
```

output = '##p: 4\n##id: yw\n';
% Q1 and Q2
data = readmatrix('P4Q1.txt');
poly = polyfit(data(1,:), data(2,:), 11)
curve = [0:0.01:1; polyval(poly, 0:0.01:1)]
plot(data(1,:), data(2,:), 'o', curve(1,:), curve(2,:))
snapnow
output = [output '##1: ' mat2str(poly) '\n'];
output = [output '##2: ' mat2str(curve) '\n'];
% Q3 and Q4
data = readmatrix('P4Q3.txt');
poly = spline(data(1,:), data(2,:)).coefs
curve = [0:0.01:1; spline(data(1,:), data(2,:), 0:0.01:1)]
plot(data(1,:), data(2,:), 'o', curve(1,:), curve(2,:))
snapnow
output = [output '##3: ' mat2str(poly) '\n'];
output = [output '##4: ' mat2str(curve) '\n'];
% Q5 and Q6
data = readmatrix('P4Q5.txt');
poly = polyfit(data(1,:), data(2,:), 7)
curve = [0:0.01:1; polyval(poly, 0:0.01:1)]
plot(data(1,:), data(2,:), 'o', curve(1,:), curve(2,:))
snapnow
output = [output '##5: ' mat2str(poly) '\n'];
output = [output '##6: ' mat2str(curve) '\n'];
% Q7
reshape(make(3, 3) \ [-13 / 3; zeros(3 * 3 - 2, 1); 2 / 3], [3, 3])
output = [output '##7: ' mat2str(ans) '\n'];
% Q8
reshape(make(6, 6) \ [3 / 3; zeros(6 * 6 - 2, 1); 9 / 3], [6, 6])
output = [output '##8: ' mat2str(ans) '\n'];
% Q9
reshape(make(13, 13) \ [-15 / 3; zeros(13 * 13 - 2, 1); 0 / 3], [13, 13])
output = [output '##9: ' mat2str(ans) '\n'];
% Q10 and write to file
output = [output '##10: None'];
file = fopen('P4.txt', 'wt');
fprintf(file, output);
fclose(file);
% Helper Function
function coef = make(n, m)
    [x, y] = meshgrid(1:(n * m), 1:(n * m));
    coef = abs(mod(x - 1, m) - mod(y - 1, m)) + abs(floor((x - 1) / n) -
    floor((y - 1) / n)) == 1;
    coef = -coef ./ (sum(coef, 2) + [1; zeros(n * m - 2, 1); 1]);
    coef = coef + diag(ones(1, n * m));
end

poly =

    1.0e+03 *

```

Columns 1 through 7

0.6407 -2.9084 4.4078 -1.5204 -1.5656 -0.0627 1.4631

Columns 8 through 12

0.0090 -0.5091 0.0002 0.0522 -0.0000

curve =

Columns 1 through 7

0 0.0100 0.0200 0.0300 0.0400 0.0500 0.0600
-0.0000 0.5216 1.0401 1.5526 2.0561 2.5475 3.0242

Columns 8 through 14

0.0700 0.0800 0.0900 0.1000 0.1100 0.1200 0.1300
3.4832 3.9220 4.3379 4.7285 5.0916 5.4249 5.7267

Columns 15 through 21

0.1400 0.1500 0.1600 0.1700 0.1800 0.1900 0.2000
5.9952 6.2286 6.4258 6.5856 6.7070 6.7893 6.8321

Columns 22 through 28

0.2100 0.2200 0.2300 0.2400 0.2500 0.2600 0.2700
6.8350 6.7981 6.7217 6.6060 6.4519 6.2602 6.0320

Columns 29 through 35

0.2800 0.2900 0.3000 0.3100 0.3200 0.3300 0.3400
5.7687 5.4717 5.1429 4.7841 4.3975 3.9852 3.5497

Columns 36 through 42

0.3500 0.3600 0.3700 0.3800 0.3900 0.4000 0.4100
3.0936 2.6194 2.1299 1.6281 1.1167 0.5989 0.0775

Columns 43 through 49

0.4200 0.4300 0.4400 0.4500 0.4600 0.4700 0.4800
-0.4443 -0.9635 -1.4771 -1.9820 -2.4755 -2.9545 -3.4163

Columns 50 through 56

0.4900 0.5000 0.5100 0.5200 0.5300 0.5400 0.5500
-3.8582 -4.2777 -4.6722 -5.0395 -5.3774 -5.6840 -5.9575

Columns 57 through 63

0.5600 0.5700 0.5800 0.5900 0.6000 0.6100 0.6200

-6.1962 -6.3989 -6.5643 -6.6914 -6.7796 -6.8282 -6.8371

Columns 64 through 70

0.6300 0.6400 0.6500 0.6600 0.6700 0.6800 0.6900
-6.8061 -6.7355 -6.6257 -6.4772 -6.2910 -6.0682 -5.8100

Columns 71 through 77

0.7000 0.7100 0.7200 0.7300 0.7400 0.7500 0.7600
-5.5179 -5.1937 -4.8393 -4.4566 -4.0480 -3.6158 -3.1626

Columns 78 through 84

0.7700 0.7800 0.7900 0.8000 0.8100 0.8200 0.8300
-2.6909 -2.2035 -1.7033 -1.1932 -0.6761 -0.1551 0.3669

Columns 85 through 91

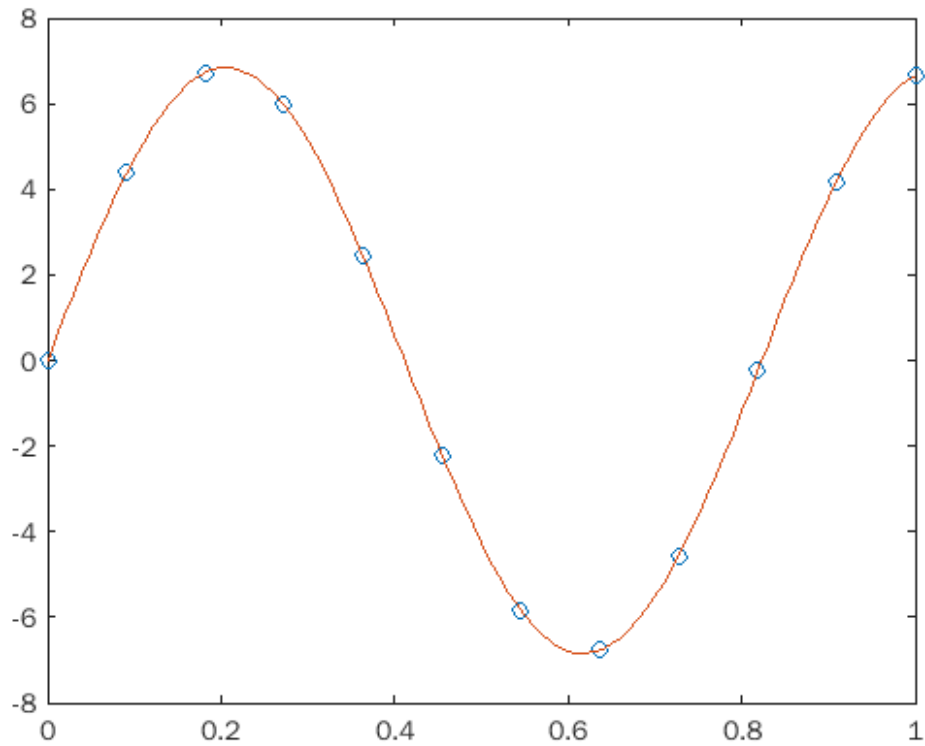
0.8400 0.8500 0.8600 0.8700 0.8800 0.8900 0.9000
0.8867 1.4013 1.9078 2.4032 2.8845 3.3490 3.7940

Columns 92 through 98

0.9100 0.9200 0.9300 0.9400 0.9500 0.9600 0.9700
4.2169 4.6151 4.9865 5.3288 5.6400 5.9183 6.1622

Columns 99 through 101

0.9800 0.9900 1.0000
6.3704 6.5416 6.6750



`poly =`

```

-792.8851  -1.5286  37.3934  0
-792.8851  -38.1599  36.7822  0.5726
-772.3624  -74.7912  35.0427  1.1271
-653.5888  -110.4743  32.1897  1.6462
-596.2046  -140.4741  28.3502  2.1105
-460.7731  -168.0187  23.5994  2.5116
-326.1110  -189.3064  18.0966  2.8335
-206.1627  -204.3728  12.0339  3.0661
 -53.9704  -213.8975   5.5925  3.2022
 104.3415  -216.3909  -1.0339  3.2374
 232.5114  -211.6016  -7.5822  3.1713
 389.0515  -200.8596  -13.9341  3.0052
 483.8454  -182.8854  -19.8438  2.7444
 632.6366  -160.5318  -25.1324  2.3972
 681.9455  -131.3039  -29.6267  1.9744
 774.0032  -99.7981  -33.1856  1.4895
 819.3110  -64.0391  -35.7087  0.9576
 821.4491  -26.4327  -37.0929  0.3992
 831.4930   11.5182  -37.3226  -0.1753
 781.0289   49.9332  -36.3763  -0.7443
 726.4189   86.0167  -34.2826  -1.2898
 666.7594  119.5773  -31.1165  -1.7947
 522.6631  150.3816  -26.9591  -2.2431

```

437.6164	174.3718	-21.9904	-2.6185
301.3248	194.5897	-16.3084	-2.9142
136.8025	208.5109	-10.1007	-3.1181
27.6340	214.8312	-3.5812	-3.2237
-165.1978	216.1078	3.0553	-3.2278
-270.3919	208.4757	9.5939	-3.1301
-408.3564	195.9836	15.8225	-2.9339
-558.6161	177.2400	21.5329	-2.6474
-620.8280	151.4320	26.5944	-2.2758
-736.5502	122.7497	30.8168	-1.8326
-786.4353	88.7211	34.0735	-1.3316
-799.7359	52.3878	36.2465	-0.7887
-856.5601	15.4400	37.2911	-0.2210
-802.9041	-23.8761	37.1620	0.3501
-770.2053	-60.9703	35.8554	0.9138
-716.1612	-96.5538	33.4295	1.4487
-609.0929	-129.6404	29.9461	1.9380
-516.4243	-157.7805	25.5198	2.3662
-391.8009	-181.6393	20.2928	2.7199
-240.4785	-199.7405	14.4195	2.9879
-122.0592	-210.7785	8.1386	3.1609
56.2417	-216.4176	1.5598	3.2358
170.8951	-213.8192	-5.0659	3.2087
328.0086	-205.9239	-11.5299	3.0806
461.0702	-190.7699	-17.6390	2.8554
566.0323	-169.4685	-23.1867	2.5402
668.9815	-143.4876	-27.9749	2.1478
750.9145	-112.5806	-31.9184	1.6854
790.3456	-77.8884	-34.8516	1.1699
824.4910	-41.3744	-36.6882	0.6176
840.1403	-3.2829	-37.3760	0.0458
798.1582	35.5316	-36.8793	-0.5275
745.9919	72.4065	-35.2171	-1.0841
701.4694	106.6475	-32.4776	-1.6033
576.4103	139.0554	-28.6937	-2.0756
470.1846	165.6855	-24.0007	-2.4824
363.0199	187.4081	-18.5631	-2.8110
186.0171	204.1796	-12.5326	-3.0511
83.3936	212.7736	-6.1116	-3.1950
-87.7508	216.6013	0.4579	-3.2384
-256.2526	212.5473	7.0668	-3.1803
-256.2526	200.7084	13.4309	-3.0220

curve =

Columns 1 through 7

0	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600
0	0.3730	0.7409	1.0990	1.4426	1.7669	2.0677

Columns 8 through 14

0.0700	0.0800	0.0900	0.1000	0.1100	0.1200	0.1300
--------	--------	--------	--------	--------	--------	--------

2.3410	2.5831	2.7909	2.9615	3.0927	3.1828	3.2306
<i>Columns 15 through 21</i>						
0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000
3.2354	3.1971	3.1162	2.9939	2.8318	2.6320	2.3972
<i>Columns 22 through 28</i>						
0.2100	0.2200	0.2300	0.2400	0.2500	0.2600	0.2700
2.1305	1.8354	1.5160	1.1763	0.8210	0.4548	0.0825
<i>Columns 29 through 35</i>						
0.2800	0.2900	0.3000	0.3100	0.3200	0.3300	0.3400
-0.2909	-0.6604	-1.0211	-1.3682	-1.6971	-2.0035	-2.2832
<i>Columns 36 through 42</i>						
0.3500	0.3600	0.3700	0.3800	0.3900	0.4000	0.4100
-2.5324	-2.7480	-2.9271	-3.0673	-3.1665	-3.2237	-3.2380
<i>Columns 43 through 49</i>						
0.4200	0.4300	0.4400	0.4500	0.4600	0.4700	0.4800
-3.2092	-3.1376	-3.0244	-2.8710	-2.6793	-2.4519	-2.1919
<i>Columns 50 through 56</i>						
0.4900	0.5000	0.5100	0.5200	0.5300	0.5400	0.5500
-1.9028	-1.5884	-1.2528	-0.9005	-0.5364	-0.1650	0.2086
<i>Columns 57 through 63</i>						
0.5600	0.5700	0.5800	0.5900	0.6000	0.6100	0.6200
0.5794	0.9424	1.2930	1.6263	1.9380	2.2239	2.4802
<i>Columns 64 through 70</i>						
0.6300	0.6400	0.6500	0.6600	0.6700	0.6800	0.6900
2.7035	2.8909	3.0398	3.1482	3.2148	3.2386	3.2192
<i>Columns 71 through 77</i>						
0.7000	0.7100	0.7200	0.7300	0.7400	0.7500	0.7600
3.1571	3.0530	2.9082	2.7248	2.5050	2.2520	1.9690
<i>Columns 78 through 84</i>						
0.7700	0.7800	0.7900	0.8000	0.8100	0.8200	0.8300
1.6598	1.3285	0.9796	0.6176	0.2474	-0.1261	-0.4980
<i>Columns 85 through 91</i>						

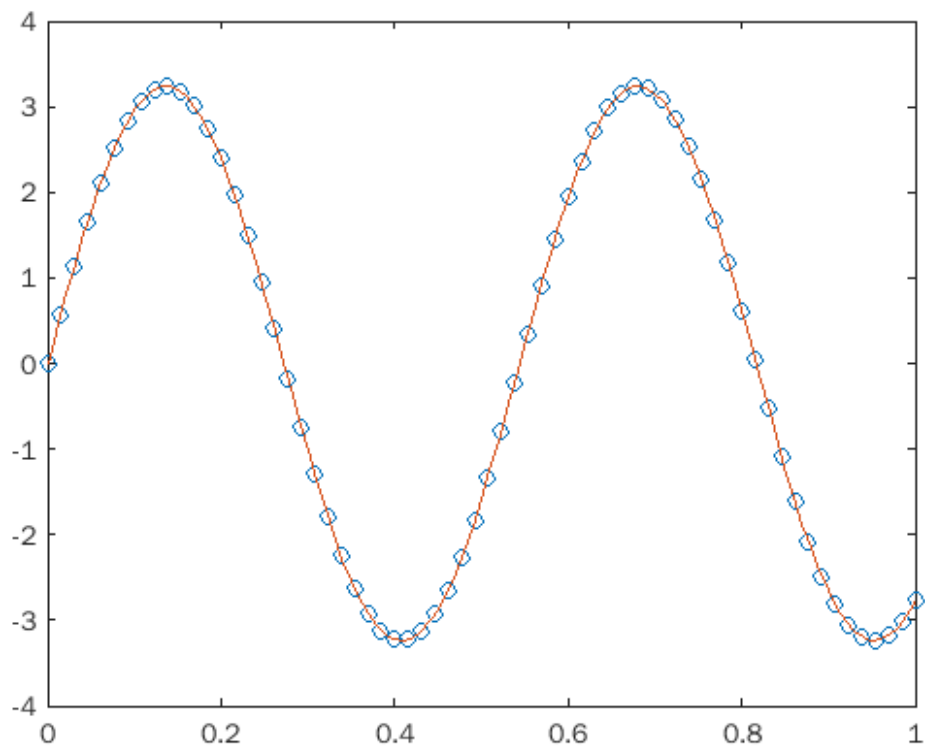
0.8400	0.8500	0.8600	0.8700	0.8800	0.8900	0.9000
-0.8632	-1.2168	-1.5543	-1.8712	-2.1632	-2.4263	-2.6572

Columns 92 through 98

0.9100	0.9200	0.9300	0.9400	0.9500	0.9600	0.9700
-2.8527	-3.0103	-3.1278	-3.2037	-3.2370	-3.2273	-3.1745

Columns 99 through 101

0.9800	0.9900	1.0000
-3.0795	-2.9437	-2.7685



`poly =`

`1.0e+04 *`

Columns 1 through 7

-0.5262	1.9938	-2.8893	1.9762	-0.6259	0.0709	0.0001
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Column 8

`0.0000`

curve =

Columns 1 through 7

0	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600
0.3499	0.4275	0.6119	0.8725	1.1824	1.5185	1.8614

Columns 8 through 14

0.0700	0.0800	0.0900	0.1000	0.1100	0.1200	0.1300
2.1947	2.5050	2.7813	3.0155	3.2012	3.3342	3.4121

Columns 15 through 21

0.1400	0.1500	0.1600	0.1700	0.1800	0.1900	0.2000
3.4337	3.3995	3.3110	3.1709	2.9825	2.7499	2.4779

Columns 22 through 28

0.2100	0.2200	0.2300	0.2400	0.2500	0.2600	0.2700
2.1716	1.8364	1.4781	1.1025	0.7153	0.3224	-0.0705

Columns 29 through 35

0.2800	0.2900	0.3000	0.3100	0.3200	0.3300	0.3400
-0.4580	-0.8350	-1.1964	-1.5377	-1.8549	-2.1441	-2.4021

Columns 36 through 42

0.3500	0.3600	0.3700	0.3800	0.3900	0.4000	0.4100
-2.6260	-2.8136	-2.9629	-3.0727	-3.1420	-3.1707	-3.1587

Columns 43 through 49

0.4200	0.4300	0.4400	0.4500	0.4600	0.4700	0.4800
-3.1067	-3.0157	-2.8873	-2.7232	-2.5259	-2.2979	-2.0421

Columns 50 through 56

0.4900	0.5000	0.5100	0.5200	0.5300	0.5400	0.5500
-1.7619	-1.4606	-1.1420	-0.8099	-0.4684	-0.1215	0.2267

Columns 57 through 63

0.5600	0.5700	0.5800	0.5900	0.6000	0.6100	0.6200
0.5719	0.9100	1.2371	1.5492	1.8425	2.1133	2.3585

Columns 64 through 70

0.6300	0.6400	0.6500	0.6600	0.6700	0.6800	0.6900
2.5749	2.7597	2.9105	3.0251	3.1020	3.1399	3.1379

Columns 71 through 77

0.7000	0.7100	0.7200	0.7300	0.7400	0.7500	0.7600
3.0957	3.0134	2.8915	2.7313	2.5341	2.3021	2.0378

Columns 78 through 84

0.7700	0.7800	0.7900	0.8000	0.8100	0.8200	0.8300
1.7443	1.4249	1.0835	0.7245	0.3524	-0.0279	-0.4110

Columns 85 through 91

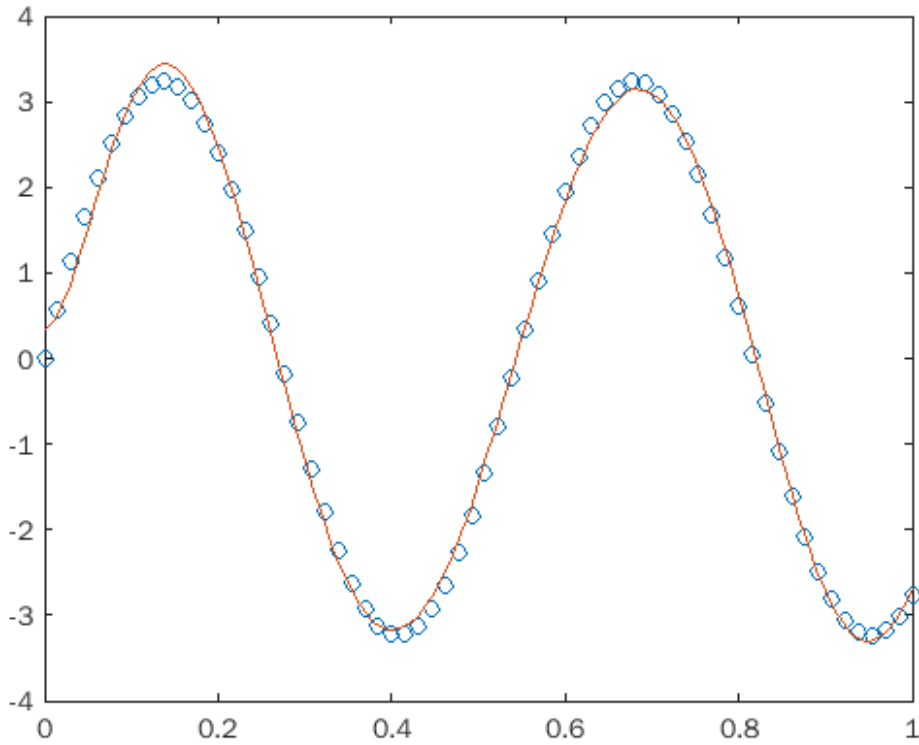
0.8400	0.8500	0.8600	0.8700	0.8800	0.8900	0.9000
-0.7918	-1.1645	-1.5237	-1.8637	-2.1790	-2.4643	-2.7148

Columns 92 through 98

0.9100	0.9200	0.9300	0.9400	0.9500	0.9600	0.9700
-2.9257	-3.0931	-3.2137	-3.2850	-3.3054	-3.2745	-3.1932

Columns 99 through 101

0.9800	0.9900	1.0000
-3.0640	-2.8909	-2.6801



ans =

-8.7143	-6.5714	-5.5000
-6.5714	-5.5000	-4.4286
-5.5000	-4.4286	-2.2857

ans =

4.3744	5.0615	5.4725	5.7418	5.9139	6.0000
5.0615	5.3378	5.6141	5.8390	6.0000	6.0861
5.4725	5.6141	5.8070	6.0000	6.1610	6.2582
5.7418	5.8390	6.0000	6.1930	6.3859	6.5275
5.9139	6.0000	6.1610	6.3859	6.6622	6.9385
6.0000	6.0861	6.2582	6.5275	6.9385	7.6256

ans =

Columns 1 through 7

-12.1935	-10.7902	-9.9421	-9.3562	-8.9158	-8.5677	-8.2854
-10.7902	-10.2350	-9.6799	-9.2107	-8.8233	-8.5020	-8.2340
-9.9421	-9.6799	-9.3317	-8.9835	-8.6649	-8.3830	-8.1376
-9.3562	-9.2107	-8.9835	-8.7266	-8.4697	-8.2274	-8.0062
-8.9158	-8.8233	-8.6649	-8.4697	-8.2601	-8.0505	-7.8501
-8.5677	-8.5020	-8.3830	-8.2274	-8.0505	-7.8646	-7.6787
-8.2854	-8.2340	-8.1376	-8.0062	-7.8501	-7.6787	-7.5000
-8.0546	-8.0109	-7.9273	-7.8096	-7.6649	-7.5000	-7.3213
-7.8674	-7.8279	-7.7509	-7.6401	-7.5000	-7.3351	-7.1499
-7.7198	-7.6823	-7.6083	-7.5000	-7.3599	-7.1904	-6.9938
-7.6098	-7.5730	-7.5000	-7.3917	-7.2491	-7.0727	-6.8624
-7.5366	-7.5000	-7.4270	-7.3177	-7.1721	-6.9891	-6.7660
-7.5000	-7.4634	-7.3902	-7.2802	-7.1326	-6.9454	-6.7146

Columns 8 through 13

-8.0546	-7.8674	-7.7198	-7.6098	-7.5366	-7.5000
-8.0109	-7.8279	-7.6823	-7.5730	-7.5000	-7.4634
-7.9273	-7.7509	-7.6083	-7.5000	-7.4270	-7.3902
-7.8096	-7.6401	-7.5000	-7.3917	-7.3177	-7.2802
-7.6649	-7.5000	-7.3599	-7.2491	-7.1721	-7.1326
-7.5000	-7.3351	-7.1904	-7.0727	-6.9891	-6.9454
-7.3213	-7.1499	-6.9938	-6.8624	-6.7660	-6.7146
-7.1354	-6.9495	-6.7726	-6.6170	-6.4980	-6.4323
-6.9495	-6.7399	-6.5303	-6.3351	-6.1767	-6.0842
-6.7726	-6.5303	-6.2734	-6.0165	-5.7893	-5.6438
-6.6170	-6.3351	-6.0165	-5.6683	-5.3201	-5.0579
-6.4980	-6.1767	-5.7893	-5.3201	-4.7650	-4.2098
-6.4323	-6.0842	-5.6438	-5.0579	-4.2098	-2.8065

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