

OKAFOR MARTINS CHINONSO

16/ENG07/018

PETROLEUM ENGINEERING

ENG 382

ASSIGNMENT 5

Question 2

```
1. function FV = funcsyss(t,Q)
2. %Fv = [Q1;Q2;Q3]
3. FV(1,1) = (-15/500)*Q(1)+(5/1000)*Q(2)+1;
4. FV(2,1) = (15/500)*Q(1)-(18/1000)*Q(2)+(3/400)*Q(3);
5. FV(3,1) = (13/1000)*Q(2)-(13/400)*Q(3);
```

commandwindow

```
>> [t, Qv] =ode45('funcsyss', [0 1200],[0;0;0]),plot(t,Qv(:,1),'+-',t,Qv(:,2),'*- ',t,Qv(:,3),'-.'),grid on, grid
minor,ylabel('Quantities of the oil in tanks'),xlabel('Time(mins)'),legend('Q(1)','Q(2)','Q(3)')
```

t =

1.0e+03 *

0

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0000

0.0001

0.0001

0.0001

0.0002

0.0003

0.0005

0.0006

0.0008

0.0015

0.0023

0.0030

0.0037

0.0047

0.0056

0.0065

0.0074

0.0088

0.0103

0.0117

0.0131

0.0151

0.0171

0.0191

0.0211

0.0238

0.0265

0.0293

0.0320

0.0356

0.0392

0.0428

0.0464

0.0511

0.0559

0.0607

0.0654

0.0718

0.0782

0.0846

0.0910

0.1000

0.1091

0.1181

0.1272

0.1386

0.1500

0.1615

0.1729

0.1874

0.2020

0.2165

0.2311

0.2492

0.2673

0.2855

0.3036

0.3299

0.3563

0.3826

0.4089

0.4268

0.4447

0.4625

0.4804

0.4983

0.5162

0.5340

0.5519

0.5735

0.5951

0.6167

0.6383

0.6620

0.6856

0.7093

0.7329

0.7539

0.7749

0.7959

0.8169

0.8342

0.8515

0.8687

0.8860

0.9027

0.9193

0.9360

0.9527

0.9724

0.9920

1.0117

1.0314

1.0547

1.0781

1.1014

1.1247

1.1436

1.1624

1.1812

1.2000

Qv =

0 0 0

0.0001 0.0000 0.0000

0.0001	0.0000	0.0000
0.0002	0.0000	0.0000
0.0002	0.0000	0.0000
0.0005	0.0000	0.0000
0.0007	0.0000	0.0000
0.0010	0.0000	0.0000
0.0012	0.0000	0.0000
0.0025	0.0000	0.0000
0.0037	0.0000	0.0000
0.0050	0.0000	0.0000
0.0062	0.0000	0.0000
0.0125	0.0000	0.0000
0.0188	0.0000	0.0000
0.0251	0.0000	0.0000
0.0313	0.0000	0.0000
0.0627	0.0001	0.0000
0.0940	0.0001	0.0000
0.1253	0.0002	0.0000
0.1566	0.0004	0.0000
0.3125	0.0015	0.0000
0.4676	0.0033	0.0000
0.6221	0.0059	0.0000
0.7758	0.0091	0.0000
1.4883	0.0339	0.0002
2.1854	0.0739	0.0007
2.8675	0.1285	0.0016
3.5348	0.1972	0.0031
4.3512	0.3026	0.0060
5.1458	0.4284	0.0101

5.9193	0.5737	0.0157
6.6723	0.7376	0.0230
7.7862	1.0226	0.0378
8.8559	1.3463	0.0573
9.8835	1.7060	0.0822
10.8710	2.0992	0.1126
12.2040	2.7082	0.1661
13.4654	3.3731	0.2323
14.6600	4.0879	0.3116
15.7921	4.8473	0.4046
17.2353	5.9400	0.5528
18.5802	7.0945	0.7266
19.8353	8.3010	0.9255
21.0081	9.5507	1.1491
22.4489	11.2612	1.4828
23.7717	13.0180	1.8562
24.9891	14.8080	2.2667
26.1125	16.6190	2.7114
27.4691	19.0257	3.3463
28.6985	21.4341	4.0282
29.8171	23.8300	4.7497
30.8397	26.2008	5.5044
32.0858	29.3308	6.5609
33.2039	32.3832	7.6511
34.2129	35.3481	8.7617
35.1304	38.2156	9.8826
36.2997	42.0875	11.4669
37.3397	45.7530	13.0313
38.2695	49.2164	14.5590

39.1108	52.4756	16.0393
40.0752	56.3106	17.8315
40.9370	59.8499	19.5243
41.7082	63.1156	21.1141
42.4062	66.1208	22.5986
43.2086	69.5883	24.3331
43.9199	72.7052	25.9083
44.5493	75.5085	27.3367
45.1115	78.0249	28.6261
45.7357	80.7991	30.0528
46.2782	83.2246	31.3037
46.7477	85.3470	32.4002
47.1577	87.2008	33.3598
47.6722	89.4715	34.5511
48.0907	91.3437	35.5252
48.4220	92.8994	36.3084
48.6967	94.1725	36.9575
48.8648	94.8887	37.3493
49.0091	95.5211	37.6855
49.1301	96.0858	37.9654
49.2363	96.5790	38.2121
49.3342	97.0000	38.4428
49.4186	97.3715	38.6407
49.4897	97.7026	38.8055
49.5521	97.9919	38.9506
49.6218	98.2840	39.1164
49.6794	98.5363	39.2521
49.7241	98.7608	39.3537
49.7630	98.9501	39.4427

49.8091	99.1017	39.5587
49.8434	99.2391	39.6413
49.8597	99.3828	39.6695
49.8761	99.4971	39.7021
49.9069	99.5402	39.7877
49.9261	99.5934	39.8375
49.9247	99.6804	39.8210
49.9266	99.7476	39.8171
49.9439	99.7586	39.8670
49.9547	99.7783	39.8966
49.9561	99.8146	39.8955
49.9579	99.8452	39.8964
49.9662	99.8554	39.9197
49.9718	99.8684	39.9346
49.9737	99.8870	39.9378
49.9756	99.9030	39.9410
49.9812	99.9110	39.9566
49.9848	99.9207	39.9659
49.9850	99.9358	39.9645
49.9857	99.9478	39.9647
49.9928	99.9449	39.9863
49.9960	99.9488	39.9955
49.9912	99.9697	39.9781
49.9888	99.9834	39.9689
49.9952	99.9742	39.9892
49.9981	99.9723	39.9982
49.9949	99.9838	39.9871
49.9928	99.9923	39.9797

```
>> [t,Qv]=ode23('functsyss',[0 1200],[0;0;0]),plot(t,Qv(:,1),'+-',t,Qv(:,2),'*- ',t,Qv(:,3),'-.'),grid on, grid
minor,ylabel('Quantities of the oil in tanks'),xlabel('Time(mins)'),legend('Q(1)','Q(2)','Q(3)')
```

t =

1.0e+03 *

0

0.0000

0.0000

0.0000

0.0000

0.0001

0.0003

0.0006

0.0010

0.0014

0.0018

0.0023

0.0027

0.0031

0.0037

0.0043

0.0051

0.0060

0.0070

0.0084

0.0100

0.0121

0.0147

0.0184

0.0236

0.0301

0.0382

0.0468

0.0565

0.0678

0.0813

0.0981

0.1201

0.1548

0.1974

0.2397

0.2929

0.3588

0.4420

0.5539

0.6352

0.6998

0.7644

0.8315

0.8910

0.9464

1.0052

1.0696

1.1331

1.1918

1.2000

Qv =

0	0	0
0.0001	0.0000	0.0000
0.0005	0.0000	0.0000
0.0025	0.0000	0.0000
0.0125	0.0000	0.0000
0.0624	0.0001	0.0000
0.3110	0.0015	0.0000
0.6002	0.0054	0.0000
0.9951	0.0151	0.0001
1.3895	0.0295	0.0002
1.7836	0.0489	0.0004
2.1774	0.0734	0.0007
2.5709	0.1029	0.0012
2.9863	0.1396	0.0019
3.4698	0.1899	0.0030
4.0332	0.2587	0.0047
4.6905	0.3534	0.0076
5.4586	0.4843	0.0122
6.3583	0.6665	0.0198
7.4160	0.9221	0.0323
8.6662	1.2851	0.0534
10.1571	1.8101	0.0899
11.9641	2.5916	0.1554
14.2310	3.8209	0.2812
17.1263	5.8507	0.5406

20.2320	8.7057	0.9971
23.4309	12.5386	1.7531
26.2284	16.8014	2.7600
28.8465	21.7231	4.1144
31.3276	27.3694	5.8927
33.7147	33.8301	8.1864
36.0633	41.2461	11.1139
38.4757	49.9383	14.8776
41.2950	61.2306	20.1683
43.7265	71.7776	25.4032
45.4330	79.4186	29.3249
46.9336	86.1721	32.8225
48.1298	91.5677	35.6231
49.0052	95.5126	37.6715
49.5829	98.1339	39.0230
49.7823	98.9741	39.4951
49.8536	99.3962	39.6497
49.9257	99.5913	39.8365
49.9322	99.8065	39.8253
49.9825	99.8158	39.9741
49.9676	99.9269	39.9137
49.9956	99.9147	39.9989
49.9790	99.9899	39.9388
50.0098	99.9406	40.0378
49.9830	100.0159	39.9471
49.9871	100.0077	39.9605

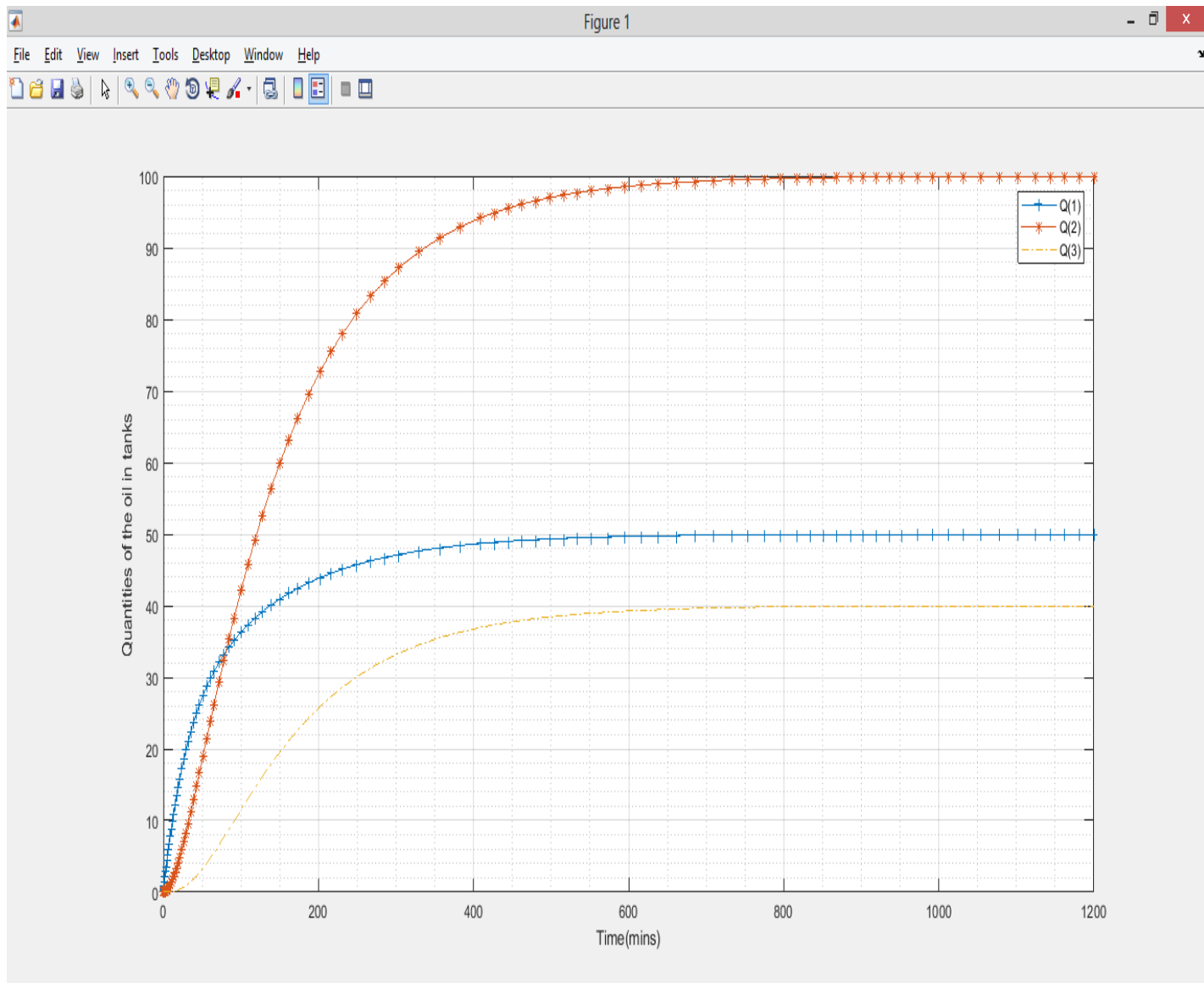


Figure 1: Graphical Representation using ODE45

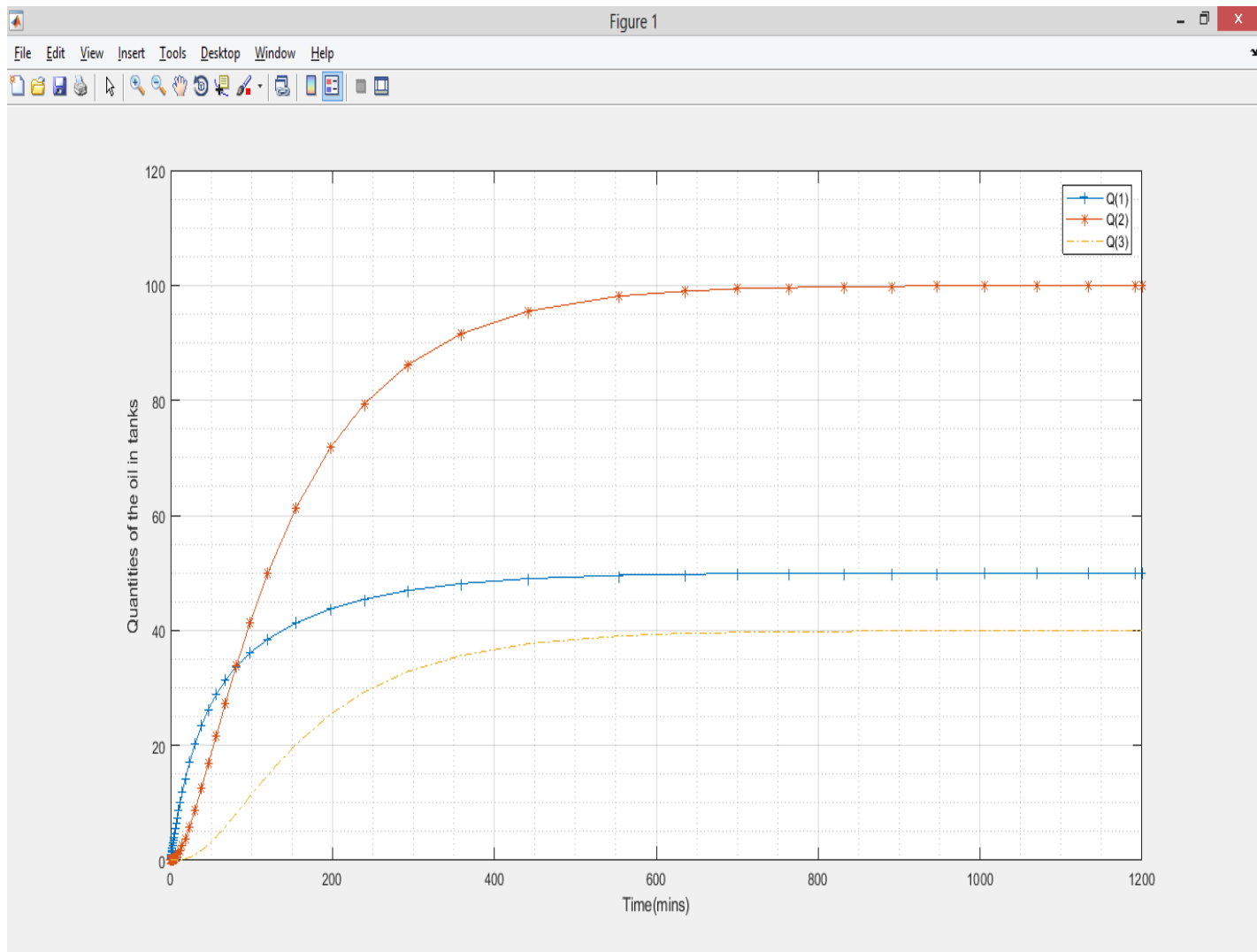


Figure 2:Graphical Representation using ODE23

Therefore, from the graphical representations above, the steady-state values are:

- $Q(1) = 50$
- $Q(2) = 100$
- $Q(3) = 40$