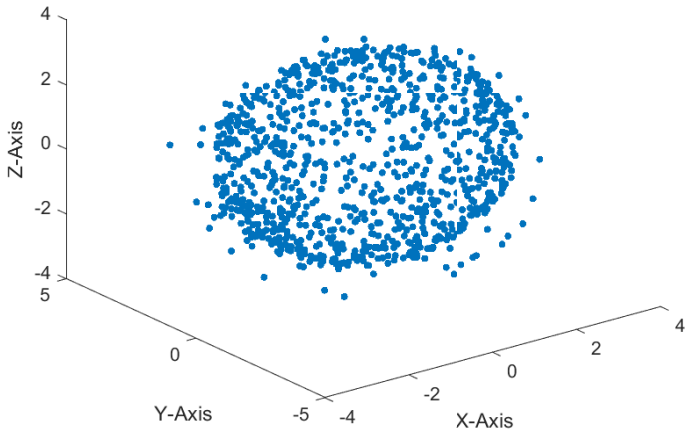
Contents

AMSC 460 - HW15

```
clear all; format compact; close all; syms f(x) x y z
```

Problem 1

```
C = dlmread('OrbitData2.txt');
X = C(:,1);
Y = C(:,2);
Z = C(:,3);
plot3(X,Y,Z,'.','MarkerSize',10)
xlabel('X-Axis')
ylabel('Y-Axis')
zlabel('Z-Axis')
```



(a)Center the X; Y;Z coordinates around zero. For example, to center the x-values you would compute X X

```
xyz0 = mean(C)
D = bsxfun(@minus,C,xyz0)
```

```
xyz0 =
    0.0571    0.0518    0.0358
```

```
D =
   -1.4539   -1.6037    1.9095
   -0.9089    1.3511    2.6288
    2.0009   -0.0593   -2.1134
    0.2480    1.8591    2.4708
   -1.6650   -2.2940    0.8254
   -1.3763   -1.1372   -2.2596
   -2.0277    1.7117   -1.1634
    2.0468    2.3107    0.2715
    1.1509    0.3619    2.8267
   -0.8804    0.5899    2.8083
    0.8632    2.0899   -1.8594
   -0.0012   -0.9302    2.8678
   -0.8489    0.8488    2.9216
    1.7000   -2.3434   -0.0586
   -0.0446   -2.3666    1.9854
   -1.8568   -0.8882   -2.1374
    1.2690    2.7523   -0.3154
    1.6036   -0.3738    2.4665
   -0.1916    2.4634    1.8780
    1.0789   -0.4277    2.8629
    0.4680    2.9949    0.9927
   -0.6032    0.8977   -2.7684
    1.9448    1.1410    2.2570
   -0.7653   -1.1491    2.6045
    1.2355    2.5977    1.1589
    2.6464    0.6730    1.5139
   -0.4954   -2.4170    1.4696
   -1.5881    2.4981   -0.5611
   -1.3753   -2.4142    1.1066
   -1.6835    1.5848   -1.9734
   -1.7281   -1.9995    1.3835
    1.1773    0.3066   -2.6720
    2.4216   -1.3716   -1.3656
    0.4796   -1.1109   -2.6366
    0.0947   -1.6863   -2.2102
    0.9087   -1.9919    1.9331
   -2.0541    1.8901    1.3190
   -2.0467   -1.9085   -0.9736
   -1.0718   -0.5338    2.8141
   -0.9244   -0.2453   -2.7045
   -0.4515    3.0733   -0.2614
    0.0686    2.8722   -0.6398
   -2.2672    0.9473    1.5764
    0.4345    2.5314    1.8080
    0.9753   -2.0207   -1.7742
```

2.9818	-0.1850	0.0611
3.0791	0.5670	-0.1296
-2.6851	-0.6243	1.0865
2.3318	1.5552	1.2438
0.8918	-2.2481	1.6578
2.7186	-0.1455	-1.2290
2.6483	1.2796	1.1609
2.7908	-1.0842	0.9839
2.1688	0.3498	-1.9412
-0.6363	-1.7214	-2.1541
0.7843	-2.8020	0.1943
-1.1208	-0.2376	2.7449
2.1872	-1.9034	-0.7941
2.4665	-1.6915	0.6235
-1.6398	-1.6705	-1.4649
1.8084	1.9574	1.4971
0.6579	2.6236	-1.4319
1.2808	2.8425	0.0128
2.7077	0.8697	1.2847
1.6459	1.1896	2.5017
-0.7961	-0.7434	2.7907
2.9298	-0.9361	0.3038
-1.2532	1.7659	-2.1212
-1.7114	1.1473	-2.0267
2.7009	-0.1195	-1.3064
2.2523	-0.7153	2.1360
-1.1977	-2.3225	-1.4145
2.3950	-0.2216	2.0763
0.3451	-2.5190	-1.3333
-0.8317	1.3731	2.6968
-1.3280	-2.4147	-0.9029
0.2514	2.4039	-1.7017
-0.6812	2.5050	-1.4335
-1.1012	-2.4594	0.9083
-2.9700	-0.3583	-0.1244
-2.3363	1.5583	-0.7493
-1.7896	-1.2841	2.0830
0.0640	-2.8666	0.5241
-2.4294	-1.4252	0.4349
-1.5748	-0.5130	2.4800
-2.3268	-1.1633	-1.2747
-2.5018	-0.1968	1.5188
2.2720	1.4457	1.7078
-0.4110	-2.9035	-0.5432
3.1612	-0.0406	0.4007
-0.9873	1.3935	-2.4781

```
 1.3356   -0.1342   -2.6820
-1.5871    2.4516    0.2920
 1.9196   -1.4415    1.8766
-1.2433    0.5023    2.6324
-1.5401    1.0550   -2.0089
 0.7021    3.0034    0.4646
 2.2665    2.3031   -0.1673
-0.1920    0.7787   -2.7979
-0.3234   -2.7356   -0.7697
 0.6428   -2.1058   -1.9070
-0.7561   -2.2495    1.7458
 2.9490    0.1330   -1.0751
 1.7786   -2.3593    0.1770
 2.0341   -1.0647   -1.9841
 0.4882   -2.8743    0.5891
 2.7120    0.7467   -1.2325
-2.0655    2.1469    1.0870
-0.7440   -2.7099    1.1927
-0.1434   -2.4237    1.6611
 0.5239    2.9666   -0.1441
-0.0910    1.6616   -2.3774
-1.0040   -2.1616   -1.5634
-1.4794    0.3684    2.5340
-1.4308   -1.5135   -2.0993
 0.1636    2.2696    2.0045
 1.2742    2.8753    0.3314
 0.2760   -0.2302    3.0561
 0.2556   -1.5773   -2.4054
 2.9146   -1.0025   -0.2514
 1.5720    1.3337   -2.1923
 0.5830    1.0418    2.7599
 0.4048    0.1863   -2.8921
-2.4928    0.2872    1.7611
 0.9928    2.3378    1.9148
 1.6861   -1.2552    2.3292
 1.3057    0.9308   -2.5162
 2.9437    0.9029   -0.4932
-2.3899   -0.8277   -1.2660
 0.2957   -2.2985    1.8895
-0.9621    2.6995   -0.3376
 0.7641    1.6644    2.4653
-1.2269    2.1468   -1.9376
 0.6266    2.7283   -1.2638
-2.0909   -0.1584   -1.9635
 1.7113   -1.1048   -2.1460
-1.2885   -1.4562    2.2088
```

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 2.3386    1.8521    0.5362
-2.2984    1.9917    0.4706
 2.0025    0.7341   -1.9556
-1.9615    0.1306    2.2487
-2.5916    1.3573    0.9366
 2.9952    0.0995   -0.6943
 1.2257   -2.7411    0.0719
-2.7909    0.2266   -0.4629
 1.2241   -0.8533   -2.4598
 1.8510    2.1452   -1.5797
-1.3651    1.2463   -2.0714
 2.0421   -1.0479   -1.8080
 2.2851   -1.0932   -1.4033
-0.6469   -2.8129   -0.5171
-0.8589   -0.7211   -2.6723
-0.9831    1.6319    2.5433
 1.3490   -0.5413    2.6663
 2.2177    2.1280    0.0690
-0.2721   -3.0153   -0.0040
-1.6633   -2.1577   -0.8181
 0.8498   -1.4170    2.5278
-2.2527    1.8031   -0.7250
 0.0427   -1.9312   -2.2936
 1.2376   -1.9409    1.7307
-1.2288    2.7015   -0.4676
-2.3758   -0.7972   -1.4716
 2.9995   -0.3933   -0.5017
-1.5427   -0.4355   -2.3435
-0.8650    1.8690   -2.0076
-0.8642   -0.8203    2.6713
-0.8311    0.9302    2.9216
 0.1191   -2.9260    0.4204
-1.1615    0.7167   -2.5917
-2.3577    0.2831   -1.4356
-0.8353   -2.6639   -0.8312
 2.3213   -0.3750    2.0461
-0.3205    0.6021   -2.8301
 0.5958   -0.8882   -2.7751
-0.0261   -2.1706   -1.8721
 2.8152   -0.7305    1.0093
 2.5980    0.6955    1.5169
-1.7334    2.3727    0.9364
-1.5724   -2.4319   -0.2069
-0.4565    2.9213    0.4217
 0.3718    2.8048   -1.0359
-0.4543   -2.3504    1.4461
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-2.1937   -1.3497    1.2473
-1.1395   -1.7700   -1.7437
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-1.5833    2.3638    0.7492
-2.2448    0.7047    1.7367
 0.0601    1.6965   -2.3800
-0.1726   -1.5485    2.6345
 1.4950   -1.8994    1.8343
-0.5734    3.1264   -0.0421
-0.3655   -2.9437   -0.3873
 2.1080    2.3163   -0.1869
 1.3936   -2.3093   -1.1471
 2.0204    2.4502    0.2324
-2.4481   -1.4242    0.2166
-1.4391    1.7882    1.9748
 1.0050   -2.2272    1.7332
-2.9146    0.1114    0.8675
-2.7569    0.3235   -0.6957
 1.7554   -1.5050    2.0518
-1.6905    2.5715    0.3115
-2.7239    0.9700   -0.8511
 1.4771   -0.1800    2.6693
 2.0270    0.5807    2.3287
 3.1239   -0.3443    0.4911
 1.1382    2.7448    0.9303
-1.5055   -2.4298    0.6128
-2.1266   -1.0657   -1.6325
-1.1477   -2.3746   -1.0485
-1.7819    2.3510   -0.2043
-1.7233   -1.7330   -1.5091
 0.8446   -1.9877    2.0417
 2.5383    0.2627   -1.7616
 2.2416    1.3039   -1.5633
 2.4106   -0.3253   -2.0059
-1.5002   -2.0142   -1.6535
 0.3446    3.1069   -0.1906
-2.1458    1.6641   -1.0357
 1.3209    1.1856    2.5962
-0.2049    3.0925   -0.3636
-0.0980    2.3043   -1.8891
-0.8833    1.6381    2.4309
 0.6420    0.7255    2.9304
-1.5807    2.4624   -0.3186
 1.3717    1.3969   -2.1731
 1.9599   -1.5825   -1.3657
```

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 2.4702   1.6447  -0.4673
 2.8158  -1.1371   0.5664
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 2.8922   0.8595   0.7499
-1.4052   2.2967   1.4403
-0.2051  -2.4105  -1.5412
 0.6528  -1.6852  -2.0853
-2.4904  -0.6896  -1.0108
-1.0374  -2.5571  -1.0606
 2.3818  -1.7558  -0.3347
 2.8829   1.1042   0.1934
-0.5424   1.6348  -2.3982
 2.6412   0.7073  -1.2484
 0.9735   2.3801   1.8180
-0.0183  -0.9180  -2.8294
-0.1426  -1.4747   2.5380
 1.9237  -1.8850   1.3844
-2.4905  -1.4470   0.0294
 2.6512   1.2798   0.5630
 2.2314  -1.1918  -1.5158
 0.9212  -2.6897  -0.2051
-0.2740   1.1491   2.7436
-2.7860  -0.8476   0.4488
 2.9449  -0.2443   0.2506
-0.3931  -2.3305  -1.5341
 1.7143  -2.5532  -0.0414
-2.4800   1.3595   0.9094
-2.6872   0.5420   1.2450
-2.6163  -1.0616  -0.4497
-0.1807   2.8711  -0.7144
 0.0735  -0.5138   3.1348
-1.1296  -0.0623  -2.5991
-0.9683  -1.3390   2.2948
-0.6473   1.5663   2.5033
 1.5800   1.8697   1.9457
-1.5825   0.3935  -2.3421
-1.6785   1.9898  -1.3480
 0.6921  -2.6756  -0.7858
 0.5028  -2.6204   1.2838
-0.8375  -1.6156  -2.0252
 1.7748   2.1325   1.4352
 1.8618   0.3858  -2.1662
-2.4879  -0.9982   1.0106
-0.8739   2.8562  -0.0293
 2.4078  -0.8466   1.7200
 2.7776  -0.3213   1.3285
```

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-0.2862   1.8820   2.5261
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-2.3010  -1.4366   1.1984
 1.9327  -1.5262  -1.6121
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-2.3398  -0.6758   1.6063
-0.4017  -2.7775   0.2069
-2.5674  -1.2496   0.0933
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-2.1189  -0.1406   2.2535
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 2.0482  -2.1043   0.1044
 2.0268  -0.9351  -1.9670
-0.2847  -0.6262   2.8523
 0.6943   2.7171   1.3062
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-2.8775   0.3656   0.1651
 0.1471  -1.6265  -2.4434
-1.9825   1.2188   1.9279
 2.3893  -0.2533   1.9293
 2.6514  -0.1740   1.3062
 1.3875  -1.4218  -1.9610
-2.2300   1.8453   0.9237
-2.6936   0.8074   0.2285
 0.2057   1.1087   2.9041
 0.5884  -2.6410   0.9204
 1.8372  -1.4317   1.9293
 2.6659  -1.5114  -0.2329
-2.7599  -0.9152  -0.4155
-1.7210  -1.2432   2.0500
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-2.1524   0.8827  -1.8289
```

```
 0.9363   2.7822  -0.4782
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 0.3134  -2.3703   1.9861
 1.1023  -0.9147  -2.5147
-0.4626   2.8831  -0.4627
-1.3829  -2.4975   0.2976
-1.4411  -2.3423  -0.4548
 2.2233   2.0970   1.0383
-2.4122   1.7192   0.9503
-0.4262   2.8750  -1.2703
-0.4430  -2.7868  -0.3208
-0.1942   0.8149  -2.8347
 0.6149  -0.4127   3.0947
 1.1269  -1.8777  -1.8752
-1.4309   1.2172  -2.1527
-2.7986   0.0883  -0.6550
-0.6704  -2.2087  -1.6369
 1.5849  -2.5224   0.0195
-2.0878  -1.7319  -0.8625
-1.0061  -0.4067   2.7188
-0.7458   1.4425   2.6448
-1.1973   0.3952  -2.4790
-0.6241  -2.4791   1.5249
 2.0613  -1.6973  -1.3012
-0.3874  -2.9007  -0.3004
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-0.6101   0.3533   2.9904
 2.2141   1.8164  -1.0575
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-1.5447   2.3067   1.3032
-1.9916   2.0865   1.1917
-2.1562  -0.5991  -1.7964
-1.8067  -0.5970  -2.0310
-0.1235   0.2241   2.9835
-1.6960   1.3863  -1.8813
-1.0947  -0.0678  -2.8127
-1.5908  -2.4773   0.4677
 1.8619  -0.4015   2.4276
-0.4685  -2.7578   1.0161
-1.9373   1.3716  -1.6988
 1.5158  -2.4819  -0.7225
 2.0007   2.3687  -0.0469
```

```
 0.7298    0.4234    2.9308
 1.8242    1.2240   -2.0821
 1.1001    1.7580    2.1522
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-0.7675    2.9281   -0.5406
 2.3053    0.2007   -1.8862
-2.7070   -0.6392   -0.4376
 2.4513    1.7136   -0.1406
 1.3342    1.5348   -2.2581
-1.8620   -2.1207    0.5041
 1.7641   -1.7883   -1.5181
 2.8581   -0.2773   -0.5988
-2.6011   -1.1100    0.5235
 2.6479   -0.0824   -1.4765
-2.5848   -0.8665   -1.2704
-2.8161   -0.2756    0.7589
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-2.0692    1.1663    2.0611
-0.7092    0.1255    2.9799
 2.5923    1.2850    1.4227
 2.2353   -1.6890   -0.7864
 2.8334    1.1582    0.6784
-1.6672    0.9001   -2.3236
 0.7613   -1.5751    2.5306
-1.5229    1.3355    2.3538
-1.6088   -1.3845    1.9561
 1.1307   -2.2654   -1.2616
 2.1887   -1.9495    0.7760
 0.8786   -0.3137   -2.7441
 1.1130    2.8387   -0.4389
-0.0222    2.8584   -1.1287
 1.8427   -1.1585   -1.9219
-1.7706   -1.1549   -1.8811
-2.8161    0.0781   -0.4314
-1.3404   -1.0600   -2.3329
 1.2164   -2.4786    0.6005
-2.7869   -0.6312   -0.0406
 0.9210    2.7194    1.1538
-2.6883    0.8041    1.1720
-2.4250    1.3299    0.8670
 1.1285   -0.1095   -2.8148
-1.0277   -1.0398   -2.3978
-0.8468   -2.5346   -0.9066
-0.4250   -2.9121    0.2483
-1.4750    2.5090    0.9332
-2.8929   -0.3326   -0.4825
```

```
-2.1964   -0.8301    1.9881
 1.6223    2.4343    1.4565
-0.9412   -0.4110    2.8777
-0.8649   -2.8295    0.3902
-2.4800    1.2401   -0.8569
 1.1014   -1.6092   -2.1642
-0.3543   -2.8434    0.7164
-1.6125    2.0339    1.7096
-2.6799    0.9972   -0.2734
-1.3493    1.2746   -2.4384
 0.5387   -2.4922   -1.4043
-0.0872   -2.0868   -1.9837
-2.3901    1.2694   -1.1234
-0.9930   -2.6066   -0.2947
 3.0077   -0.9363    0.1810
 0.6806   -2.8958   -0.2716
-0.4931   -1.7594    2.4497
 2.3001    1.9086    0.2232
-1.0415    0.8893    2.7203
-2.4048   -1.4948    0.9567
-1.0021    0.4079    2.9084
 2.4425    0.8999   -1.5082
 0.3954    2.7614    1.1941
 1.4177   -2.3691   -1.2505
 2.9236    0.2958    1.2347
 1.7886   -1.9545    1.3130
 1.4930    0.7625   -2.5861
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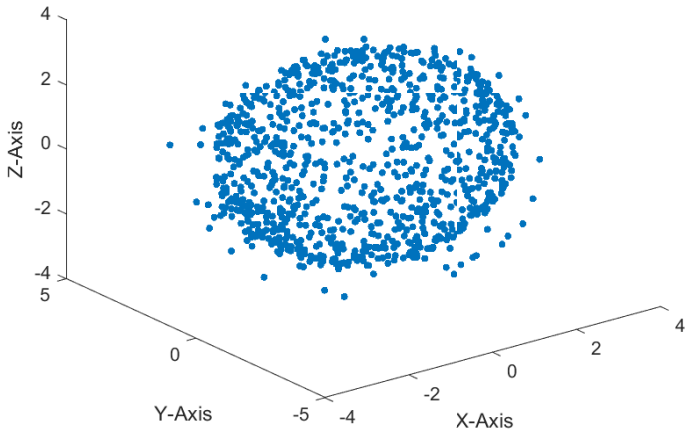
 0.5880    1.9816   -2.8132
 1.0722   -1.4124    1.3202
-2.2565   -0.9417   -0.3689
-0.1416   -0.1869    3.8738
 1.0338   -3.8876   -1.2733
 2.4437    1.1714    0.3372
 2.2079   -1.7464   -2.7213
-2.8644    0.9173   -1.0328
-0.1039   -0.9501   -2.3217
-0.1107   -4.1194    1.2922
 1.1700   -1.1800    1.9564
 1.7782    2.0743   -1.1863
-2.5762    0.3280    0.9588
-2.0885   -2.5662   -1.0568
 2.5145   -0.3419    0.7048
```

```
 1.1407   -1.6926    1.7763
 2.1561   -1.9382    1.4629
-2.6004   -1.1426   -0.5876
-2.2104   -0.6569   -0.6306
 2.1340   -3.0646   -0.8104
 2.9849   -0.0037   -1.4140
 2.6210   -1.4338   -0.7147
-2.9321    2.7697    0.4863
 2.5037    1.4803    0.5693
-0.1051   -3.1031   -1.2327
 2.0185    1.4039   -0.2836
 1.2946   -0.2501   -1.7683
-0.8666   -1.3189   -2.2110
 0.0048    3.5174   -1.7538
-1.1513    2.0317   -0.8284
-2.3397    1.8129    1.1935
-1.5772    0.7837    2.6898
-0.9123   -0.7391    2.0526
-3.2357   -1.0161   -0.8407
 1.2493    3.6892   -1.2227
 0.5214    2.2768    0.7065
 1.9789    2.1339    1.3727
-0.8745    1.7367    1.4783
 0.1363   -2.2044    1.9728
 0.6061    3.3778   -2.5799
-0.0316   -1.8581    0.3573
-1.1707   -3.3776   -0.0822
 0.8180   -3.0086   -2.1227
 0.6604   -1.5897   -1.5559
-0.5790    1.9731    1.4717
-1.4806    2.0242   -1.9002
-2.0994    0.5815   -1.0332
-1.2767    2.6331    1.4872
 1.0546   -0.4094    2.3221
 1.5637   -2.8698    0.3031
-2.7065   -1.1130    2.3818
-0.4783    2.6993   -1.4139
-0.2963   -0.8777    2.0207
 0.4731    2.7650    0.3019
-2.7880   -0.4860    1.5750
-1.0482   -0.1421   -3.5838
-2.2834   -0.1554    1.9638
 2.2598    0.2201    1.4218
 0.0234   -3.1028   -2.1705
 2.7571   -0.3289   -0.2881
 0.0065    3.1445   -1.9943
```

```
-2.7542   -1.4664   -0.2933
 2.7364    0.1326    0.2949
 0.4083   -2.1099   -0.6101
-2.1795   -2.7473   -2.4271
 1.6346   -1.7623   -0.7696
 0.5300    0.6191   -2.4531
 1.5369   -2.0782    2.0750
-2.1365    1.3875    1.4239
 1.7029   -0.9300    3.1151
-2.7321   -0.5481   -2.4416
 0.5379    1.1924    2.7607
 0.4099    1.0887    1.5468
-1.3324    3.0456    1.0540
 2.2593    2.0841   -1.0266
-0.5105   -3.1392   -1.6944
 0.1418   -2.2471    1.8863
-2.6110   -1.7372   -1.7036
-0.9129    0.2728   -2.3625
 1.2388   -3.1203    2.4369
-2.0892   -1.0481    0.7782
 3.1284   -1.1588    0.7076
 1.8618   -0.4121    1.5977
-2.0121    2.2168   -0.7402
-2.6142   -0.4719   -0.5321
-1.9020    2.2872    1.5701
-1.7480   -1.7204   -1.9156
 0.5375   -2.1407    1.3778
 0.2293   -1.5657    2.3548
 1.2233    0.5856    1.8702
 1.0302   -1.5201   -0.0771
 3.3730    0.9173    0.9282
-1.0237   -0.2500    3.2580
-0.4820   -2.1800   -0.2958
-0.0362   -0.5624   -2.8049
-1.1516    2.7387    1.7385
```



(b)The general equation of a sphere centered at the origin can be written

```
%\[ax^2 +by^2 + c = z^2,\]
```

```
X2 = D(:,1).^2;
Y2 = D(:,2).^2;
A = zeros(1000,3);
A(:,1) = X2;
A(:,2) = Y2;
A(:,3) = 1;
w = D(:,3).^2;
```

(c)Solve the normal equations for the system $A\mathbf{u} = \mathbf{w}$ to get the least-squares solution $\mathbf{u}$. (It is wise to compute cond$(A^T A)$ to check the quality of the solution!)

```
A_T = A.'
B = A_T*A
C = A_T*w
tu = B\C
% tu is [-0.8012, -0.7230, 2.6731]^T
```

```
A_T =
  Columns 1 through 7
    2.1139    0.8262    4.0036    0.0615    2.7723    1.8942    4.1116
    2.5720    1.8254    0.0035    3.4561    5.2626    1.2933    2.9298
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
Columns 8 through 14
  4.1894    1.3246    0.7751    0.7451    0.0000    0.7206    2.8900
  5.3392    0.1310    0.3480    4.3675    0.8652    0.7205    5.4917
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 15 through 21
  0.0020    3.4477    1.6103    2.5715    0.0367    1.1640    0.2190
  5.6010    0.7889    7.5750    0.1398    6.0682    0.1829    8.9692
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 22 through 28
  0.3639    3.7822    0.5858    1.5264    7.0034    0.2454    2.5221
  0.8058    1.3018    1.3205    6.7479    0.4529    5.8421    6.2403
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 29 through 35
  1.8915    2.8342    2.9864    1.3860    5.8641    0.2300    0.0090
  5.8285    2.5115    3.9981    0.0940    1.8814    1.2342    2.8437
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 36 through 42
  0.8258    4.2194    4.1890    1.1488    0.8545    0.2039    0.0047
  3.9678    3.5723    3.6425    0.2849    0.0602    9.4450    8.2493
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 43 through 49
  5.1402    0.1888    0.9512    8.8911    9.4808    7.2098    5.4373
  0.8974    6.4078    4.0834    0.0342    0.3215    0.3898    2.4185
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 50 through 56
  0.7953    7.3907    7.0134    7.7885    4.7037    0.4049    0.6152
  5.0541    0.0212    1.6373    1.1756    0.1223    2.9633    7.8514
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 57 through 63
  1.2562    4.7838    6.0836    2.6890    3.2703    0.4328    1.6404
  0.0564    3.6231    2.8613    2.7907    3.8313    6.8831    8.0796
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 64 through 70
  7.3316    2.7090    0.6338    8.5837    1.5705    2.9289    7.2948
  0.7564    1.4151    0.5526    0.8763    3.1183    1.3162    0.0143
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 71 through 77
  5.0728    1.4345    5.7360    0.1191    0.6918    1.7636    0.0632
  0.5117    5.3942    0.0491    6.3455    1.8853    5.8310    5.7786
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 78 through 84
  0.4640    1.2127    8.8210    5.4583    3.2027    0.0041    5.9020
  6.2748    6.0488    0.1284    2.4282    1.6490    8.2176    2.0313
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 85 through 91
  2.4800    5.4140    6.2590    5.1619    0.1690    9.9931    0.9748
```

```
  0.2632    1.3534    0.0387    2.0899    8.4305    0.0017    1.9417
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 92 through 98
  1.7838    2.5189    3.6848    1.5458    2.3719    0.4930    5.1370
  0.0180    6.0102    2.0780    0.2523    1.1129    9.0202    5.3041
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 99 through 105
  0.0369    0.1046    0.4132    0.5718    8.6965    3.1634    4.1375
  0.6063    7.4837    4.4345    5.0604    0.0177    5.5665    1.1337
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 106 through 112
  0.2384    7.3549    4.2663    0.5536    0.0206    0.2744    0.0083
  8.2618    0.5576    4.6090    7.3438    5.8745    8.8005    2.7608
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 113 through 119
  1.0080    2.1887    2.0472    0.0268    1.6236    0.0762    0.0653
  4.6727    0.1357    2.2908    5.1509    8.2671    0.0530    2.4880
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 120 through 126
  8.4948    2.4712    0.3399    0.1638    6.2141    0.9856    2.8429
  1.0049    1.7787    1.0853    0.0347    0.0825    5.4651    1.5756
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 127 through 133
  1.7048    8.6653    5.7117    0.0874    0.9257    0.5838    1.5053
  0.8663    0.8152    0.6851    5.2833    7.2871    2.7701    4.6086
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 134 through 140
  0.3926    4.3719    2.9285    1.6603    5.4690    5.2827    4.0100
  7.4434    0.0251    1.2207    2.1206    3.4301    3.9667    0.5389
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 141 through 147
  3.8475    6.7164    8.9712    1.5023    7.7892    1.4984    3.4262
  0.0170    1.8422    0.0099    7.5138    0.0513    0.7282    4.6017
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 148 through 154
  1.8635    4.1701    5.2216    0.4185    0.7378    0.9664    1.8198
  1.5532    1.0982    1.1952    7.9126    0.5200    2.6630    0.2930
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 155 through 161
  4.9182    0.0740    2.7666    0.7221    5.0747    0.0018    1.5316
  4.5282    9.0923    4.6558    2.0080    3.2510    3.7297    3.7672
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 162 through 168
  1.5100    5.6445    8.9969    2.3800    0.7482    0.7468    0.6907
  7.2979    0.6356    0.1547    0.1896    3.4930    0.6730    0.8653
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
Columns 169 through 175
  0.0142    1.3491    5.5588    0.6978    5.3884    0.1028    0.3549
  8.5617    0.5136    0.0801    7.0966    0.1406    0.3626    0.7889
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 176 through 182
  0.0007    7.9253    6.7496    3.0047    2.4725    0.2084    0.1383
  4.7117    0.5337    0.4838    5.6295    5.9143    8.5338    7.8667
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 183 through 189
  0.2064    2.9519    4.8124    1.2985    8.0866    2.5069    5.0392
  5.5245    2.4312    1.8218    3.1330    1.0438    5.5874    0.4966
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 190 through 196
  0.0036    0.0298    2.2350    0.3287    0.1336    4.4436    1.9421
  2.8780    2.3980    3.6079    9.7742    8.6656    5.3651    5.3330
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 197 through 203
  4.0820    5.9932    2.0710    1.0100    8.4949    7.6005    3.0814
  6.0033    2.0284    3.1975    4.9606    0.0124    0.1047    2.2651
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 204 through 210
  2.8578    7.4197    2.1818    4.1087    9.7587    1.2955    2.2666
  6.6124    0.9408    0.0324    0.3372    0.1185    7.5337    5.9041
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 211 through 217
  4.5225    1.3172    3.1752    2.9698    0.7134    6.4429    5.0247
  1.1358    5.6389    5.5270    3.0034    3.9511    0.0690    1.7001
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 218 through 224
  5.8110    2.2506    0.1187    4.6045    1.7448    0.0420    0.0096
  0.1058    4.0571    9.6526    2.7691    1.4056    9.5633    5.3096
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 225 through 231
  0.7801    0.4122    2.4986    1.8815    3.8412    6.1018    7.9287
  2.6833    0.5263    6.0632    1.9512    2.5044    2.7049    1.2931
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 232 through 238
  3.9086    8.3648    1.9746    0.0421    0.4262    6.2021    1.0762
  3.0205    0.7387    5.2747    5.8107    2.8400    0.4755    6.5389
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 239 through 245
  5.6729    8.3111    0.2942    6.9759    0.9477    0.0003    0.0203
  3.0830    1.2192    2.6725    0.5003    5.6647    0.8427    2.1748
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 246 through 252
  3.7006    6.2026    7.0288    4.9791    0.8486    0.0751    7.7618
```

```
  3.5534    2.0939    1.6378    1.4205    7.2347    1.3203    0.7185
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 253 through 259
  8.6724    0.1546    2.9388    6.1504    7.2211    6.8451    0.0327
  0.0597    5.4314    6.5190    1.8481    0.2938    1.1271    8.2430
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 260 through 266
  0.0054    1.2760    0.9376    0.4190    2.4964    2.5043    2.8174
  0.2640    0.0039    1.7930    2.4532    3.4956    0.1549    3.9592
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 267 through 273
  0.4790    0.2528    0.7015    3.1499    3.4663    6.1897    0.7636
  7.1590    6.8667    2.6103    4.5474    0.1489    0.9964    8.1577
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 274 through 280
  5.7975    7.7150    0.0819    0.2888    5.3972    5.2946    3.7353
  0.7167    0.1032    3.5418    2.7620    2.4547    2.0639    2.3294
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 281 through 287
  0.9930    5.4747    0.1614    6.5916    3.6699    7.8860    3.2827
  0.1102    0.4568    7.7147    1.5616    0.1940    1.1871    4.9348
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 288 through 294
  4.4898    2.3639    8.0021    1.1727    2.6768    1.5063    0.7641
  0.0198    3.1676    0.9532    4.2884    3.5768    1.7936    0.2194
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 295 through 301
  4.1951    4.1079    0.0811    0.4821    2.8962    7.2743    1.4750
  4.4282    0.8745    0.3921    7.3824    5.4063    1.9596    0.8775
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 302 through 308
  1.5267    1.4969    0.4953    8.2801    0.0217    3.9303    5.7087
  5.4281    0.0930    1.6064    0.1337    2.6456    1.4854    0.0642
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 309 through 315
  7.0299    1.9251    4.9729    7.2555    0.0423    0.3462    3.3753
  0.0303    2.0216    3.4050    0.6519    1.2291    6.9751    2.0499
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 316 through 322
  7.1070    7.6171    2.9619    1.1391    2.8794    4.6329    0.8766
  2.2844    0.8376    1.5456    1.9591    1.0980    0.7792    7.7404
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 323 through 329
  3.9283    0.0982    1.2150    0.2140    1.9124    2.0768    4.9430
  1.4379    5.6185    0.8367    8.3121    6.2377    5.4865    4.3973
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

```
Columns 330 through 336
  5.8188    0.1817    0.1963    0.0377    0.3781    1.2699    2.0475
  2.9555    8.2654    7.7665    0.6641    0.1703    3.5259    1.4815
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 337 through 343
  7.8322    0.4494    2.5119    4.3589    1.0122    0.5562    1.4335
  0.0078    4.8785    6.3627    2.9996    0.1654    2.0807    0.1562
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 344 through 350
  0.3895    4.2489    0.1501    9.8526    0.3217    7.4459    0.3722
  6.1461    2.8809    8.4143    0.1949    1.1525    1.1631    0.1248
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 351 through 357
  4.9022    1.3365    1.2006    0.0040    2.3861    3.9665    4.6492
  3.2992    5.9240    6.7858    9.7979    5.3207    4.3533    0.3589
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 358 through 364
  3.2642    0.0153    2.8764    1.1984    2.5307    3.4666    0.2195
  0.3564    0.0502    1.9217    0.0046    6.1372    0.1612    7.6057
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 365 through 371
  3.7532    2.2976    4.0028    0.5326    3.3277    1.2102    1.4653
  1.8812    6.1600    5.6106    0.1792    1.4981    3.0904    6.7947
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 372 through 378
  0.5891    5.3144    7.3279    6.0088    1.7801    3.4671    3.1120
  8.5736    0.0403    0.4086    2.9363    2.3555    4.4975    3.1981
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 379 through 385
  8.1687    6.7658    7.0113    6.6812    7.9305    1.4199    4.2816
  0.0769    1.2322    0.0068    0.7509    0.0760    5.4914    1.3602
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 386 through 392
  0.5030    6.7200    4.9965    8.0281    2.7796    0.5795    2.3193
  0.0158    1.6511    2.8528    1.3413    0.8102    2.4811    1.7835
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 393 through 399
  2.5883    1.2785    4.7904    0.7720    1.2387    0.0005    3.3955
  1.9169    5.1322    3.8007    0.0984    8.0580    8.1702    1.3422
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 400 through 406
  3.1351    7.9305    1.7967    1.4796    7.7669    0.8482    7.2270
  1.3339    0.0061    1.1237    6.1436    0.3985    7.3949    0.6466
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 407 through 413
  5.8807    1.2735    1.0562    0.7171    0.1806    2.1757    8.3689
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  1.7685    0.0120    1.0812    6.4244    8.4805    6.2949    0.1106
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 414 through 420
  4.8242    2.6318    0.8859    0.7480    6.1504    1.2131    0.1255
  0.6891    5.9256    0.1690    8.0063    1.5378    2.5896    8.0851
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 421 through 427
  2.6002    7.1819    1.8206    0.2902    0.0076    5.7126    0.9860
  4.1366    0.9943    1.6245    6.2112    4.3549    1.6113    6.7946
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 428 through 434
  9.0462    0.4632    0.2432    5.2904    1.0848    5.7831    1.0042
  0.8767    8.3859    3.0956    3.6426    0.7909    2.2345    0.1664
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 435 through 441
  5.9658    0.1564    2.0098    8.5474    3.1991    2.2290    1.7151
  0.8097    7.6251    5.6128    0.0875    3.8202    0.5814    4.5285
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 442 through 448
  5.9702    0.2652    3.3387    4.7058    1.4016    4.6847    0.2940
  0.0319    7.9353    0.9697    4.2893    4.2018    2.6155    0.0577
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 449 through 455
  8.4692    3.1071    3.3127    0.0193    2.2804    4.5352    8.7617
  1.0438    6.6237    0.0748    0.0268    6.7482    4.0890    0.1714
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 456 through 462
  3.3529    5.5323    4.2940    5.6744    0.9788    2.1444    6.3278
  3.0707    3.0852    1.8215    4.2114    0.0000    3.6137    0.6149
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 463 through 469
  9.9319    0.0991    2.8544    6.4373    5.5309    6.5644    0.0864
  0.0018    4.3775    5.0361    1.8729    0.0503    0.0008    6.3039
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 470 through 476
  2.1307    7.2744    4.1144    0.0916    5.4382    0.5670    8.7333
  1.1329    0.0000    1.5184    5.0048    1.8332    1.8426    0.0742
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 477 through 483
  2.0255    8.0985    6.3333    7.4546    7.9146    2.0364    7.3360
  5.8984    1.1710    2.5070    1.1134    0.8446    5.0483    0.8282
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 484 through 490
  0.4716    5.2850    6.6740    0.9200    1.5132    0.0413    6.0187
  1.3272    0.1114    0.5499    5.2319    2.3826    9.4032    1.5214
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```

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Columns 491 through 497
  4.5629    4.8422    3.5272    7.2744    0.5670    5.2473    1.5176
  4.1658    2.6033    2.6548    1.2913    7.1549    2.9083    3.4530
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 498 through 504
  3.1400    3.8861    3.1436    4.1591    0.0063    3.2367    5.6335
  2.0568    3.1035    5.4787    6.0647    9.4609    0.9955    1.6558
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 505 through 511
  0.0001    0.2852    1.4064    5.1383    8.0793    0.3742    0.0890
  8.3623    3.7105    0.4411    3.8689    0.0260    7.6665    8.6781
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 512 through 518
  0.5981    6.8314    4.7128    8.7675    0.0090    5.8981    0.5433
  7.8795    1.8340    2.7615    0.0267    0.3852    0.0293    3.4636
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 519 through 525
  1.4417    0.0077    2.2897    3.7597    5.3936    4.9742    7.4005
  2.5232    2.6172    7.6533    5.2078    2.2074    2.2902    0.9357
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 526 through 532
  0.1855    2.0247    0.2896    5.2813    0.0059    6.8042    2.4205
  6.1413    0.0297    0.5177    0.1254    4.5824    1.7819    0.5303
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 533 through 539
  2.0756    9.8257    3.8220    7.3176    8.4140    0.0957    7.7684
  7.5843    0.3467    0.2080    1.7297    0.2897    6.9239    0.0661
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 540 through 546
  1.4775    0.5308    1.3979    7.4918    0.4669    0.0542    0.1786
  7.2524    6.7669    2.9242    0.7737    7.2192    1.2107    6.7609
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 547 through 553
  2.9122    5.3245    2.8470    5.7346    0.8664    5.1734    6.3327
  3.9843    2.9451    4.9281    2.6862    6.6042    3.2268    2.0780
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 554 through 560
  5.8801    5.4700    0.0551    2.8254    7.4633    5.6920    5.9492
  1.6709    2.2086    0.8377    5.0402    1.0448    2.1384    0.3217
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 561 through 567
  4.3348    0.3105    0.5781    2.0054    0.9314    1.4571    3.3084
  0.1398    7.3579    3.1736    6.5243    6.4220    7.0441    2.1184
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 568 through 574
  5.5994    8.1973    5.2149    0.1408    0.0145    0.0044    2.8615
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  0.3434    0.9856    0.6088    6.2174    1.5948    8.8951    5.6262
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 575 through 581
  9.2951    4.0876    1.0205    0.0197    0.8738    0.1926    1.6172
  0.6111    0.4807    4.9905    4.8322    3.3054    0.3088    7.6517
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 582 through 588
  3.5997    1.0694    0.5024    2.7653    7.5576    5.4043    0.1770
  0.0004    7.8006    4.1707    2.7580    0.4336    1.2893    5.0592
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 589 through 595
  5.4710    0.0644    0.0445    1.9419    0.0006    1.3241    4.6682
  0.0266    6.7680    8.9057    0.4215    3.1960    2.1110    4.2344
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 596 through 602
  9.2095    1.3547    6.0599    2.0332    0.3473    1.0981    6.9012
  0.0017    4.2467    2.8421    2.9438    1.5702    3.3198    1.8273
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 603 through 609
  0.1202    0.0089    9.5945    4.7826    0.0480    0.5409    0.0048
  2.0284    8.0274    0.0364    0.1993    4.1378    0.0014    0.0076
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 610 through 616
  2.5145    8.9622    0.0476    3.0481    9.4839    5.4158    5.6521
  1.6357    0.2526    0.1274    6.4767    0.1184    0.8858    0.5811
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 617 through 623
  6.7559    0.2816    0.2618    1.2733    0.1710    3.6738    5.3103
  1.7719    2.3742    7.9921    3.0458    7.0243    4.4574    1.5132
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 624 through 630
  5.1824    2.9577    8.7243    0.4142    4.9138    3.7577    0.2128
  3.9691    0.6128    0.1355    8.4685    1.7624    0.1403    0.5118
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 631 through 637
  0.7013    2.1887    2.5421    5.1122    0.0001    1.3428    2.7265
  6.3472    6.5023    0.4306    4.1823    0.7638    2.4607    2.0140
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 638 through 644
  3.9090    2.5587    4.9649    6.7200    4.5344    1.0390    7.1135
  4.3300    2.4086    1.3555    3.0355    3.4911    0.0216    1.3413
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 645 through 651
  0.6056    0.0174    7.9130    4.5361    3.2829    5.6692    1.4670
  8.0340    2.0334    1.1789    0.8755    0.6981    0.0080    2.7674
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
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Columns 652 through 658
  0.1728    0.5477    8.3769    2.5208    9.0133    0.2572    0.0011
  5.5657    0.7352    0.2676    4.7569    0.0070    7.2133    8.5441
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 659 through 665
  0.0653    8.7515    1.5874    5.3002    1.2226    3.4670    0.0024
  9.8506    0.3786    1.5046    2.9692    3.6137    1.4205    8.0172
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 666 through 672
  2.6618    7.3008    0.8804    0.2019    0.2454    1.0977    0.4543
  2.9328    2.5874    7.1163    8.6568    5.8495    0.1970    2.3456
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 673 through 679
  1.9743    4.5633    3.7056    1.5843    8.5323    1.4111    0.0289
  1.0536    0.0046    1.4991    7.1298    0.0044    0.4270    1.9120
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 680 through 686
  6.1257    5.7947    0.6178    2.1529    0.1645    0.0620    3.4063
  0.7671    0.1407    1.6375    2.2796    1.7531    0.6014    0.4258
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 687 through 693
  0.0507    5.6944    3.7772    0.0568    3.7416    1.4590    0.0417
  5.8716    3.6121    2.5785    8.9166    0.0774    0.0013    1.9125
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 694 through 700
  0.7404    0.3607    2.9067    6.7912    2.7739    0.0072    3.3804
  7.3277    7.8269    4.5120    2.3625    4.6455    1.2185    1.4900
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 701 through 707
  2.6549    3.0496    7.1027    8.2558    1.0119    0.2818    1.9135
  5.9626    0.9081    0.5285    1.4414    0.3385    5.4101    5.4053
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 708 through 714
  1.0731    2.2681    2.0258    0.0921    1.8228    0.6369    0.0088
  7.8141    0.3979    1.4282    0.3137    6.4726    6.9309    0.1005
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 715 through 721
  3.8565    1.5598    7.3219    1.7153    2.4000    3.2700    4.3284
  4.6219    6.8180    1.2729    5.7911    4.1635    0.1300    1.3554
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 722 through 728
  6.5444    1.8371    7.7801    1.0453    4.1039    3.0468    0.2301
  0.8738    0.1309    1.1672    7.1628    0.5752    2.9652    2.9102
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 729 through 735
  3.1677    8.7504    0.1843    2.0354    1.3143    2.3818    9.6031
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  4.9265    0.4220    2.6300    1.5429    5.4301    4.1675    0.1850
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 736 through 742
  4.0937    6.0339    4.9872    0.5109    0.0289    0.0309    2.9282
  1.1033    1.8315    2.3237    4.0726    6.5672    2.8990    0.0126
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 743 through 749
  1.2891    0.0499    1.0156    0.5240    0.5576    4.2920    0.0521
  5.9896    1.7989    8.1326    0.0145    3.0062    1.2626    2.3733
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 750 through 756
  7.1610    1.3115    0.9166    0.2924    4.9685    5.9414    0.3963
  0.0318    7.7381    2.6253    0.0209    2.1740    2.0094    1.9776
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 757 through 763
  5.4429    0.0023    8.6212    5.5564    0.1587    2.3425    0.4830
  1.2271    1.4574    0.6933    0.4238    8.3015    0.3402    2.2836
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 764 through 770
  6.2341    2.7906    9.0390    1.2219    4.7375    1.6018    4.8440
  0.0028    0.0406    0.0238    2.0134    0.2740    5.7352    2.6829
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 771 through 777
  5.6150    0.3005    0.0990    4.9080    0.7133    7.3452    0.0743
  0.7404    0.0727    1.8889    2.8617    6.9650    0.9625    6.2162
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 778 through 784
  7.6126    5.5908    7.1439    7.0740    5.5512    8.0661    0.1392
  0.0005    0.2304    0.3943    0.1969    4.3621    0.8220    2.1974
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 785 through 791
  4.2366    7.2793    6.1652    5.6668    2.4464    3.1347    0.4079
  1.3283    0.3354    2.8969    0.4250    0.5877    0.1655    7.6487
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 792 through 798
  8.7645    0.3017    2.6403    6.7913    0.0029    0.9124    0.6750
  0.1589    2.8633    3.9306    0.3046    2.0437    1.5410    1.6221
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 799 through 805
  1.6553    0.0328    0.6875    0.3944    1.1486    1.6731    6.8524
  4.8297    1.9607   10.8298    2.5328    6.1438    0.4606    0.8154
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 806 through 812
  6.4980    1.4503    8.8988    3.5555    1.8561    3.3761    3.2910
  0.1438    0.5202    1.2813    6.8422    5.4174    3.6482    2.5965
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
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Columns 813 through 819
  3.1998    0.0286    4.2140    0.4057    5.4028    8.0600    2.9822
  1.2540    0.6294    0.5627   10.0472    3.6269    1.4592    2.9171
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 820 through 826
  4.9801    3.5536    0.3155    4.1226    0.1332    7.3538    4.1743
  3.0546    3.6739    4.6753    1.4626    0.5683    0.6397    0.0006
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 827 through 833
  9.8980    1.2616    6.5065    2.1562    4.5062    3.0601    6.6651
  0.8700    7.6445    4.6663    3.1035    8.8189    0.2195    0.0020
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 834 through 840
  2.4130    3.3106    5.0809    8.4477    0.1056    5.3274    1.6167
  1.4773    9.3009    1.0203    1.0023    0.3336    0.0552    4.4646
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 841 through 847
  3.2076    0.1720    3.4954    1.0381    0.8508    7.7162    8.1550
  0.0027    4.8790    2.0623    9.4916    0.3710    1.5069    4.5372
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 848 through 854
  5.6648    5.8433    6.5747    0.0112    1.3326    2.5465    6.4892
  0.0721    2.0905    1.0323    6.4098    7.7570    4.7347    1.3464
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 855 through 861
  4.1409    0.2551    0.1537   10.6825    0.0702    1.1503    9.2119
  0.0108   10.7687    7.7427    0.0173    5.6698    1.2407    1.7851
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 862 through 868
  2.9677    6.8796    1.6091    0.2121    6.0315    5.2850    2.4828
  4.0431    6.3879    6.3351    7.1729    0.2784    0.3715    5.2828
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 869 through 875
  3.6604    0.1376    1.5317    0.7455    1.6282    0.3880    5.5300
  1.5764    3.0296    0.0048    0.1456    4.4254    5.3187    0.9325
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 876 through 882
 11.3117    3.1958    0.0036    3.6336    1.3538    1.3929    1.8989
  0.0000    2.1737    6.3987    0.0499    4.9423    0.0983    0.6092
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 883 through 889
  3.3229    5.3732    4.1800    1.1842    4.7804    5.2372    1.8523
  0.9273    1.6823   10.1414    3.9100    6.0097    1.6334    1.7595
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 890 through 896
  8.8299    3.3683    6.5889    0.6458    1.8007    0.1021    2.5297
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  2.3258    2.1332    0.0000    3.1942    1.2070    0.0999    6.1463
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 897 through 903
  0.5343    3.3834    3.7450    6.1936    0.0012    0.0001    1.9205
 16.6949    9.9530    2.3407    0.5219    2.1776   11.7535    4.5585
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 904 through 910
  5.3025    0.3458    1.1496    5.0918    0.0201    1.0687    5.9716
  3.9468    3.9266    1.9950    0.8867    0.0349   15.1137    1.3721
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 911 through 917
  4.8748    8.2048    0.0108    0.0123    1.3689    3.1620    6.6369
  3.0500    0.8415    0.9026   16.9698    1.3925    4.3026    0.1076
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 918 through 924
  4.3619    6.3227    1.3012    4.6487    6.7621    4.8859    4.5539
  6.5856    0.1169    2.8650    3.7568    1.3056    0.4315    9.3920
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 925 through 931
  8.9096    6.8696    8.5973    6.2685    0.0110    4.0743    1.6760
  0.0000    2.0559    7.6710    2.1912    9.6295    1.9708    0.0625
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 932 through 938
  0.7510    0.0000    1.3255    5.4742    2.4876    0.8323   10.4698
  1.7396   12.3718    4.1277    3.2865    0.6141    0.5463    1.0325
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 939 through 945
  1.5607    0.2719    3.9160    0.7648    0.0186    0.3674    0.0010
 13.6099    5.1837    4.5534    3.0160    4.8595   11.4093    3.4527
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 946 through 952
  1.3706    0.6691    0.4361    0.3353    2.1922    4.4075    1.6300
 11.4084    9.0519    2.5273    3.8930    4.0972    0.3381    6.9330
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 953 through 959
  1.1122    2.4451    7.3252    0.2287    0.0878    0.2238    7.7730
  0.1676    8.2360    1.2388    7.2860    0.7704    7.6450    0.2362
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 960 through 966
  1.0986    5.2140    5.1067    0.0005    7.6016    0.0000    7.5857
  0.0202    0.0242    0.0485    9.6276    0.1082    9.8877    2.1504
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
Columns 967 through 973
  7.4878    0.1667    4.7503    2.6719    0.2809    2.3620    4.5647
  0.0176    4.4518    7.5479    3.1058    0.3833    4.3191    1.9251
  1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
```
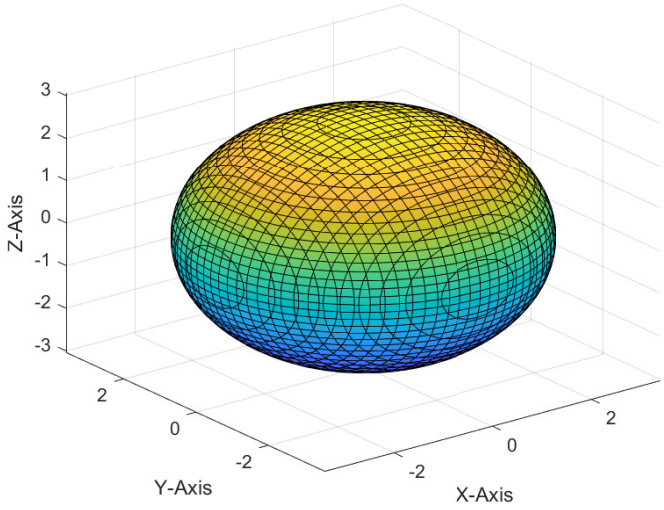

```
  Columns 974 through 980
    2.8998    7.4644    0.2893    0.1681    1.7753    5.1044    0.2606
    0.8650    0.3004    1.4217    1.1852    9.2755    4.3433    9.8548
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
  Columns 981 through 987
    0.0201    6.8174    0.8333    1.5346    4.3648    9.7868    3.4663
    5.0496    3.0180    0.0744    9.7365    1.0984    1.3429    0.1698
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
  Columns 988 through 994
    4.0486    6.8341    3.6176    3.0555    0.2889    0.0526    1.4964
    4.9140    0.2227    5.2311    2.9599    4.5828    2.4515    0.3429
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
  Columns 995 through 1,000
    1.0613   11.3771    1.0480    0.2323    0.0013    1.3262
    2.3108    0.8414    0.0625    4.7526    0.3163    7.5003
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
B =
   1.0e+04 *
    1.7601    0.5912    0.3149
    0.5912    1.7699    0.3065
    0.3149    0.3065    0.1000
C =
   1.0e+03 *
    5.7893
    5.9868
    2.9333
tu =
   -0.8012
   -0.7230
    7.6731
```

(d)Plot the coordinate data points and the equation of the ellipse in the same figure. (Use \texttt{fimplicit3} to plot the sphere. Also if the viewing angle is bad when publishing, you can change it by using the command \texttt{view}.)

```
f = @(x,y,z) 0.8012*x.^2 +0.7230*y.^2 -7.6731+z.^2;
fimplicit3(f)
xlabel('X-Axis')
ylabel('Y-Axis')
zlabel('Z-Axis')
```



(e) Compute the error for the fit using the Euclidean norm $\|\cdot\|_2$ of the residual $\mathbf{r} = \mathbf{w} - A\mathbf{u}$.

```
r = w-A*tu
norm(r,2)
```

```
r =
   -0.4736
    1.2192
    0.0037
    0.9799
   -0.9656
   -0.1145
   -0.9069
   -0.3823
    1.4731
    1.0861
   -0.4609
    1.1768
    1.9610
   -1.3835
    0.3199
    0.2282
   -0.8065
    0.5720
    0.2706
    1.5880
```

```
-0.0273
 0.8651
 1.3927
 0.5344
-0.2282
 0.5577
-1.0928
-0.8256
-0.7189
 0.3079
-0.4755
 0.6450
 0.2506
 0.3552
-0.7249
-0.4057
 0.0303
-0.7352
 1.3725
 0.3694
-0.6125
-1.2955
-0.4206
 0.3800
-0.8108
-0.5207
 0.1726
-0.4340
-0.0208
-0.6333
-0.2256
 0.4779
 0.3854
-0.0476
-0.5660
-1.4657
 0.9087
-0.5900
-0.3411
-1.3549
-0.0414
-0.2994
-0.5169
 0.3987
 1.7791
 1.0223
```

```
-0.0696
 0.3394
-0.2671
-0.1112
 1.3239
-0.6228
 1.2694
-1.2120
 1.5170
-1.2289
-0.5487
-0.7095
-1.5031
-0.4971
-0.9826
 0.4242
-1.4537
-1.2863
 0.6547
-0.7318
-0.3233
 0.8905
-1.1473
 0.4956
 0.6529
 0.9623
-1.2241
 0.3034
 0.6774
-0.9322
-0.5405
 0.3058
 0.6231
-1.5860
-0.4991
-0.5084
 0.4636
-1.0825
 0.3984
-1.1616
 0.1422
 0.2592
-0.4973
-0.6500
-1.0695
-0.0183
```

```
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 0.3991
 1.0010
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 0.7345
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 0.8752
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-0.3796
-0.2967
 0.1612
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-0.5235
-0.3509
-0.2461
 0.4787
-0.0825
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-1.0316
-1.1807
 0.1046
 0.8947
-0.7663
-0.2689
-0.6559
-1.3494
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 1.4950
 1.1060
-0.4537
-1.0399
-1.4209
 0.7471
```

```
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-0.9680
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-1.2922
 0.9325
 0.6809
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 0.0815
 0.3857
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```

```
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```

```
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```
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```

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 5.9046
-1.6571
-0.1390
 3.3571
-3.5667
-2.8161
 7.3746
 5.7320
-1.7826
 5.8435
 0.5761
-1.6215
 6.2759
-1.7420
-0.6214
-1.3582
 1.7001
-2.0258
-1.4038
 0.9080
-0.9658
-3.0486
 3.4229
 1.4651
-0.1716
 4.9982
-0.7421
 0.8176
-2.9032
-3.1581
-0.9251
 4.3478
-2.9405
 0.5137
 1.9991
-2.3980
 2.1691
 4.9126
-3.2082
```

```
 0.6411
-2.6943
-0.2527
 7.5263
-5.0483
 1.6803
 3.9136
-3.0756
-2.4239
 0.6565
-2.8297
 0.8574
-1.2687
 0.3327
 4.7648
-0.2228
-2.9625
-1.8751
 1.2064
 6.0654
 0.3785
-1.5249
 3.9993
-1.4212
 3.4531
 0.0457
-1.5738
-3.9485
 7.4811
-2.6945
-1.1532
 1.6479
-0.5963
 4.9796
 4.4863
 1.2081
-4.2889
 1.5666
 0.6110
 2.5319
-0.4479
 2.8736
-1.3701
 6.5346
-2.7760
 1.6401
```

```
   -2.2203
   -0.3283
   -1.7532
    1.4729
    0.5847
   -2.2298
   -0.3134
   -2.7285
   -5.1460
    2.9126
    3.8263
   -3.9632
    0.4242
    1.8347
ans =
   47.1659
```