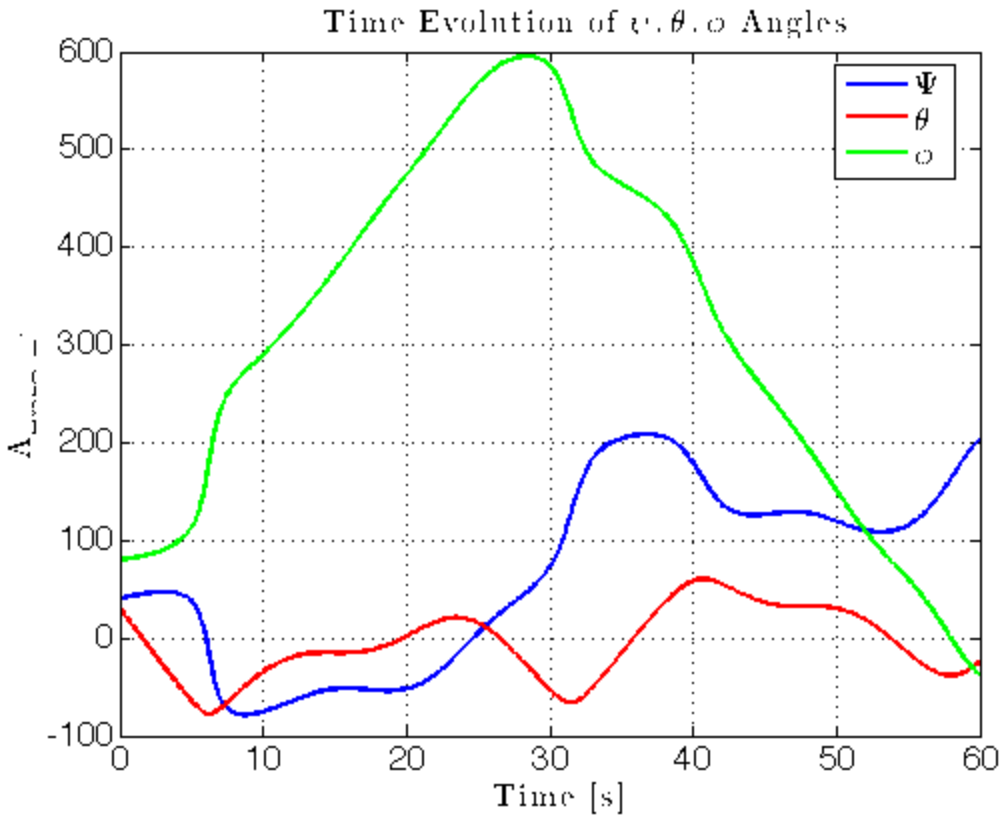
```
function Q = Problem312()

clc;clear all;close all
```

Initial Conditions

```
Q_init  = deg2rad([40 30 80]);
% Time space
t=linspace(0,60,1000);
```

Perform the integration

```
Q = zeros(length(t),length(Q_init));
Q(1,:)= Q_init;
for ii=2:length(t)
   % Find the Derivative
   Qprime = IntYPR(t(ii),Q(ii-1,:));

   % General linear integration:
   %    x_(n+1) = x_(n) + x'*delta_t
   Q(ii,:) = Q(ii-1,:) + Qprime'*(t(ii)-t(ii-1));

end

 [t,Q]=ode45(@IntYPR,t,Q_init');

domod=0;

figure;hold on
xlabel('Time [s]');ylabel('Angle ({$^\circ$})')
title('Time Evolution of $\psi , \theta , \phi$ Angles')
plot(t,mod(rad2deg(Q(:,1)),360*domod),'b');
plot(t,mod(rad2deg(Q(:,2)),360*domod),'r');
plot(t,mod(rad2deg(Q(:,3)),360*domod),'g');
legend('{$\Psi $}','{$\theta $}','{$\phi $}','location','best')
```




```
end
```

```
function Qprime = IntYPR(t,Q)
    % Calculate [B(th)] Matrix
    w=Calcw(t);
    B = BmatEuler321(Q);
    Qprime = B*w;
end

function w = Calcw(t)
w       =  [sin(0.1*t) ;
            0.01 ;
            cos(0.1*t)].*deg2rad(20);
end
```

```
        ans =
              0.69813       0.5236       1.3963
              0.70252      0.50298       1.3985
              0.70681      0.48236       1.4007
                0.711      0.46173       1.4029
               0.7151       0.4411       1.4051
               0.7191      0.42046       1.4074
              0.72302      0.39982       1.4096
              0.72685      0.37917       1.4119
               0.7306      0.35852       1.4142
```

0.73427	0.33786	1.4165
0.73786	0.31721	1.4189
0.74138	0.29656	1.4213
0.74481	0.2759	1.4237
0.74818	0.25525	1.4261
0.75147	0.2346	1.4286
0.75469	0.21395	1.4312
0.75784	0.1933	1.4338
0.76092	0.17266	1.4364
0.76394	0.15202	1.4391
0.76688	0.13139	1.4418
0.76976	0.11077	1.4446
0.77257	0.090147	1.4475
0.77531	0.069536	1.4504
0.77799	0.048934	1.4534
0.7806	0.028341	1.4564
0.78314	0.0077581	1.4595
0.78562	-0.012814	1.4627
0.78803	-0.033374	1.466
0.79037	-0.053922	1.4694
0.79264	-0.074457	1.4728
0.79484	-0.094978	1.4763
0.79697	-0.11548	1.4799
0.79903	-0.13597	1.4836
0.80101	-0.15645	1.4874
0.80291	-0.1769	1.4912
0.80474	-0.19734	1.4952
0.80649	-0.21776	1.4993
0.80816	-0.23816	1.5035
0.80975	-0.25854	1.5078
0.81126	-0.2789	1.5122
0.81268	-0.29923	1.5167
0.814	-0.31954	1.5213
0.81524	-0.33982	1.5261
0.81638	-0.36008	1.531
0.81742	-0.38031	1.536
0.81835	-0.40052	1.5412
0.81917	-0.42069	1.5465
0.81988	-0.44084	1.552
0.82047	-0.46095	1.5577
0.82094	-0.48103	1.5635
0.82127	-0.50107	1.5695
0.82147	-0.52108	1.5756
0.82153	-0.54105	1.582
0.82143	-0.56098	1.5885
0.82118	-0.58087	1.5953
0.82076	-0.60072	1.6023
0.82015	-0.62052	1.6095
0.81934	-0.64028	1.617
0.81833	-0.65999	1.6247
0.81712	-0.67965	1.6327
0.81569	-0.69925	1.6409
0.81404	-0.71881	1.6494
0.81216	-0.73831	1.6583

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0.80186	-0.81571	1.6969
0.79848	-0.83489	1.7075
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0.78594	-0.89197	1.7422
0.78084	-0.91082	1.7548
0.77521	-0.92958	1.768
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0.76222	-0.96678	1.7964
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0.74656	-1.0035	1.8277
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0.71712	-1.0577	1.8812
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0.24514	-1.3175	2.5038
0.18671	-1.3276	2.572
0.12355	-1.3367	2.6449
0.055714	-1.3446	2.7227
-0.016644	-1.3512	2.805
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-0.33748	-1.3628	3.1669
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-0.49857	-1.3593	3.3492
-0.57535	-1.3553	3.4368
-0.64853	-1.3499	3.5208
-0.71747	-1.3433	3.6007
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-1.2036	-1.2062	4.2283
-1.2235	-1.1923	4.2608
-1.2415	-1.1783	4.2916
-1.2577	-1.1642	4.3207
-1.2724	-1.15	4.3483
-1.2855	-1.1357	4.3746
-1.2973	-1.1214	4.3997
-1.3079	-1.107	4.4238
-1.3174	-1.0926	4.4468
-1.3258	-1.0782	4.469
-1.3334	-1.0638	4.4905
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0.11366	0.24584	9.9296
0.1288	0.23731	9.9455
0.14384	0.22852	9.9612
0.15876	0.21946	9.9767
0.17358	0.21014	9.9918
0.18828	0.20056	10.007
0.20286	0.19073	10.021
0.21733	0.18066	10.036
0.23168	0.17036	10.05
0.24591	0.15982	10.064
0.26002	0.14905	10.077
0.274	0.13806	10.09
0.28787	0.12685	10.103
0.30163	0.11542	10.116
0.31527	0.10378	10.129
0.3288	0.091933	10.141
0.34222	0.079879	10.153
0.35554	0.067626	10.164
0.36874	0.055178	10.176
0.38185	0.04254	10.187
0.39485	0.029717	10.197
0.40776	0.016712	10.208
0.42057	0.0035314	10.218

0.43328	-0.0098217	10.228
0.44591	-0.023342	10.238
0.45846	-0.037026	10.247
0.47092	-0.050869	10.256
0.4833	-0.064866	10.265
0.49562	-0.079013	10.274
0.50786	-0.093306	10.282
0.52004	-0.10774	10.29
0.53216	-0.12231	10.298
0.54422	-0.13701	10.305
0.55624	-0.15184	10.312
0.56821	-0.1668	10.319
0.58014	-0.18188	10.326
0.59204	-0.19707	10.332
0.60391	-0.21237	10.338
0.61577	-0.22778	10.343
0.62761	-0.24329	10.349
0.63944	-0.2589	10.354
0.65127	-0.27461	10.359
0.6631	-0.2904	10.363
0.67495	-0.30628	10.367
0.68682	-0.32225	10.371
0.69872	-0.33829	10.375
0.71066	-0.35441	10.378
0.72264	-0.37059	10.381
0.73467	-0.38685	10.384
0.74677	-0.40316	10.386
0.75895	-0.41953	10.388
0.77122	-0.43595	10.39
0.7836	-0.45241	10.391
0.79608	-0.46892	10.392
0.80868	-0.48547	10.393
0.8214	-0.50206	10.393
0.83425	-0.51868	10.393
0.84724	-0.53533	10.392
0.86039	-0.55201	10.391
0.87371	-0.56871	10.39
0.88722	-0.58542	10.388
0.90093	-0.60214	10.386
0.91486	-0.61887	10.384
0.92903	-0.63559	10.381
0.94346	-0.65231	10.377
0.95818	-0.669	10.373
0.97321	-0.68567	10.369
0.98857	-0.70231	10.364
1.0043	-0.7189	10.358
1.0204	-0.73545	10.352
1.0369	-0.75193	10.345
1.0539	-0.76835	10.338
1.0713	-0.78468	10.33
1.0893	-0.80093	10.321
1.1078	-0.81707	10.312
1.1269	-0.8331	10.302
1.1466	-0.84901	10.291

1.167	-0.86478	10.279
1.188	-0.8804	10.266
1.2099	-0.89586	10.252
1.2325	-0.91115	10.238
1.2559	-0.92625	10.222
1.28	-0.94117	10.206
1.305	-0.95587	10.189
1.3309	-0.97034	10.17
1.3579	-0.98452	10.15
1.3862	-0.99838	10.129
1.4157	-1.0119	10.107
1.4465	-1.025	10.083
1.4788	-1.0377	10.057
1.5126	-1.05	10.03
1.5478	-1.0618	10.001
1.5846	-1.073	9.9705
1.6229	-1.0837	9.9383
1.6627	-1.0937	9.9044
1.704	-1.1032	9.8689
1.7468	-1.1119	9.8318
1.7909	-1.12	9.7932
1.8364	-1.1273	9.7531
1.8831	-1.1339	9.7116
1.9309	-1.1396	9.6689
1.9798	-1.1445	9.625
2.0296	-1.1484	9.5801
2.0802	-1.1515	9.5342
2.1313	-1.1536	9.4877
2.1829	-1.1547	9.4406
2.2347	-1.1548	9.3931
2.286	-1.1539	9.346
2.3364	-1.1521	9.2996
2.386	-1.1495	9.2538
2.4347	-1.1459	9.2087
2.4826	-1.1414	9.1643
2.5296	-1.136	9.1208
2.5756	-1.1297	9.0781
2.6207	-1.1224	9.0363
2.6648	-1.1143	8.9954
2.7078	-1.1052	8.9555
2.7498	-1.0953	8.9167
2.7907	-1.0846	8.8789
2.8305	-1.0732	8.8422
2.869	-1.0609	8.8067
2.9063	-1.048	8.7724
2.9423	-1.0344	8.7393
2.9769	-1.0202	8.7076
3.0101	-1.0055	8.6772
3.0417	-0.9903	8.6481
3.0718	-0.97471	8.6205
3.1003	-0.9588	8.5944
3.1271	-0.94264	8.5697
3.1521	-0.92633	8.5467
3.1752	-0.90995	8.5252

3.1964	-0.8936	8.5054
3.2163	-0.87715	8.4867
3.2352	-0.86049	8.4688
3.2534	-0.84363	8.4516
3.2707	-0.8266	8.435
3.2873	-0.80939	8.4191
3.3033	-0.79203	8.4037
3.3185	-0.77452	8.3889
3.3331	-0.75688	8.3746
3.3471	-0.7391	8.3608
3.3605	-0.72122	8.3474
3.3734	-0.70322	8.3345
3.3858	-0.68512	8.3219
3.3977	-0.66694	8.3096
3.4091	-0.64867	8.2977
3.4201	-0.63032	8.2861
3.4306	-0.6119	8.2748
3.4408	-0.59342	8.2637
3.4506	-0.57488	8.2529
3.46	-0.55629	8.2423
3.4691	-0.53764	8.232
3.4779	-0.51895	8.2218
3.4863	-0.50021	8.2118
3.4944	-0.48144	8.2019
3.5022	-0.46264	8.1922
3.5097	-0.44381	8.1827
3.5169	-0.42495	8.1732
3.5239	-0.40608	8.1639
3.5306	-0.38718	8.1546
3.5371	-0.36826	8.1455
3.5433	-0.34933	8.1364
3.5493	-0.33039	8.1274
3.5551	-0.31143	8.1184
3.5606	-0.29247	8.1096
3.5659	-0.2735	8.1007
3.571	-0.25453	8.092
3.5758	-0.23555	8.0832
3.5805	-0.21658	8.0745
3.585	-0.19761	8.0658
3.5892	-0.17865	8.0571
3.5933	-0.1597	8.0484
3.5972	-0.14076	8.0397
3.6009	-0.12183	8.031
3.6044	-0.10292	8.0223
3.6077	-0.084024	8.0135
3.6109	-0.065152	8.0047
3.6139	-0.046303	7.9959
3.6167	-0.02748	7.987
3.6193	-0.0086854	7.978
3.6217	0.010079	7.969
3.624	0.028809	7.9599
3.6261	0.047504	7.9507
3.628	0.066161	7.9415
3.6298	0.084778	7.9321

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3.6328	0.12188	7.9131
3.634	0.14036	7.9034
3.635	0.15879	7.8936
3.6359	0.17717	7.8837
3.6366	0.19549	7.8736
3.6371	0.21375	7.8634
3.6374	0.23195	7.8531
3.6375	0.2501	7.8426
3.6374	0.26817	7.8319
3.6371	0.28618	7.8211
3.6366	0.30412	7.81
3.6359	0.32198	7.7988
3.635	0.33977	7.7875
3.6339	0.35749	7.7759
3.6325	0.37512	7.7641
3.6309	0.39267	7.7521
3.6291	0.41013	7.7399
3.6271	0.42753	7.7276
3.625	0.44484	7.7152
3.6228	0.46209	7.7026
3.6205	0.47924	7.6899
3.6179	0.4963	7.677
3.6151	0.51327	7.6638
3.612	0.53012	7.6503
3.6086	0.54686	7.6366
3.6049	0.56348	7.6225
3.6008	0.57997	7.608
3.5964	0.59632	7.5931
3.5916	0.61253	7.5779
3.5864	0.62859	7.5622
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3.5366	0.73607	7.4382
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3.485	0.80654	7.3324
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3.2433	0.97493	6.9198
3.2228	0.98336	6.8873
3.2018	0.99139	6.8542
3.1803	0.999	6.8207
3.1584	1.0062	6.7866
3.136	1.013	6.7519
3.1133	1.0193	6.7168
3.0901	1.0252	6.6812
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2.9941	1.0439	6.5345
2.9694	1.0474	6.4969
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2.894	1.0547	6.3823
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2.8175	1.0571	6.2657
2.7922	1.0568	6.2268
2.7672	1.0561	6.1882
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2.7184	1.0533	6.1116
2.6946	1.0512	6.0738
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2.626	1.0426	5.9626
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2.5829	1.0349	5.8905
2.5623	1.0306	5.8552
2.5422	1.0259	5.8204
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2.4682	1.0042	5.6862
2.4513	0.99817	5.654
2.4351	0.99186	5.6223
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2.4047	0.97861	5.5607
2.3904	0.97171	5.5307
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2.364	0.9574	5.4723
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2.329	0.93498	5.3885
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2.3088	0.91959	5.3351
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2.2609	0.87278	5.1848
2.2546	0.865	5.1609
2.2486	0.85722	5.1373
2.2431	0.84946	5.114
2.238	0.84173	5.091
2.2332	0.83403	5.0682
2.2288	0.82636	5.0456
2.2247	0.81874	5.0233
2.221	0.81117	5.0012
2.2176	0.80365	4.9793
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2.2117	0.78882	4.9361
2.2091	0.7815	4.9147
2.2069	0.77427	4.8935
2.2049	0.76712	4.8725
2.2031	0.76005	4.8516
2.2016	0.75308	4.8308
2.2003	0.74621	4.8101
2.1992	0.73943	4.7896
2.1983	0.73276	4.7691
2.1976	0.7262	4.7487
2.1971	0.71975	4.7284
2.1968	0.71341	4.7082
2.1966	0.70719	4.6881
2.1966	0.70109	4.6681
2.1968	0.69512	4.648
2.197	0.68926	4.6281
2.1975	0.68354	4.6082
2.198	0.67794	4.5883
2.1987	0.67247	4.5685
2.1995	0.66714	4.5487
2.2003	0.66193	4.529
2.2013	0.65687	4.5092
2.2024	0.65193	4.4895
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2.2104	0.62527	4.3715
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2.2135	0.61751	4.3321
2.2151	0.61384	4.3124
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2.2183	0.60691	4.273
2.22	0.60365	4.2533
2.2216	0.60053	4.2335
2.2233	0.59754	4.2137
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2.2343	0.58035	4.0744
2.2357	0.5784	4.0544
2.2371	0.57658	4.0343
2.2384	0.57487	4.0142
2.2397	0.57328	3.994
2.2409	0.57181	3.9738
2.242	0.57045	3.9535
2.2431	0.5692	3.9332
2.2441	0.56805	3.9128
2.245	0.56701	3.8924
2.2458	0.56607	3.8719
2.2465	0.56522	3.8513
2.2471	0.56447	3.8307
2.2477	0.56381	3.8101
2.2481	0.56324	3.7894
2.2484	0.56275	3.7686
2.2486	0.56234	3.7477
2.2487	0.56201	3.7268
2.2487	0.56175	3.7059
2.2486	0.56156	3.6848
2.2483	0.56143	3.6637
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2.2468	0.56137	3.6
2.2461	0.56145	3.5787
2.2452	0.56156	3.5572
2.2441	0.56171	3.5357
2.243	0.5619	3.5142
2.2416	0.5621	3.4925
2.2402	0.56233	3.4708
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2.2368	0.56282	3.4272
2.235	0.56307	3.4053
2.2329	0.56331	3.3833
2.2307	0.56355	3.3612
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2.2144	0.56442	3.2274
2.2111	0.56442	3.2049
2.2077	0.56437	3.1823
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2.2003	0.56409	3.1368
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2.1924	0.56352	3.0912
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2.1402	0.55311	2.8373
2.1349	0.5514	2.8141
2.1295	0.54954	2.7909
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2.1185	0.54537	2.7446
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2.1073	0.54056	2.6984
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1.933	0.35489	1.9744
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1.8937	0.17269	1.6357
1.8932	0.16128	1.618
1.893	0.14976	1.6005
1.8929	0.13813	1.583
1.893	0.1264	1.5656
1.8934	0.11456	1.5484
1.894	0.10263	1.5312
1.8947	0.090612	1.5141
1.8957	0.078501	1.4971
1.8969	0.066306	1.4801
1.8983	0.05403	1.4633
1.8999	0.041679	1.4465
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1.9286	-0.085034	1.2811
1.9328	-0.097923	1.2647
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1.942	-0.12376	1.2319
1.9469	-0.13669	1.2155
1.9521	-0.14963	1.1991
1.9576	-0.16257	1.1827
1.9633	-0.1755	1.1662
1.9693	-0.18842	1.1497
1.9756	-0.20133	1.1332
1.9822	-0.21422	1.1166
1.989	-0.22707	1.0999
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2.0112	-0.26543	1.0496
2.0192	-0.27812	1.0327
2.0275	-0.29075	1.0156
2.0361	-0.30333	0.99847
2.045	-0.31584	0.98122
2.0541	-0.32828	0.96389
2.0636	-0.34064	0.94645
2.0734	-0.35292	0.92889
2.0835	-0.36511	0.91121
2.094	-0.37719	0.89338
2.1047	-0.38916	0.8754
2.1159	-0.40101	0.85726

2.1274	-0.41273	0.83894
2.1392	-0.4243	0.82044
2.1515	-0.43573	0.80175
2.1641	-0.44701	0.78286
2.1771	-0.45811	0.76377
2.1905	-0.46904	0.74447
2.2042	-0.47978	0.72495
2.2184	-0.49033	0.7052
2.2329	-0.50067	0.68524
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2.2632	-0.52071	0.64462
2.2789	-0.53038	0.62397
2.295	-0.53982	0.60308
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2.3284	-0.55792	0.56062
2.3457	-0.56657	0.53904
2.3634	-0.57495	0.51723
2.3814	-0.58303	0.4952
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2.4378	-0.60546	0.42782
2.4573	-0.61229	0.40494
2.4771	-0.61879	0.38186
2.4973	-0.62494	0.3586
2.5178	-0.63073	0.33515
2.5387	-0.63616	0.31154
2.5598	-0.64122	0.28776
2.5812	-0.64588	0.26383
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2.6249	-0.65403	0.21557
2.6472	-0.65748	0.19126
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2.6924	-0.66311	0.14236
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2.8794	-0.66792	-0.053995
2.9031	-0.66651	-0.078206
2.9267	-0.66464	-0.10226
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2.9739	-0.65956	-0.14983
2.9974	-0.65635	-0.1733
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3.2029     -0.60788     -0.37192
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3.5224     -0.44697     -0.64819
3.5399     -0.43451     -0.66172
3.5571     -0.42187     -0.67479
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