

BULLEM, FLORENCE ILUEH-OCHUWEH

16/ENG01/005

CHEMICAL ENGINEERING

ASSIGNMENT 5

QUESTION 1

```
function f = Philomina(t,y)
f = (2*t) + (y^2);
```

```
(new m file)
clc
commandwindow
clear
clc
close all
[t,y] = ode45('Philomina',[0:0.1:0.5],1.4)
```

t =

0
0.1
0.2
0.3
0.4
0.5

y =

1.4
1.639
1.9959
2.5563
3.53
5.6022

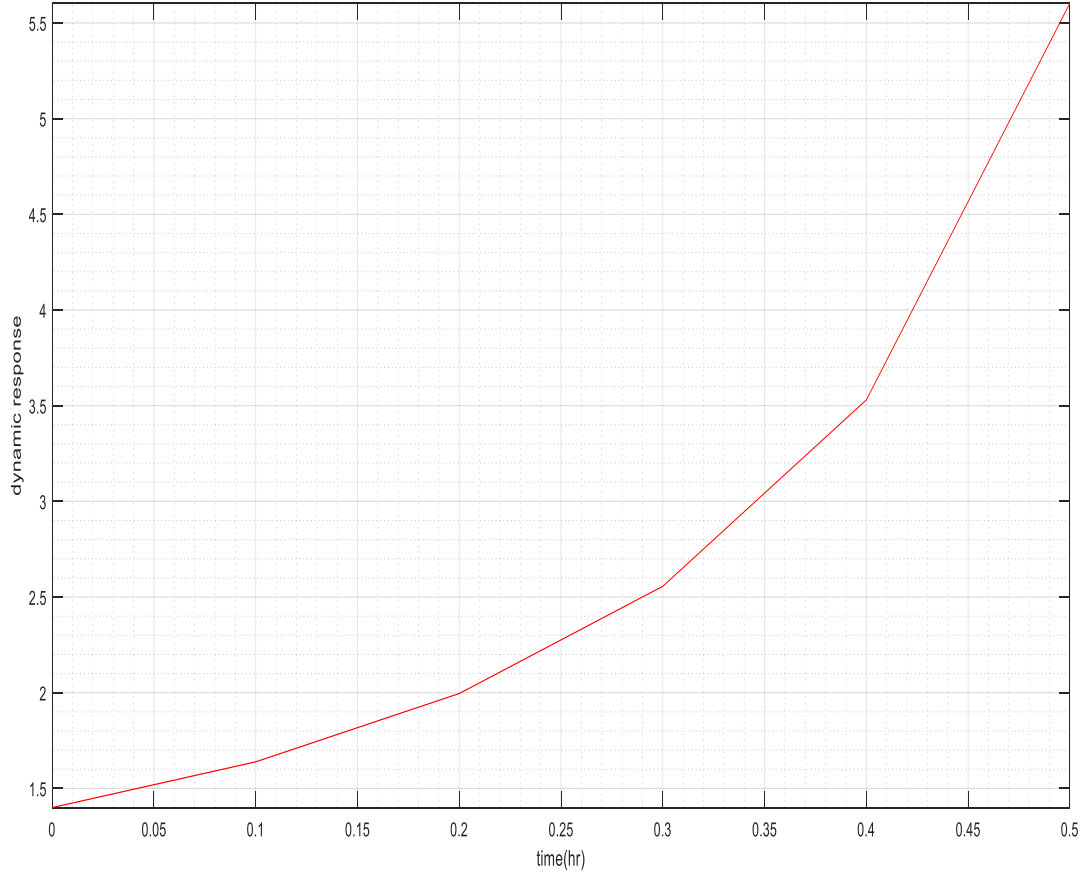


Figure 1: Dynamic response of a system

```

format short g
t = 0
y = 1.4
h = 0.1
for i = 1:inf
    iter(i+1) = i;
    t(i+1) = t(i) + h;
    y(i+1) = y(i) + h*((2*t(i)) + (y(i)^2));
    if t(i+1) == 0.5
        break
    end
end
iter'
t'
y'
tableau = table(iter',t',y')
figure(1)
plot(t,y,'r')
xlabel('time(hr)')
ylabel('dynamic response')

```

```
grid on
grid minor
axis tight
```

```
t =
```

```
0
```

```
y =
```

```
1.4
```

```
h =
```

```
0.1
```

```
iter =
```

```
0 1
```

```
t =
```

```
0 0.1
```

```
y =
```

```
1.4 1.596
```

```
iter =
```

```
0 1 2
```

```
t =
```

```
0 0.1 0.2
```

```
y =
```

```
1.4 1.596 1.8707
```

```
iter =
```

```
0 1 2 3
```

```
t =
```

```
0 0.1 0.2 0.3
```

```
y =
```

```
1.4 1.596 1.8707 2.2607
```

```
iter =
```

```
0 1 2 3 4
```

```
t =
```

```
0 0.1 0.2 0.3 0.4
```

```
y =
```

```
1.4 1.596 1.8707 2.2607 2.8317
```

```
iter =
  0    1    2    3    4    5
t =
      0      0.1      0.2      0.3      0.4
0.5
y =
      1.4      1.596      1.8707      2.2607      2.8317
3.7136
ans =
  0
  1
  2
  3
  4
  5
ans =
      0
      0.1
      0.2
      0.3
      0.4
      0.5
ans =
      1.4
      1.596
      1.8707
      2.2607
      2.8317
      3.7136
```

tableau =

6×3 table

Var1	Var2	Var3
0	0	1.4
1	0.1	1.596
2	0.2	1.8707
3	0.3	2.2607
4	0.4	2.8317
5	0.5	3.7136

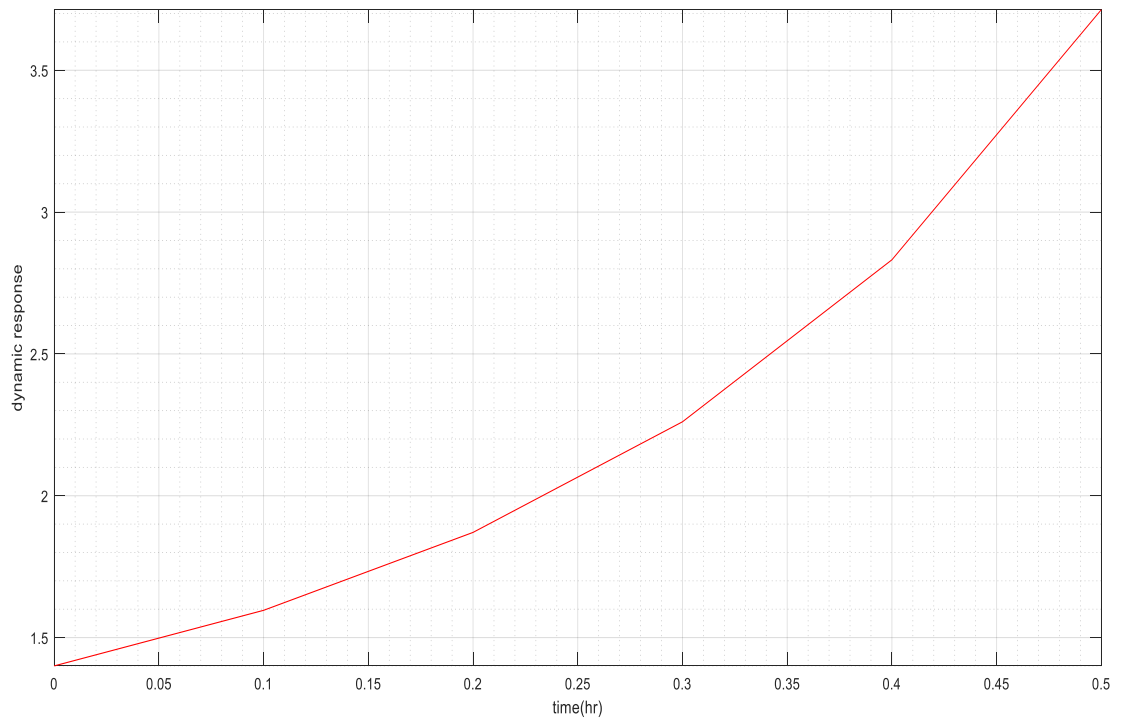


Figure 2: Dynamic response of a system

Codes on Excel

B12 = 0.1

B2 = 0

$$=B2+\$B\$12 = 0.1$$

$$=B3+\$B\$12 = 0.2$$

$$=B4+\$B\$12 = 0.3$$

$$=B5+\$B\$12 = 0.4$$

$$=B6+\$B\$12 = 0.5$$

$$=C2+(\$B\$12*((2*B2)+(C2^2))) = 1.4$$

$$=C3+(\$B\$12*((2*B3)+(C3^2))) = 1.596$$

$$=C4+(\$B\$12*((2*B4)+(C4^2))) = 1.870722$$

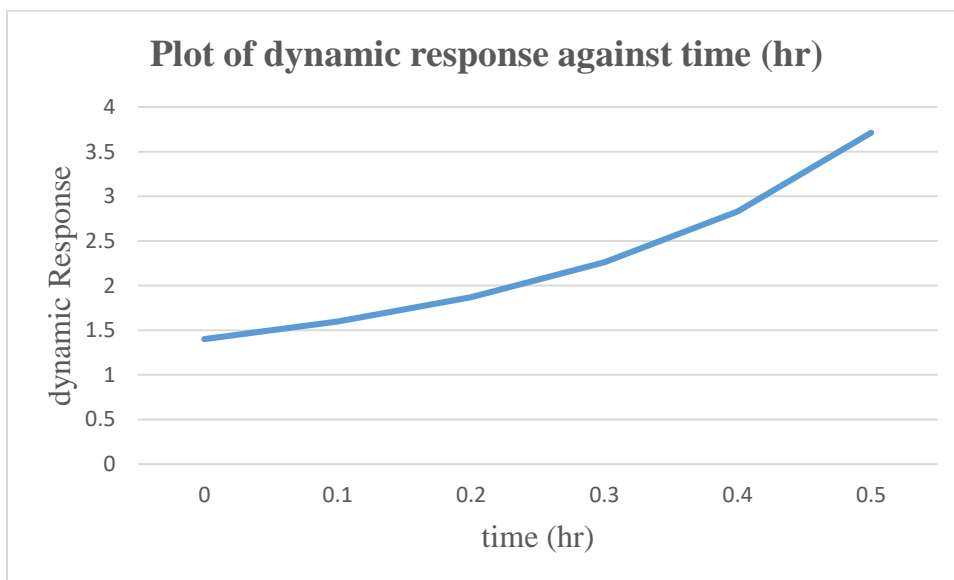
$$=C5+(\$B\$12*((2*B5)+(C5^2))) = 2.260682$$

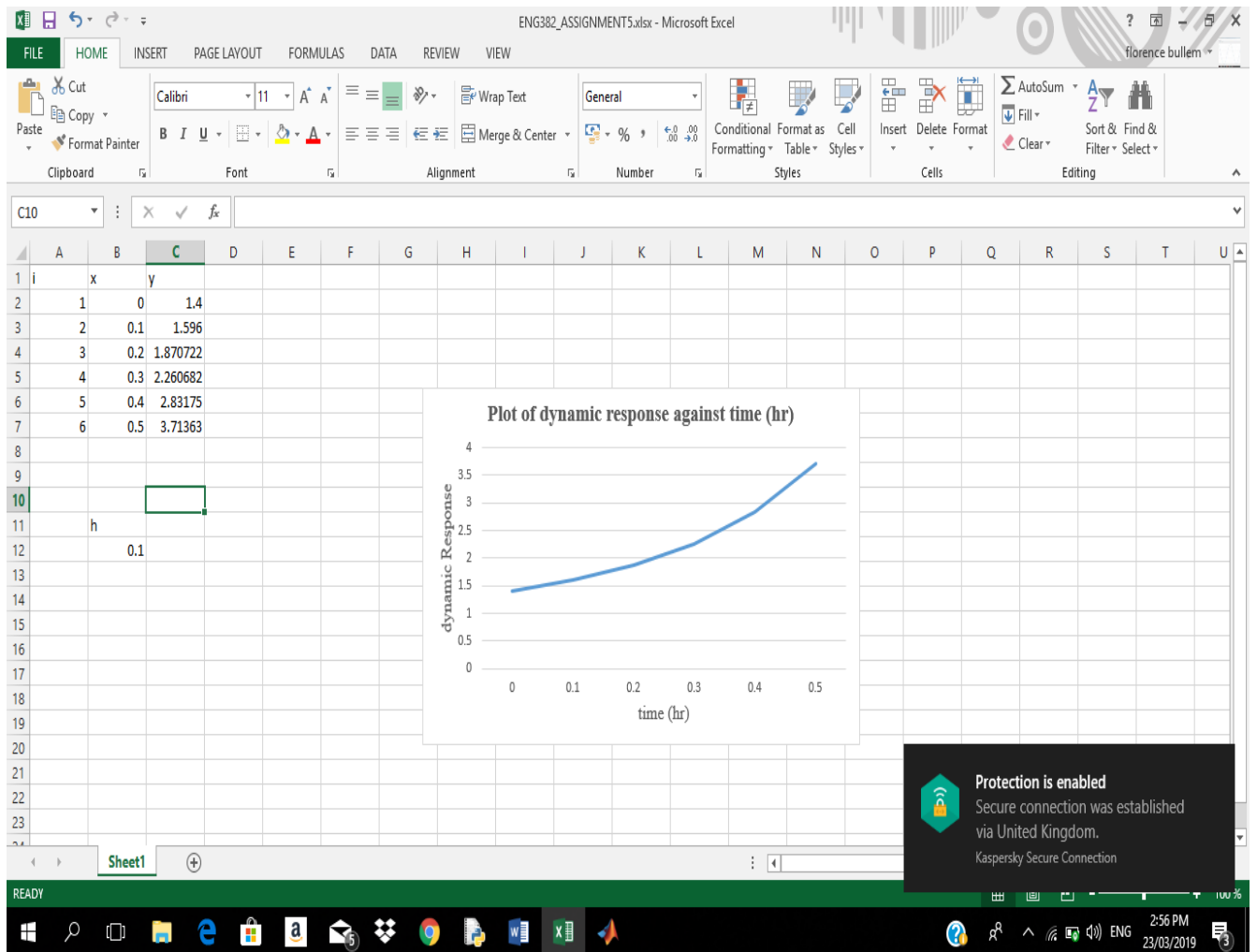
$$=C5+(\$B\$12*((2*B6)+(C6^2))) = 3.71363$$

i	x	y
1	0	1.4
2	0.1	1.596
3	0.2	1.870722
4	0.3	2.260682
5	0.4	2.83175
6	0.5	3.71363

h

0.1





QUESTION 2

```
function dQdt = ochuweh(t,Q)
dQdt(1) = (-0.03*Q(1)) + (0.005*Q(2)) + 1;
dQdt(2) = (0.03*Q(1)) - (0.018*Q(2)) + (0.0075*Q(3));
dQdt(3) = (0.013*Q(2)) - (0.0325*Q(3));
dQdt = dQdt'
```

```
(new m file)
commandwindow
clear
clc
close all
format short g
[t,dQ] = ode45('ochuweh',[0 1200],[0 0 0]);
```

```
tablo = table(t,dQ)
```

```
tablo =
```

```
117×2 table
```

t		dQ	
0	0	0	0
5.0238e-05	5.0238e-05	3.7857e-11	8.2414e-18
0.00010048	0.00010048	1.5143e-10	6.5931e-17
0.00015071	0.00015071	3.4072e-10	2.2252e-16
0.00020095	0.00020095	6.0572e-10	5.2745e-16
0.00045214	0.00045214	3.0664e-09	6.008e-15
0.00070333	0.00070332	7.42e-09	2.2614e-14
0.00095452	0.0009545	1.3666e-08	5.6527e-14
0.0012057	0.0012057	2.1805e-08	1.1393e-13
0.0024616	0.0024616	9.0892e-08	9.6955e-13
0.0037176	0.0037174	2.073e-07	3.3394e-12
0.0049735	0.0049732	3.7101e-07	7.9959e-12
0.0062295	0.0062289	5.8204e-07	1.5711e-11
0.012509	0.012507	2.3467e-06	1.272e-10
0.018789	0.018784	5.2938e-06	4.3098e-10
0.025069	0.025059	9.4228e-06	1.0235e-09
0.031348	0.031334	1.4733e-05	2.0012e-09
0.062747	0.062688	5.8998e-05	1.6038e-08
0.094146	0.094013	0.00013275	5.4136e-08
0.12554	0.12531	0.00023595	1.2829e-07
0.15694	0.15657	0.00036854	2.5048e-07
0.31394	0.31246	0.0014709	1.9985e-06
0.47093	0.46762	0.0033017	6.7247e-06
0.62792	0.62205	0.0058552	1.5891e-05
0.78491	0.77576	0.0091262	3.0941e-05
1.5225	1.4883	0.033936	0.00022264
2.2601	2.1854	0.073913	0.00071735

2.9977	2.8675	0.12852	0.0016489
3.7352	3.5348	0.19725	0.0031434
4.6599	4.3512	0.30258	0.0059928
5.5846	5.1458	0.42836	0.010128
6.5093	5.9193	0.57366	0.015746
7.434	6.6723	0.7376	0.023031
8.8487	7.7862	1.0226	0.037777
10.263	8.8559	1.3463	0.057336
11.678	9.8835	1.706	0.08216
13.093	10.871	2.0992	0.11264
15.095	12.204	2.7082	0.1661
17.097	13.465	3.3731	0.23225
19.1	14.66	4.0879	0.31162
21.102	15.792	4.8473	0.40458
23.818	17.235	5.94	0.55283
26.535	18.58	7.0945	0.72656
29.251	19.835	8.301	0.92548
31.968	21.008	9.5507	1.1491
35.571	22.449	11.261	1.4828
39.174	23.772	13.018	1.8562
42.777	24.989	14.808	2.2667
46.381	26.113	16.619	2.7114
51.138	27.469	19.026	3.3463
55.896	28.699	21.434	4.0282
60.654	29.817	23.83	4.7497
65.412	30.84	26.201	5.5044
71.808	32.086	29.331	6.5609
78.205	33.204	32.383	7.6511
84.602	34.213	35.348	8.7617
90.998	35.13	38.216	9.8826
100.04	36.3	42.088	11.467
109.08	37.34	45.753	13.031
118.11	38.269	49.216	14.559
127.15	39.111	52.476	16.039
138.59	40.075	56.311	17.832

150.03	40.937	59.85	19.524
161.47	41.708	63.116	21.114
172.91	42.406	66.121	22.599
187.45	43.209	69.588	24.333
201.99	43.92	72.705	25.908
216.54	44.549	75.509	27.337
231.08	45.112	78.025	28.626
249.21	45.736	80.799	30.053
267.35	46.278	83.225	31.304
285.48	46.748	85.347	32.4
303.61	47.158	87.201	33.36
329.93	47.672	89.471	34.551
356.26	48.091	91.344	35.525
382.58	48.422	92.899	36.308
408.91	48.697	94.173	36.958
426.78	48.865	94.889	37.349
444.66	49.009	95.521	37.686
462.53	49.13	96.086	37.965
480.4	49.236	96.579	38.212
498.28	49.334	97	38.443
516.15	49.419	97.372	38.641
534.02	49.49	97.703	38.806
551.9	49.552	97.992	38.951
573.51	49.622	98.284	39.116
595.12	49.679	98.536	39.252
616.73	49.724	98.761	39.354
638.34	49.763	98.95	39.443
661.99	49.809	99.102	39.559
685.64	49.843	99.239	39.641
709.29	49.86	99.383	39.669
732.94	49.876	99.497	39.702
753.94	49.907	99.54	39.788
774.93	49.926	99.593	39.838
795.93	49.925	99.68	39.821
816.93	49.927	99.748	39.817

834.2	49.944	99.759	39.867
851.47	49.955	99.778	39.897
868.74	49.956	99.815	39.895
886.01	49.958	99.845	39.896
902.68	49.966	99.855	39.92
919.35	49.972	99.868	39.935
936.01	49.974	99.887	39.938
952.68	49.976	99.903	39.941
972.37	49.981	99.911	39.957
992.05	49.985	99.921	39.966
1011.7	49.985	99.936	39.965
1031.4	49.986	99.948	39.965
1054.7	49.993	99.945	39.986
1078.1	49.996	99.949	39.995
1101.4	49.991	99.97	39.978
1124.7	49.989	99.983	39.969
1143.6	49.995	99.974	39.989
1162.4	49.998	99.972	39.998
1181.2	49.995	99.984	39.987
1200	49.993	99.992	39.98

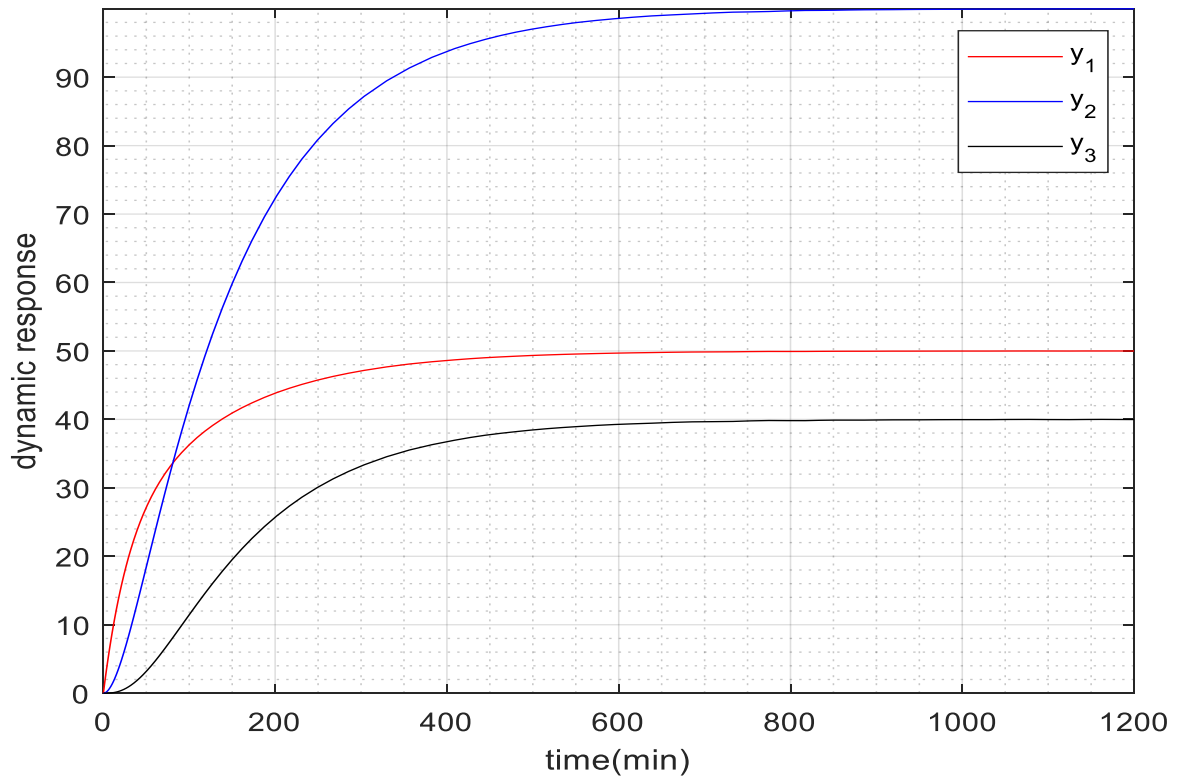


Figure 3: dynamic models of oil quantities in three interconnecting tanks

The steady state values are:

For $Q_1 = 49.993$

For $Q_2 = 99.992$

For $Q_3 = 39.98$