UNIVERSITY
OF WOLLONGONG
IN DUBAI

Assignment Cover Sheet

Student Name	**Student number**
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Subject code and name	ECTE202 – Circuits and Systems
Lab Instructor	Ms. Eva Barbulescu
Title of Assignment	Lab 4
Lab Number	4

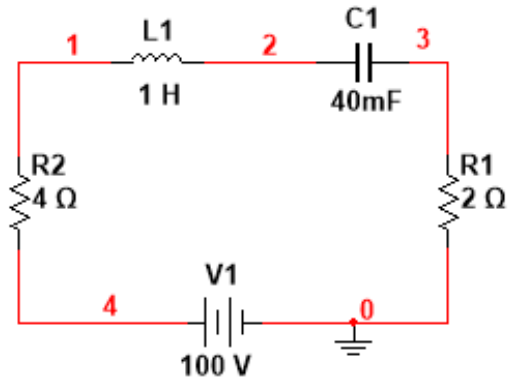
Student declaration and acknowledgment

By submitting this assignment online, the submitting student declares on behalf of the team that:

1. All team members have read the subject outline for this subject, and this assessment item meets the requirements of the subject detailed therein.
2. This assessment is entirely our work, except where we have included fully documented references to the work of others. The material in this assessment item has yet to be submitted for assessment.
3. Acknowledgement of source information is by the guidelines or referencing style specified in the subject outline.
4. All team members know the late submission policy and penalty.
5. The submitting student undertakes to communicate all feedback with the other team members.

Lab 4

Task 1: RLC Series Circuit



Voltage at stabilization (V)	100.023
Time of stabilization (s)	2.779
Number of Samples	73
Type of Graph	Underdamped

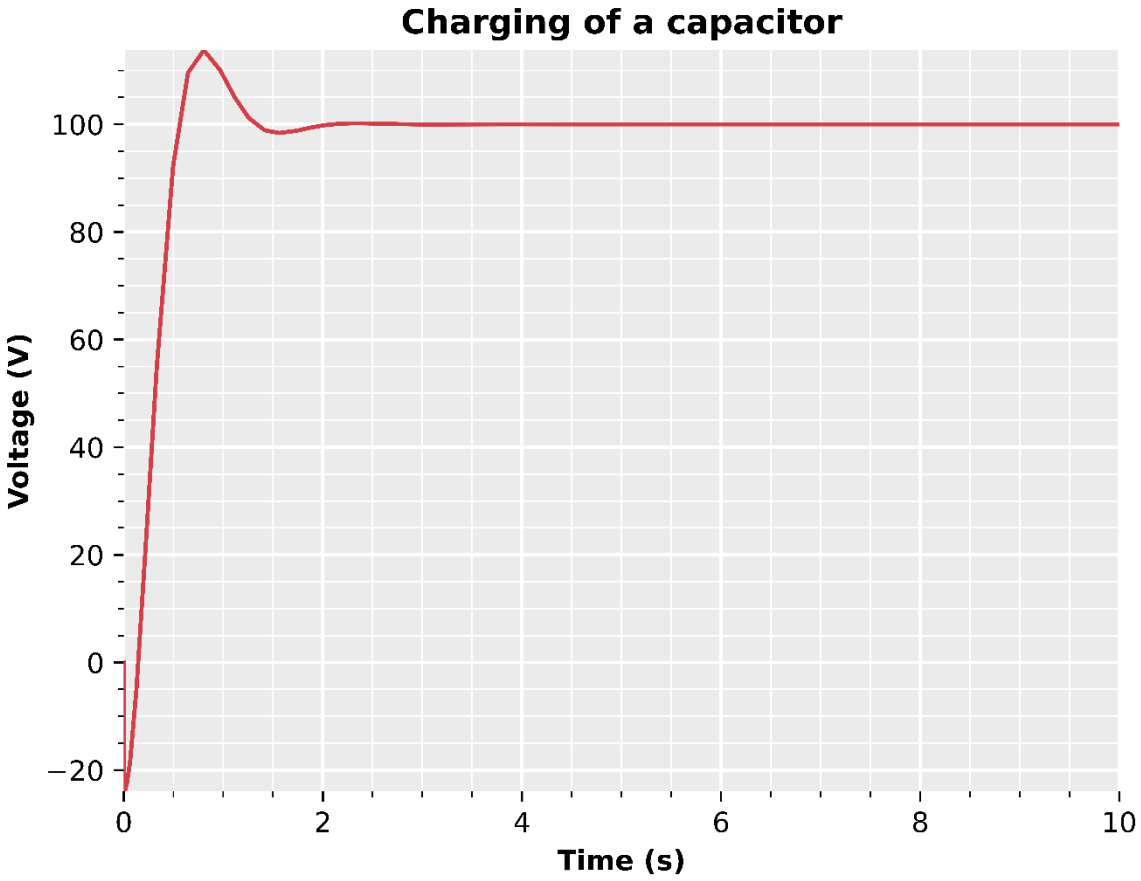
$\alpha = \frac{R}{2L}$ $\omega_0 = \frac{1}{\sqrt{LC}}$

$R = 6\ \Omega$ $L = 1\ H$ $C = 40 \times 10^{-3}\ F$

$\alpha = \frac{6}{2\times1} = 3$ $\omega_0 = \frac{1}{\sqrt{1\times40\times10^{-3}}} = 5$

$\alpha < \omega_0 \Rightarrow$ Underdamped

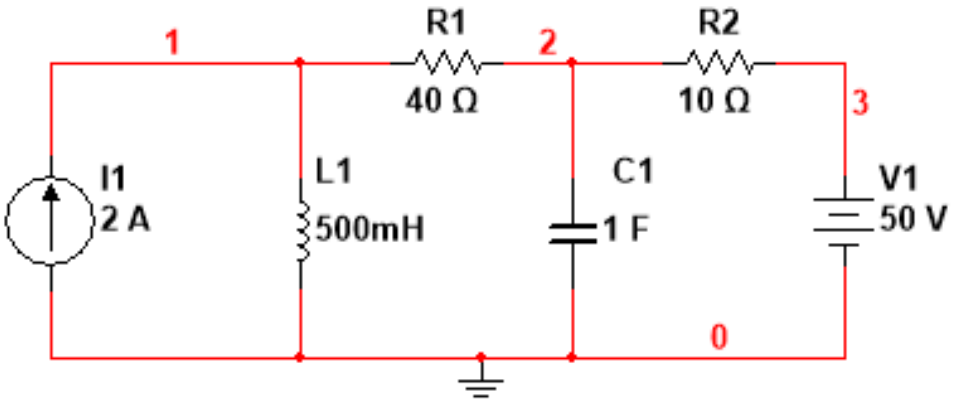
The graph shows the voltage across a capacitor during charging in an underdamped RLC circuit. The overshoot before settling indicates the system is underdamped.

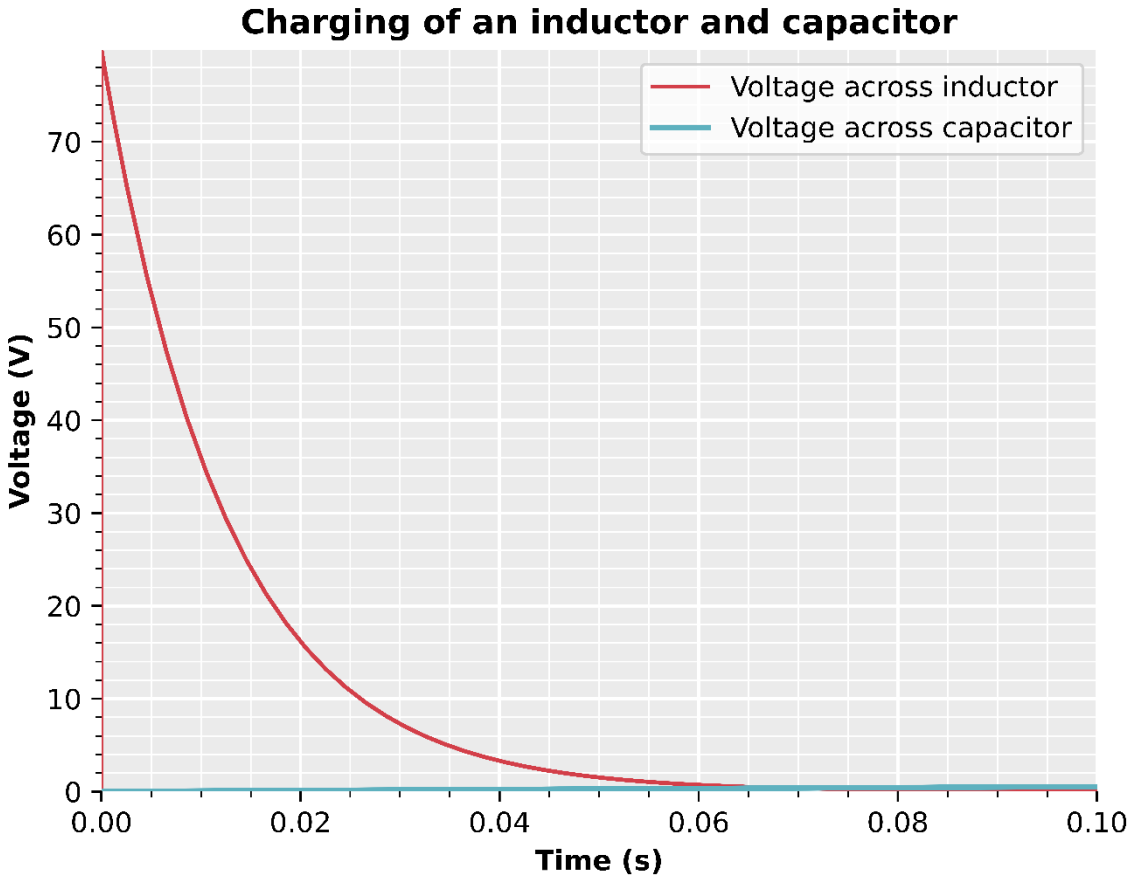

Charging of a capacitor
Voltage (V)
100
80
60
40
20
0
−20
0
2
4
6
8
10
Time (s)

Excel Values:

X--Trace 1::[V(2)-V(3)]	Y--Trace 1::[V(2)-V(3)]
0	0
0.002	-23.98774825
0.004	-23.96339243
0.008	-23.89076691
0.016	-23.60553522
0.032	-22.50958827
0.064	-18.47986594
0.128	-4.98075619
0.221439313	21.78822446
0.332307042	54.94790647
0.495732098	92.13129345
0.645659874	109.5513348
0.804892889	113.7692651
0.968197202	110.0744564
1.114534251	105.0219662
1.257122515	101.1586843
1.415501837	98.89682914
1.561950935	98.38201
1.729988423	98.77379484
1.877093567	99.37077202
2.019668385	99.83794329
2.178706449	100.1202284
2.325069829	100.1899863
2.489471129	100.1497429
2.636335918	100.0800092
2.779068363	100.0231881
2.938996565	99.98748479
3.085473741	99.97781415
3.245455176	99.98163104
...	...
8.806331622	100
8.909283858	100
9.032722772	100
9.166737869	100
9.330137781	100
9.530137781	100
9.730137781	100
9.930137781	100
10	100

Task 2: RLC Parallel Circuit





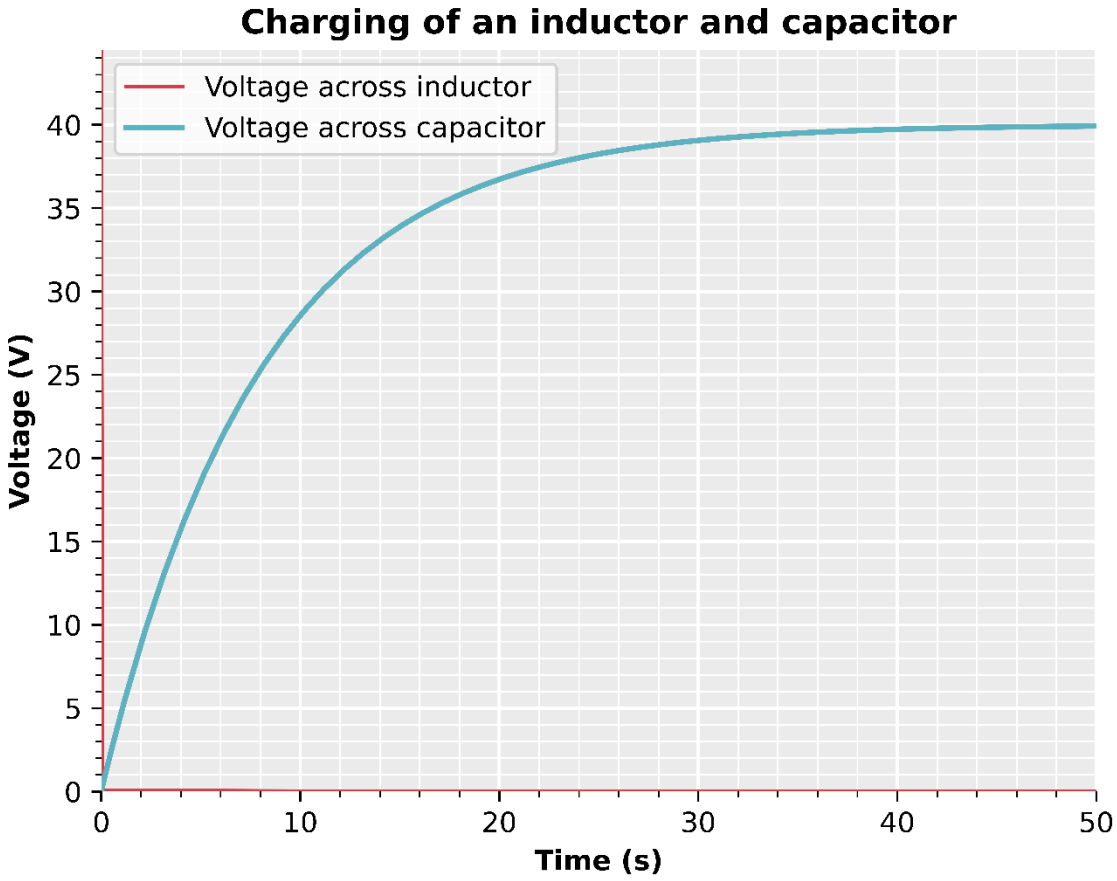
The value reached by the voltage spike is 79.872 V

The inductor voltage shows an exponential decay from its initial peak to zero, demonstrating typical overdamped or critically damped circuit behaviour. Meanwhile, the capacitor voltage stays near 0 throughout, suggesting the circuit is dominated by the inductor rather than the capacitor.

Excel Values:

X--Trace 1::[V(1)]	Y--Trace 1::[V(1)]
0	0
0.00002	79.87234418
0.00004	79.74489223
0.00008	79.49039539
0.00016	78.98383632
0.00032	77.98037929
0.00064	76.01149927
0.00128	72.22113004
0.00256	65.19407117
0.00456	55.54774621
0.00656	47.33009326
0.00856	40.32951806
0.01056	34.36576463
0.01256	29.28527392
0.01456	24.9572298
0.01656	21.27019075
0.01856	18.12922037
0.02056	15.45344285
...	...
0.06056	0.686009446
0.06256	0.593620106
0.06456	0.514911849
0.06656	0.447858431
0.06856	0.390733705
0.07056	0.342067177
0.07256	0.300606143
0.07456	0.265283428
0.07656	0.235189915
0.07856	0.20955113
0.08056	0.187707303
0.08256	0.169096381
0.08456	0.153239554
0.08656	0.139728924
0.08856	0.128217009
0.09056	0.118407787
0.09256	0.110049081
0.09456	0.102926061
0.09656	0.096855718
0.09856	0.091682143
0.1	0.088440225

X--Trace 2::[V(2)]	Y--Trace 2::[V(2)]
0	0
0.00002	0.000139936
0.00004	0.000279808
0.00008	0.000559423
0.00016	0.001117889
0.00032	0.002231784
0.00064	0.004447618
0.00128	0.008832948
0.00256	0.01742949
0.00456	0.030442051
0.00656	0.043004816
0.00856	0.055184033
0.01056	0.067036138
0.01256	0.078609208
0.01456	0.089944201
0.01656	0.101076009
0.01856	0.112034356
0.02056	0.122844563
...	...
0.06056	0.326394364
0.06256	0.336343513
0.06456	0.346285897
0.06656	0.356222153
0.06856	0.366152821
0.07056	0.376078362
0.07256	0.385999169
0.07456	0.395915577
0.07656	0.405827871
0.07856	0.415736294
0.08056	0.425641054
0.08256	0.435542326
0.08456	0.445440261
0.08656	0.455334989
0.08856	0.465226617
0.09056	0.47511524
0.09256	0.485000937
0.09456	0.494883776
0.09656	0.504763814
0.09856	0.514641102
0.1	0.521751069



Voltage across the capacitor follows an exponential rise, characteristic of an RLC circuit, where the capacitor gradually charges and asymptotically approaches its final voltage.

Voltage across the inductor initially spikes up before dropping to zero, which is expected as the inductor resists sudden changes in current and then settles to a steady state where it behaves as a short circuit.

$R_{eq} = \frac{40\times10}{40+10}$ $R_{eq} = \frac{400}{50} = 8\,\Omega$

$C = 1\ F$ $L = 500\ mH = 0.5\ H$

$\alpha = \frac{1}{2RC}$ $\alpha = \frac{1}{2\times8\times1}$ $\alpha = \frac{1}{16} = 0.0625$

$\omega_0 = \frac{1}{\sqrt{LC}}$ $\omega_0 = \frac{1}{\sqrt{(0.5\times1)}}$ $\omega_0 = \sqrt{2} = 1.414$

$\omega_0 > \alpha \Rightarrow$ Underdamped

Steady state value of capacitor's voltage = V(τ)

τ = RC = 8 × 1 = 8 s

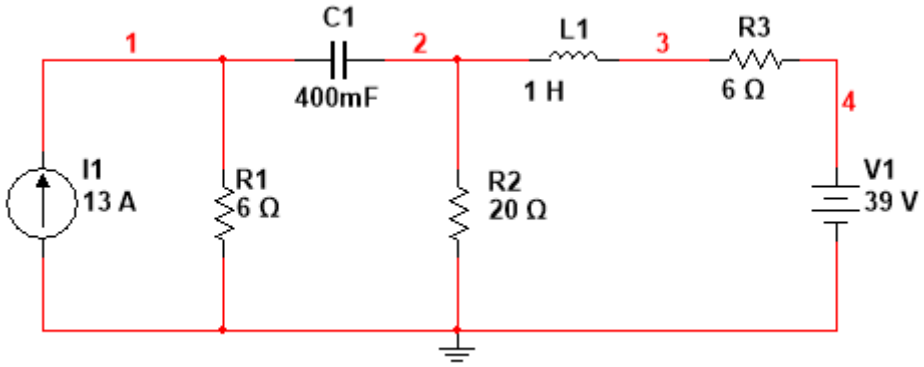
V(5τ) = 39.74 V

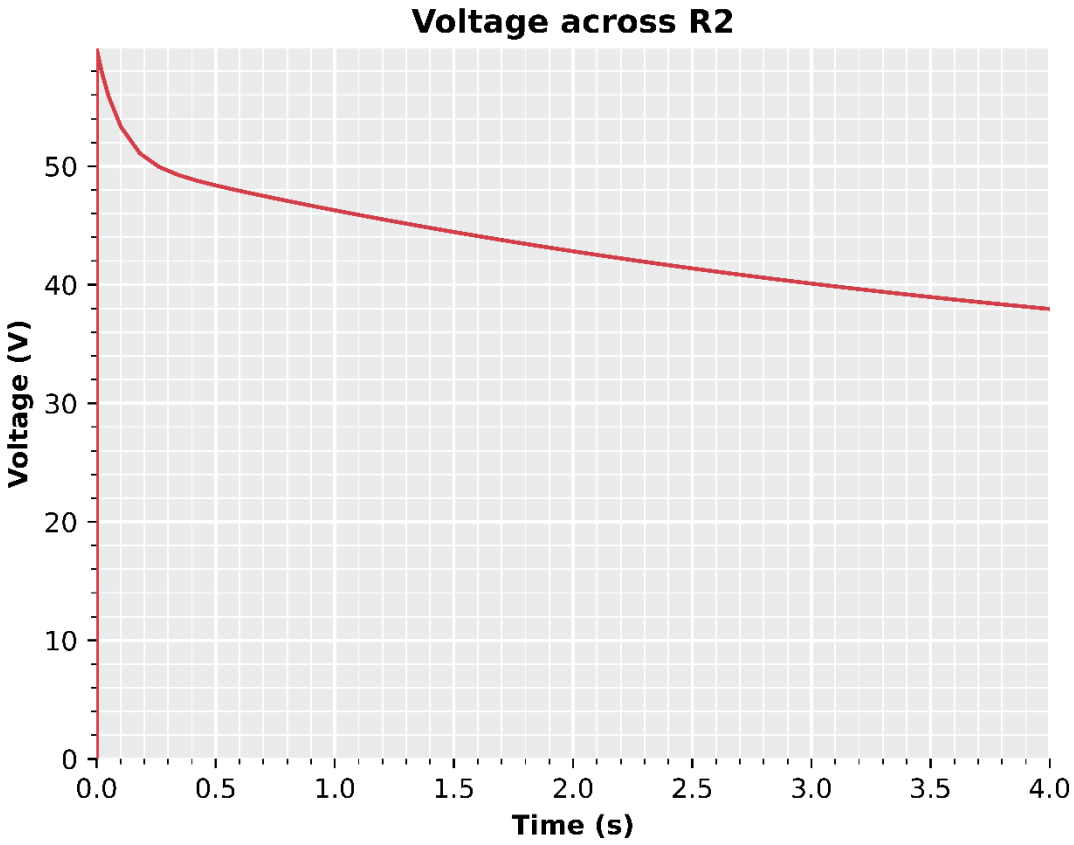
Excel Values:

X--Trace 1::[V(1)]	Y--Trace 1::[V(1)]
0	0
0.01	44.47839692
0.010981986	41.24421991
0.012945957	35.24686386
0.0168739	25.69451945
0.024729786	13.44012451
0.040441558	3.116464051
0.058259758	0.575026141
0.084283154	0.05191927
0.119371927	0.063564155
0.189549473	0.060502463
0.329904566	0.060819829
...	...
25.17203512	0.003103946
26.17203512	0.002534737
27.17203512	0.002499312
28.17203512	0.002024034
29.17203512	0.002027044
30.17203512	0.001627952
31.17203512	0.00165797
32.17203512	0.001320959
33.17203512	0.001369367
34.17203512	0.00108319
35.17203512	0.001143531
36.17203512	0.000899196
37.17203512	0.00096667
38.17203512	0.00075696
39.17203512	0.000828035
40.17203512	0.000647136
41.17203512	0.000719248
42.17203512	0.000562459
43.17203512	0.00063378
44.17203512	0.00049728
45.17203512	0.00056654
46.17203512	0.000447209
47.17203512	0.000513557
48.17203512	0.000408836
49.17203512	0.000471734
50	0.000382448

X--Trace 2::[V(2)]	Y--Trace 2::[V(2)]
0	0
0.01	0.061043295
0.010981986	0.066957536
0.012945957	0.078637351
0.0168739	0.101225088
0.024729786	0.144226969
0.040441558	0.225674257
0.058259758	0.314985357
0.084283154	0.444071696
0.119371927	0.617238709
0.189549473	0.9613116
0.329904566	1.640476528
...	...
25.17203512	38.28950844
26.17203512	38.49080908
27.17203512	38.66842018
28.17203512	38.82512984
29.17203512	38.96339752
30.17203512	39.08539375
31.17203512	39.19303315
32.17203512	39.28800547
33.17203512	39.37180118
34.17203512	39.44573578
35.17203512	39.51096953
36.17203512	39.56852656
37.17203512	39.61931009
38.17203512	39.66411742
39.17203512	39.70365166
40.17203512	39.73853353
41.17203512	39.76931036
42.17203512	39.7964654
43.17203512	39.82042472
44.17203512	39.84156453
45.17203512	39.86021651
46.17203512	39.87667356
47.17203512	39.89119385
48.17203512	39.90400543
49.17203512	39.91530927
50	39.92365153

Task 3: RLC Series–Parallel Circuit





Initial Voltage Value: 59.92 V

The voltage keeps decreasing across R2.

Excel Values:

X--Trace 1::[V(2)]	Y--Trace 1::[V(2)]
0	0
0.0008	59.91849671
0.0016	59.83763858
0.0032	59.67720192
0.0064	59.36387987
0.0128	58.76621791
0.0256	57.67773087
0.0512	55.86504282
0.1024	53.31230843
0.1824	51.0733129
0.2624	49.93834999
0.3424	49.25964121
0.4224	48.77182662
0.5024	48.36615799
0.5824	47.99802502
0.6624	47.649085
0.7424	47.31175381
0.8224	46.98285466
0.9024	46.661017
0.9824	46.34561129
...	...
2.5824	41.15620063
2.6624	40.94516429
2.7424	40.73811999
2.8224	40.5349922
2.9024	40.33570684
2.9824	40.14019122
3.0624	39.94837404
3.1424	39.76018533
3.2224	39.57555645
3.3024	39.39442007
3.3824	39.21671013
3.4624	39.0423618
3.5424	38.8713115
3.6224	38.70349683
3.7024	38.53885661
3.7824	38.37733077
3.8624	38.2188604
3.9424	38.0633877
4	37.95327325