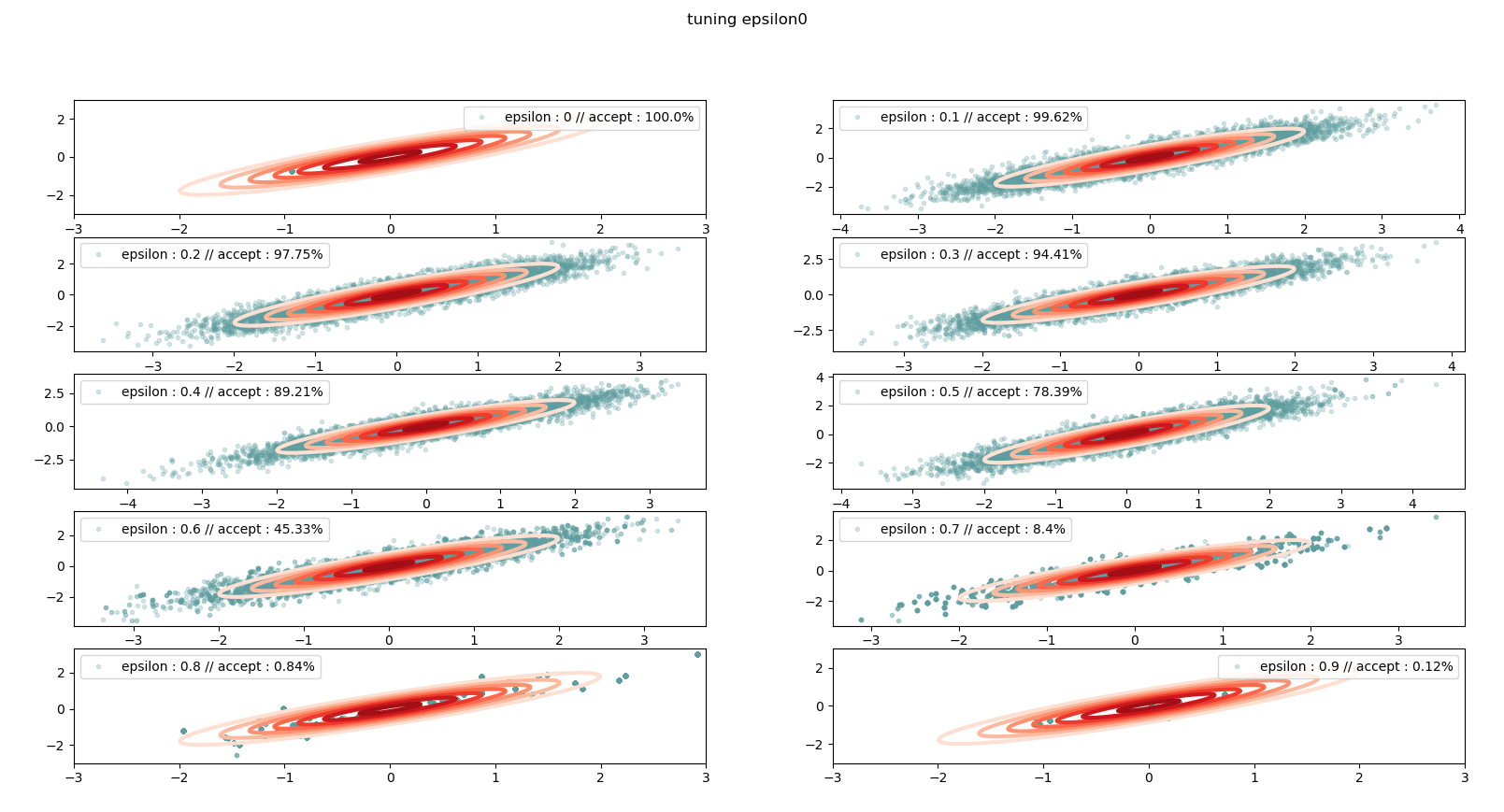
**Design of toy problem**

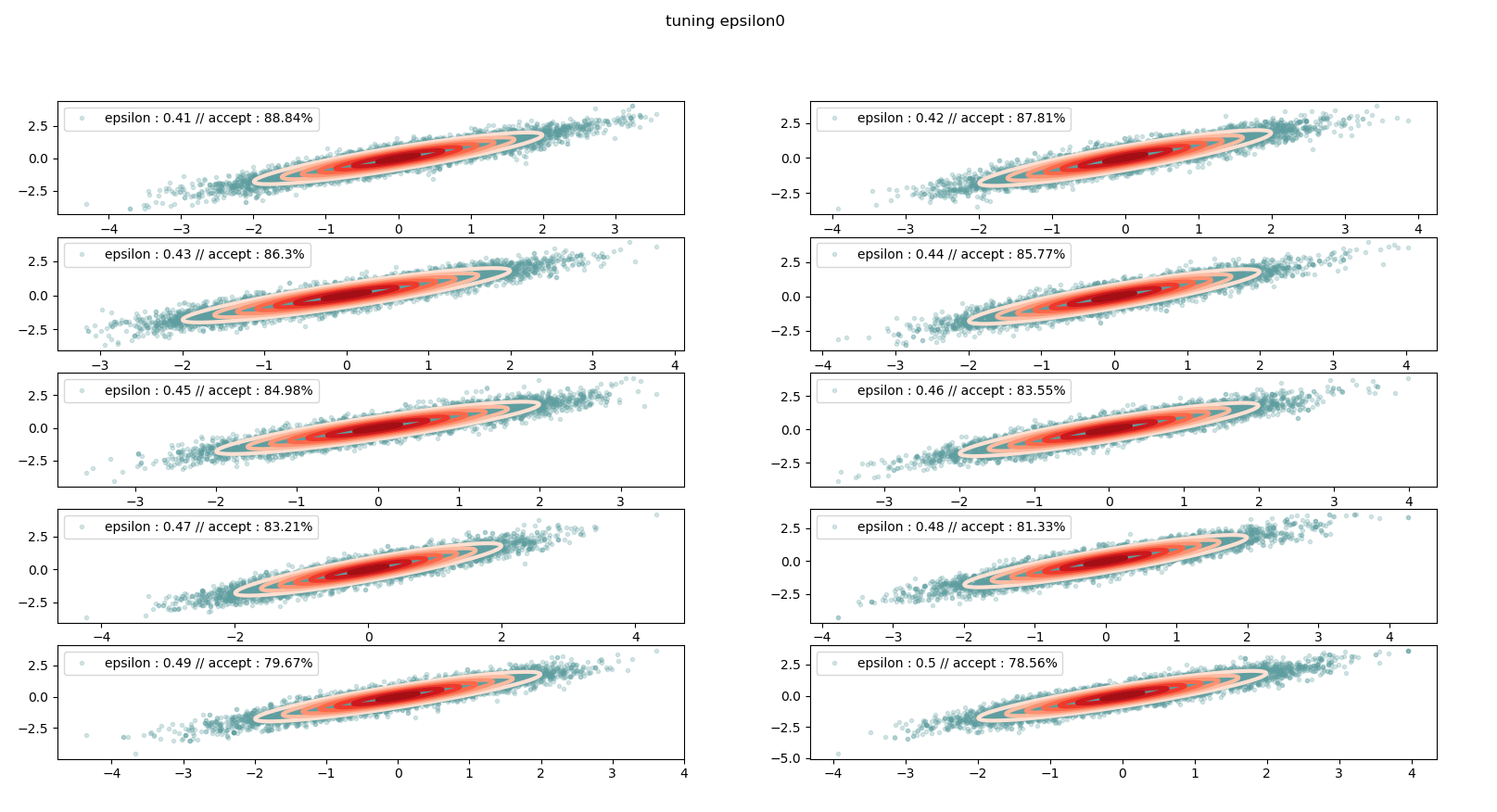
Mean and variance of both variables are 0 and 1

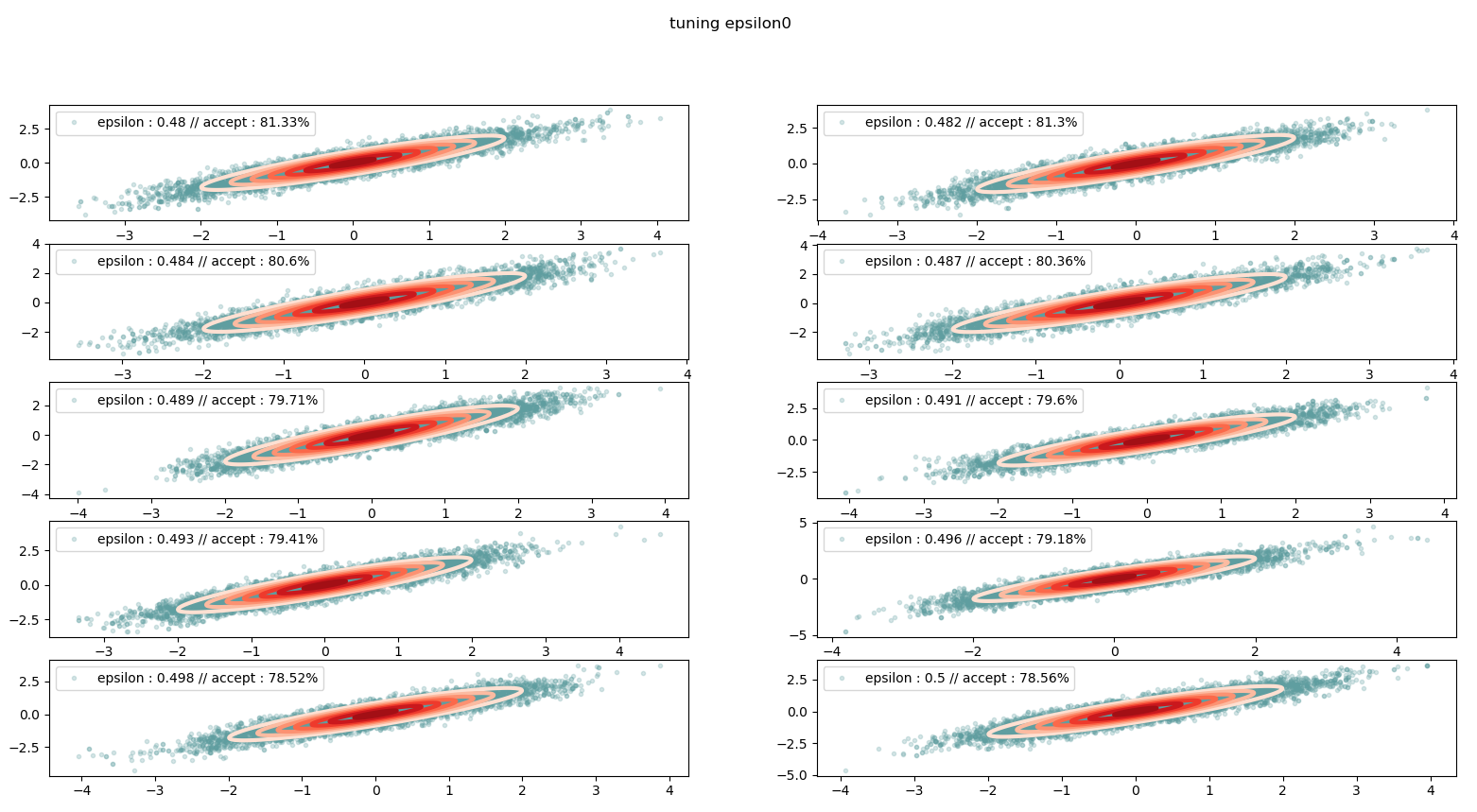
Correlation is 0.9

**Find suitable epsilon**

choose epsilon=0.487 because it is the value after this make accuracy below 0.8 for the first time







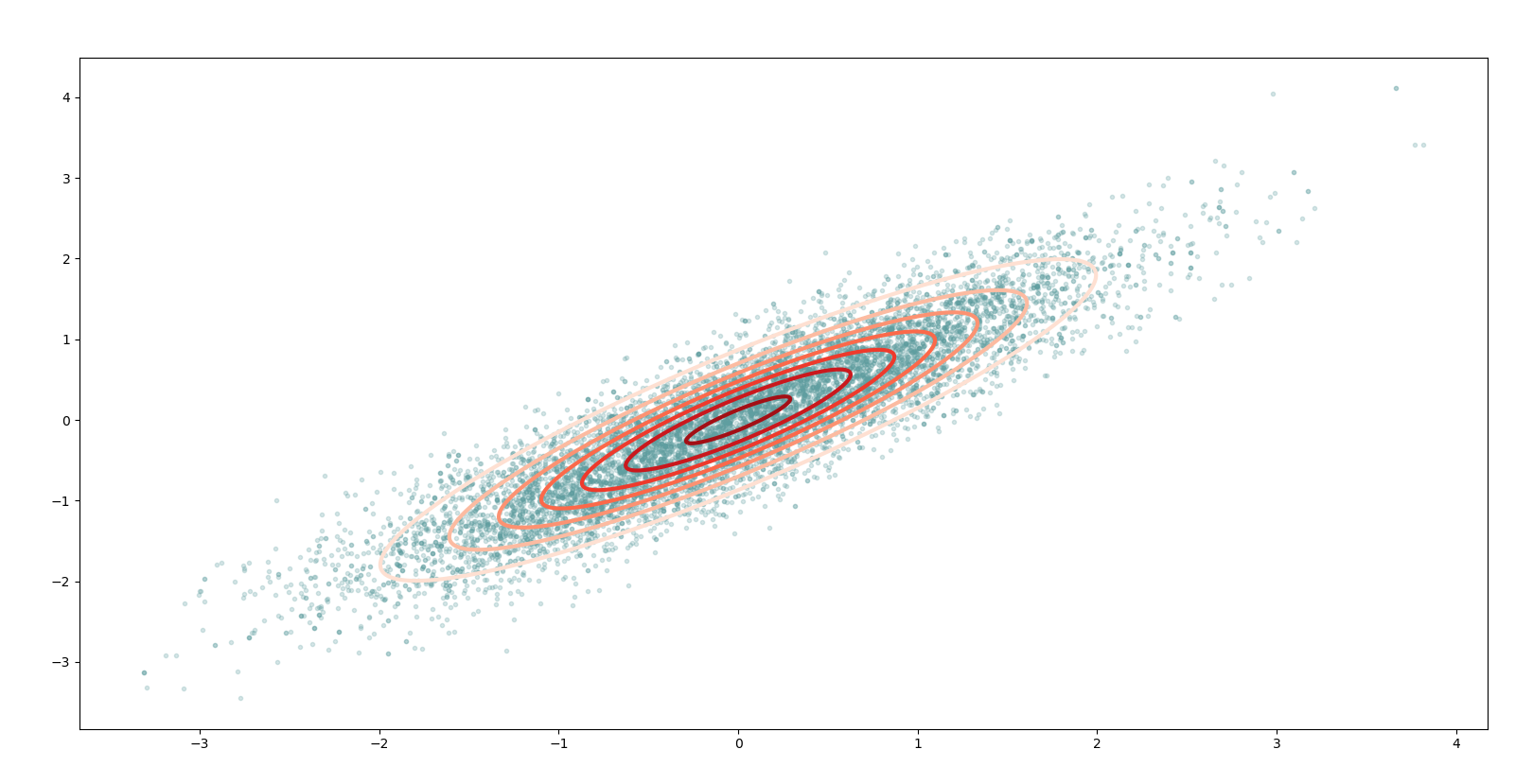
**report the values of R, L and epsilon0**

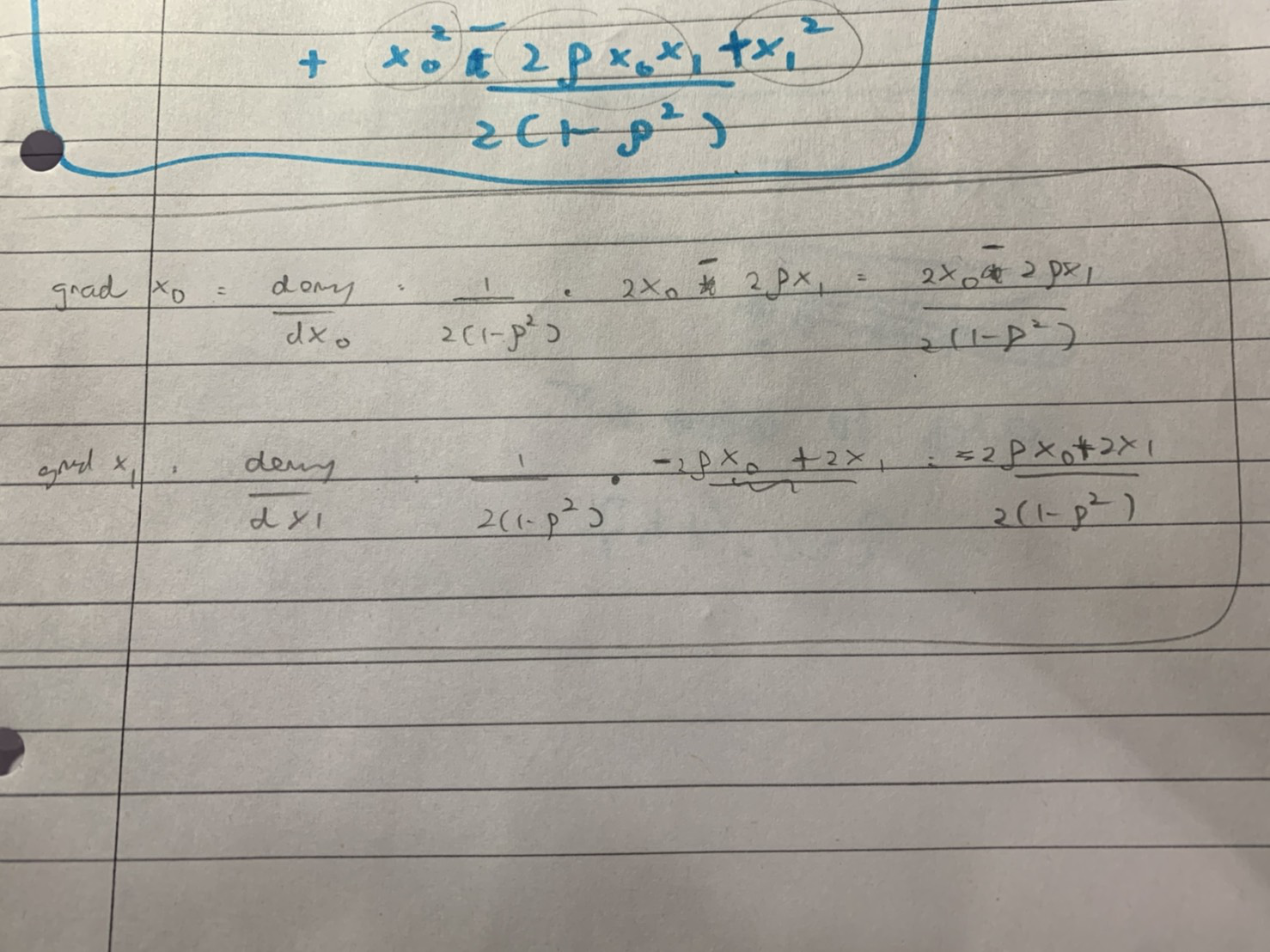
R :10000

L : 25

Epsilon0 : 0.487

**verify and demonstrate (with appropriate ﬁgures or numerical tables) that your HMC works as expected**



**report your designed functions energy\_func and energy\_grad** 

**Task 4**

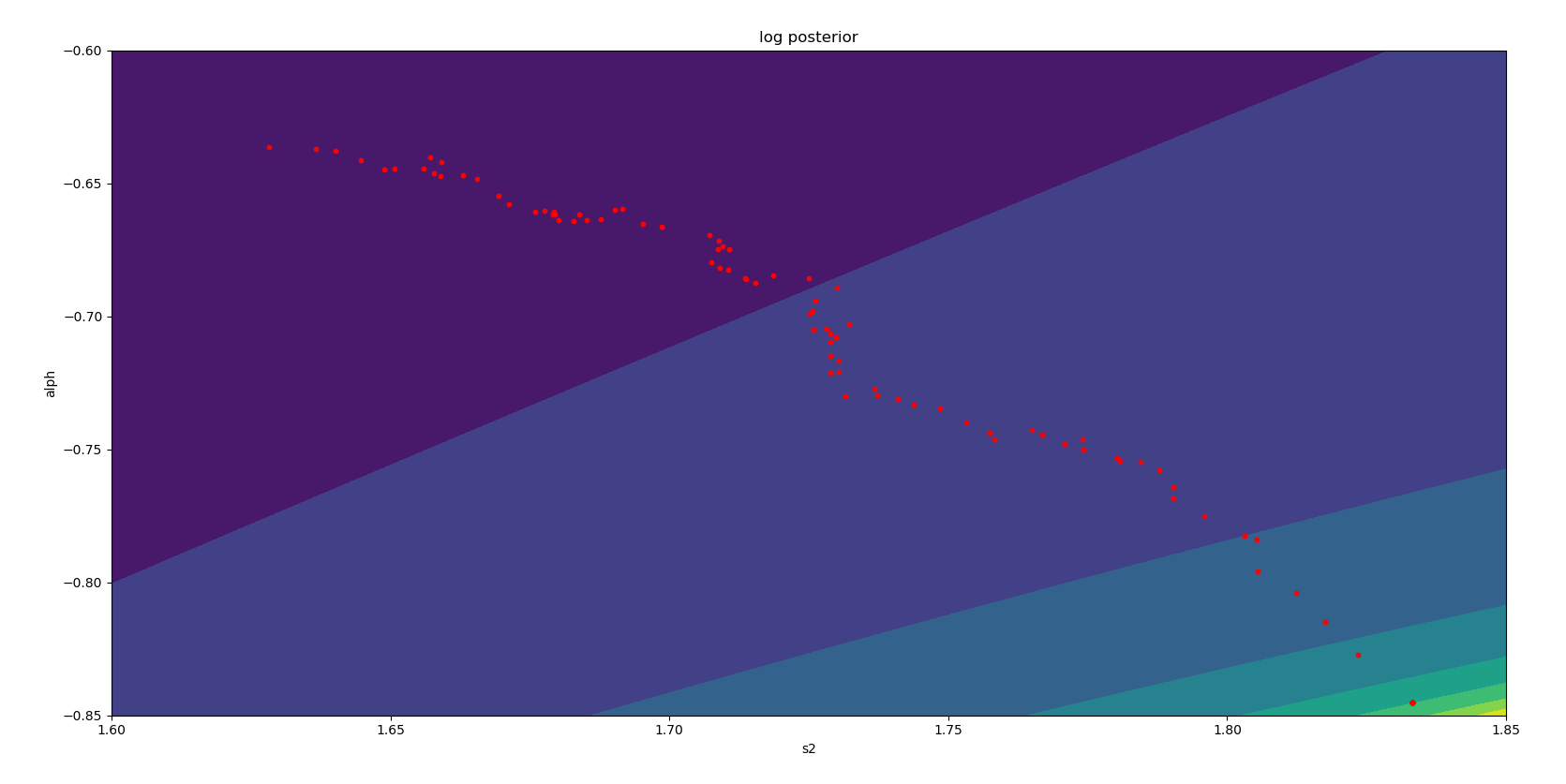
Demonstrate the accuracy of energy function

Since P(w, α,s2 | data) is proportional to P(w|data,α,s2)\* P(data | α,s2), the weight posterior, the energy is negative log of posterior that is ln (P(w, α,s2 | data)) α ln(P(w|data,α,s2))+ln( P(data | α,s2)). Assume α=5 and s2=5

|  |  |  |  |
| --- | --- | --- | --- |
|  | Coding | Stats library | Absolute difference |
| ln(P(w|data,α,s2)) | 8.405338709792451 | 8.405338709792455 | 3.55271367e-15 |
| ln(P(data | α,s2)) | -2429.4152919400444 | -2429.415291940045 | 4.5474735081e-13 |
| ln(P(w, α,s2 | data)) | -2421.009953230252 | -2421.0099532302524 | 4.54747350886e-13 |

Demonstrate the accuracy of gradient function

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Calculated | Numeric | Delta | Accuracy |
| S2 | -56.0544 | -56.0544 | -3.223275e-07 | 9 |
| α | 256.265 | 256.265 | -1.613031e-07 | 10 |



**RMSE\_train : 3.403215732248464**

**RMSE\_test : 3.5980646014154463**