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## Problem 1

```
clc;
clear all;
close all;

[t,Y] = ode15s(@funode,[0:0.1:20],[1 0]); %solving diff equations defined in funct
[t,Y]                                     %from results we can see the steady stat

plot(t,Y)                               %ploting y1 & y2 Vs temp(t)
```

*ans* =

0	1.0000	0
0.1000	0.9082	0.1832
0.2000	0.8308	0.3351
0.3000	0.7657	0.4594
0.4000	0.7105	0.5600
0.5000	0.6638	0.6403
0.6000	0.6240	0.7037
0.7000	0.5901	0.7529
0.8000	0.5613	0.7904
0.9000	0.5368	0.8185
1.0000	0.5158	0.8388
1.1000	0.4978	0.8531
1.2000	0.4824	0.8625
1.3000	0.4691	0.8682
1.4000	0.4578	0.8708
1.5000	0.4480	0.8711
1.6000	0.4396	0.8697
1.7000	0.4324	0.8668
1.8000	0.4262	0.8630
1.9000	0.4209	0.8586
2.0000	0.4164	0.8537
2.1000	0.4124	0.8487
2.2000	0.4090	0.8434
2.3000	0.4061	0.8382
2.4000	0.4036	0.8331
2.5000	0.4014	0.8281
2.6000	0.3995	0.8232
2.7000	0.3979	0.8186
2.8000	0.3965	0.8141
2.9000	0.3954	0.8099

---

3.0000	0.3944	0.8059
3.1000	0.3935	0.8023
3.2000	0.3927	0.7988
3.3000	0.3921	0.7956
3.4000	0.3915	0.7926
3.5000	0.3910	0.7899
3.6000	0.3906	0.7874
3.7000	0.3902	0.7851
3.8000	0.3899	0.7829
3.9000	0.3896	0.7810
4.0000	0.3894	0.7792
4.1000	0.3892	0.7776
4.2000	0.3890	0.7760
4.3000	0.3888	0.7747
4.4000	0.3887	0.7734
4.5000	0.3885	0.7723
4.6000	0.3884	0.7712
4.7000	0.3884	0.7703
4.8000	0.3883	0.7694
4.9000	0.3882	0.7686
5.0000	0.3882	0.7679
5.1000	0.3882	0.7673
5.2000	0.3881	0.7667
5.3000	0.3881	0.7661
5.4000	0.3881	0.7657
5.5000	0.3880	0.7652
5.6000	0.3880	0.7648
5.7000	0.3880	0.7645
5.8000	0.3880	0.7641
5.9000	0.3880	0.7638
6.0000	0.3880	0.7635
6.1000	0.3879	0.7633
6.2000	0.3879	0.7631
6.3000	0.3879	0.7629
6.4000	0.3879	0.7627
6.5000	0.3879	0.7625
6.6000	0.3879	0.7623
6.7000	0.3879	0.7622
6.8000	0.3879	0.7621
6.9000	0.3879	0.7620
7.0000	0.3879	0.7619
7.1000	0.3879	0.7618
7.2000	0.3879	0.7617
7.3000	0.3879	0.7616
7.4000	0.3879	0.7615
7.5000	0.3879	0.7615
7.6000	0.3878	0.7614
7.7000	0.3878	0.7614
7.8000	0.3878	0.7613
7.9000	0.3878	0.7613
8.0000	0.3878	0.7613
8.1000	0.3878	0.7612
8.2000	0.3878	0.7612
8.3000	0.3878	0.7612

---

---

8.4000	0.3878	0.7612
8.5000	0.3878	0.7612
8.6000	0.3878	0.7612
8.7000	0.3878	0.7612
8.8000	0.3878	0.7611
8.9000	0.3878	0.7611
9.0000	0.3878	0.7611
9.1000	0.3878	0.7611
9.2000	0.3878	0.7611
9.3000	0.3879	0.7611
9.4000	0.3879	0.7611
9.5000	0.3879	0.7611
9.6000	0.3879	0.7611
9.7000	0.3879	0.7610
9.8000	0.3879	0.7610
9.9000	0.3879	0.7610
10.0000	0.3879	0.7610
10.1000	0.3879	0.7610
10.2000	0.3879	0.7610
10.3000	0.3879	0.7610
10.4000	0.3879	0.7609
10.5000	0.3879	0.7609
10.6000	0.3879	0.7609
10.7000	0.3879	0.7609
10.8000	0.3879	0.7609
10.9000	0.3879	0.7609
11.0000	0.3879	0.7609
11.1000	0.3879	0.7609
11.2000	0.3879	0.7609
11.3000	0.3879	0.7609
11.4000	0.3879	0.7609
11.5000	0.3879	0.7609
11.6000	0.3879	0.7609
11.7000	0.3879	0.7609
11.8000	0.3879	0.7608
11.9000	0.3878	0.7608
12.0000	0.3878	0.7608
12.1000	0.3878	0.7608
12.2000	0.3878	0.7608
12.3000	0.3878	0.7608
12.4000	0.3878	0.7608
12.5000	0.3878	0.7609
12.6000	0.3878	0.7609
12.7000	0.3878	0.7609
12.8000	0.3878	0.7609
12.9000	0.3878	0.7609
13.0000	0.3878	0.7609
13.1000	0.3878	0.7609
13.2000	0.3878	0.7609
13.3000	0.3878	0.7609
13.4000	0.3878	0.7609
13.5000	0.3878	0.7609
13.6000	0.3878	0.7609
13.7000	0.3878	0.7609

---

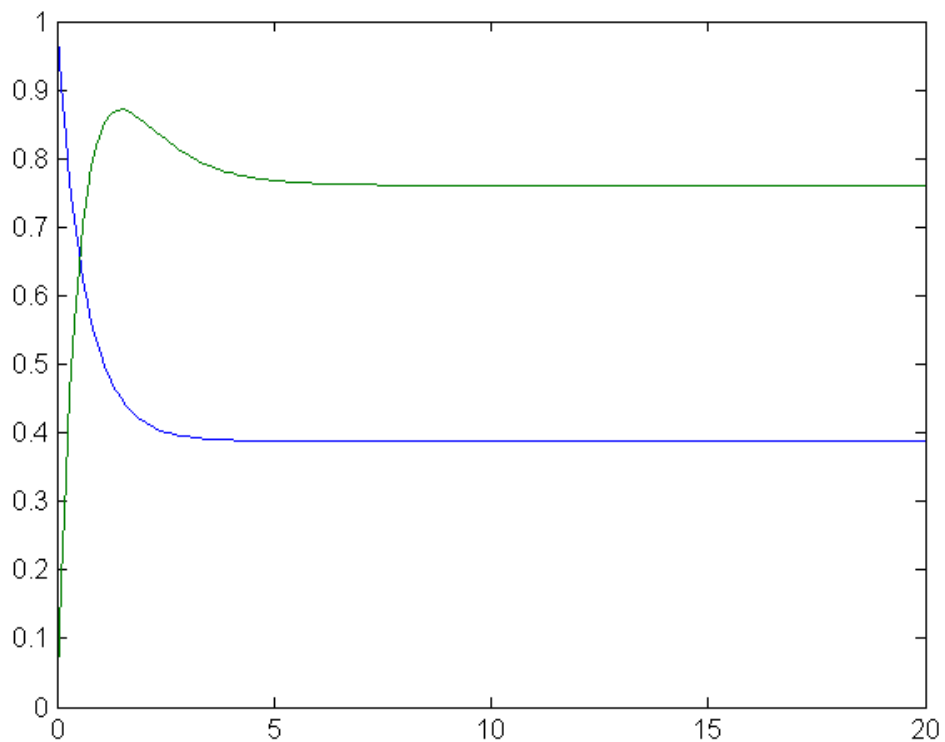
---

13.8000	0.3878	0.7609
13.9000	0.3878	0.7609
14.0000	0.3878	0.7610
14.1000	0.3878	0.7610
14.2000	0.3878	0.7610
14.3000	0.3878	0.7610
14.4000	0.3878	0.7610
14.5000	0.3878	0.7610
14.6000	0.3878	0.7610
14.7000	0.3878	0.7610
14.8000	0.3878	0.7610
14.9000	0.3878	0.7610
15.0000	0.3878	0.7610
15.1000	0.3878	0.7610
15.2000	0.3878	0.7610
15.3000	0.3878	0.7610
15.4000	0.3878	0.7610
15.5000	0.3878	0.7610
15.6000	0.3878	0.7610
15.7000	0.3878	0.7610
15.8000	0.3878	0.7610
15.9000	0.3878	0.7610
16.0000	0.3878	0.7611
16.1000	0.3878	0.7611
16.2000	0.3878	0.7611
16.3000	0.3878	0.7611
16.4000	0.3878	0.7611
16.5000	0.3878	0.7611
16.6000	0.3878	0.7611
16.7000	0.3878	0.7611
16.8000	0.3878	0.7611
16.9000	0.3878	0.7611
17.0000	0.3878	0.7611
17.1000	0.3878	0.7611
17.2000	0.3878	0.7611
17.3000	0.3878	0.7611
17.4000	0.3878	0.7611
17.5000	0.3878	0.7611
17.6000	0.3878	0.7611
17.7000	0.3878	0.7611
17.8000	0.3878	0.7611
17.9000	0.3878	0.7611
18.0000	0.3878	0.7611
18.1000	0.3878	0.7611
18.2000	0.3878	0.7611
18.3000	0.3878	0.7611
18.4000	0.3878	0.7611
18.5000	0.3878	0.7611
18.6000	0.3878	0.7611
18.7000	0.3878	0.7611
18.8000	0.3878	0.7611
18.9000	0.3878	0.7610
19.0000	0.3878	0.7610
19.1000	0.3878	0.7610

---

---

19.2000	0.3878	0.7610
19.3000	0.3878	0.7610
19.4000	0.3878	0.7610
19.5000	0.3878	0.7610
19.6000	0.3878	0.7610
19.7000	0.3878	0.7610
19.8000	0.3878	0.7610
19.9000	0.3878	0.7610
20.0000	0.3878	0.7610



## Problem 2

Program to solve ODEs to calculate distance travelled by cricket ball in different places having different  $g$  and  $c$

```
clear all
close all
clc

global c g v

v=35;
gM=9.81;
cM=0.006;
Re=6400;
```

---

```

vx1=35*cos(pi/4)
vy1=35*sin(pi/4)

% MOHALI

h=0;

g=gM*(Re/(Re+h))^2

c=cM*(1-6.5*h/300)^5

[TM,YM] = ode15s(@diff1,[0 40],[vx1,vy1,0,0])

XM=YM(40,3)      % Distance travelled in X direction in Mohali
MaxYM=max(YM(4)) % Max height attained ( in Y direction in Mohali

% DHARMASALA

h=1.2;

g=gM*(Re/(Re+h))^2

c=cM*(1-6.5*h/300)^5

[TD,YD] = ode15s(@diff1,[0 40],[vx1,vy1,0,0])
XD=YD(40,3)      % Distance travelled in X direction in DHARMASALA
MaxYD=max(YD(4)) % Max height attained ( in Y direction in DHARMASALA

    vx1 =

        24.7487

    vy1 =

        24.7487

    g =

        9.8100

    c =

        0.0060

```

---

---

$TM =$

0  
0.0003  
0.0006  
0.0009  
0.0038  
0.0067  
0.0096  
0.0126  
0.0418  
0.0710  
0.1002  
0.1294  
0.3326  
0.5358  
0.7390  
0.9422  
1.1454  
1.8691  
2.5929  
3.3166  
4.0403  
4.7640  
5.4877  
6.5569  
7.6260  
8.6952  
9.7644  
10.8335  
11.9027  
13.3692  
14.8357  
16.3022  
17.7688  
19.2353  
20.7018  
22.1683  
23.6475  
25.1266  
26.6058  
28.0849  
29.5641  
31.0432  
32.5224  
34.0015  
35.4807  
36.9599  
38.9597  
40.0000

$YM =$

---

1.0e+03 \*

0.0247	0.0247	0	0
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0001	0.0001
0.0247	0.0246	0.0002	0.0002
0.0247	0.0246	0.0002	0.0002
0.0247	0.0246	0.0003	0.0003
0.0245	0.0241	0.0010	0.0010
0.0244	0.0237	0.0017	0.0017
0.0242	0.0233	0.0025	0.0024
0.0241	0.0228	0.0032	0.0031
0.0231	0.0199	0.0080	0.0074
0.0221	0.0171	0.0125	0.0112
0.0212	0.0145	0.0169	0.0144
0.0203	0.0119	0.0212	0.0171
0.0195	0.0095	0.0252	0.0192
0.0167	0.0015	0.0383	0.0232
0.0144	-0.0053	0.0495	0.0218
0.0123	-0.0111	0.0591	0.0158
0.0106	-0.0161	0.0674	0.0059
0.0091	-0.0204	0.0745	-0.0074
0.0078	-0.0241	0.0806	-0.0235
0.0062	-0.0287	0.0881	-0.0519
0.0050	-0.0323	0.0941	-0.0845
0.0040	-0.0352	0.0989	-0.1207
0.0032	-0.0375	0.1027	-0.1596
0.0025	-0.0394	0.1057	-0.2007
0.0020	-0.0408	0.1082	-0.2437
0.0015	-0.0424	0.1107	-0.3048
0.0011	-0.0435	0.1126	-0.3678
0.0008	-0.0444	0.1140	-0.4323
0.0006	-0.0450	0.1150	-0.4979
0.0004	-0.0455	0.1158	-0.5642
0.0003	-0.0458	0.1163	-0.6312
0.0002	-0.0460	0.1167	-0.6985
0.0002	-0.0462	0.1170	-0.7667
0.0001	-0.0464	0.1173	-0.8352
0.0001	-0.0464	0.1174	-0.9038
0.0001	-0.0465	0.1175	-0.9726
0.0000	-0.0466	0.1176	-1.0414
0.0000	-0.0466	0.1177	-1.1104
0.0000	-0.0466	0.1177	-1.1793
0.0000	-0.0467	0.1178	-1.2483
0.0000	-0.0467	0.1178	-1.3174
0.0000	-0.0467	0.1178	-1.3864
0.0000	-0.0467	0.1178	-1.4798
0.0000	-0.0467	0.1178	-1.5283

$\mathbf{X}\mathbf{M} =$



---

117.5284

MaxYM =

24.7442

$g$  =

9.8063

$c$  =

0.0053

$TD$  =

0  
0.0003  
0.0006  
0.0009  
0.0039  
0.0069  
0.0099  
0.0128  
0.0427  
0.0725  
0.1024  
0.1323  
0.3456  
0.5589  
0.7723  
0.9856  
1.1990  
1.9939  
2.7888  
3.5837  
4.3786  
5.1735  
5.9685  
7.2241  
8.4798  
9.7354  
10.9911  
12.2467  
13.5024  
15.1743  
16.8462  
18.5181  
20.1900

---

21.8620  
 23.5339  
 25.2058  
 26.8914  
 28.5770  
 30.2626  
 31.9482  
 33.6338  
 35.3194  
 37.0051  
 38.6907  
 40.0000

YD =

1.0e+03 \*

0.0247	0.0247	0	0
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0000	0.0000
0.0247	0.0247	0.0001	0.0001
0.0247	0.0247	0.0002	0.0002
0.0247	0.0246	0.0002	0.0002
0.0247	0.0246	0.0003	0.0003
0.0246	0.0241	0.0011	0.0010
0.0244	0.0237	0.0018	0.0018
0.0243	0.0233	0.0025	0.0025
0.0242	0.0229	0.0032	0.0031
0.0232	0.0199	0.0083	0.0077
0.0223	0.0171	0.0131	0.0117
0.0215	0.0144	0.0178	0.0150
0.0206	0.0118	0.0223	0.0178
0.0198	0.0093	0.0266	0.0201
0.0171	0.0008	0.0413	0.0240
0.0148	-0.0066	0.0540	0.0216
0.0128	-0.0129	0.0649	0.0138
0.0111	-0.0184	0.0744	0.0013
0.0095	-0.0232	0.0826	-0.0153
0.0082	-0.0273	0.0896	-0.0354
0.0065	-0.0326	0.0989	-0.0731
0.0052	-0.0369	0.1062	-0.1168
0.0041	-0.0403	0.1121	-0.1654
0.0033	-0.0430	0.1167	-0.2177
0.0026	-0.0451	0.1203	-0.2730
0.0021	-0.0468	0.1233	-0.3307
0.0015	-0.0485	0.1262	-0.4104
0.0011	-0.0498	0.1284	-0.4926
0.0008	-0.0507	0.1300	-0.5766
0.0006	-0.0514	0.1312	-0.6620
0.0004	-0.0519	0.1320	-0.7483
0.0003	-0.0522	0.1327	-0.8354
0.0002	-0.0525	0.1331	-0.9230

---

0.0002	-0.0527	0.1335	-1.0117
0.0001	-0.0529	0.1337	-1.1007
0.0001	-0.0530	0.1339	-1.1899
0.0001	-0.0531	0.1341	-1.2793
0.0001	-0.0531	0.1342	-1.3687
0.0000	-0.0532	0.1342	-1.4583
0.0000	-0.0532	0.1343	-1.5479
0.0000	-0.0532	0.1343	-1.6376
0.0000	-0.0532	0.1344	-1.7073

$XD =$

134.0689

$MaxYD =$

24.7447

## Problem 3

Program to find temperature of 3 tanks in series for heating oil using steam

```
clear all
close all
clc

global M C UA Tst T0 W

M=1000;
T0=20;
Tst=250;
W=100; % in kg/min
C=2 ; % in KJ/kg
UA=10;

[T,Y] = ode15s(@diff2,[0 100],[20 20 20])
hold on

figure(1)
xlabel('Time');
ylabel('Temperature');
plot(T,Y(:,1),'r');
plot(T,Y(:,2),'b');
plot(T,Y(:,3),'k');
hold off
```

$T =$

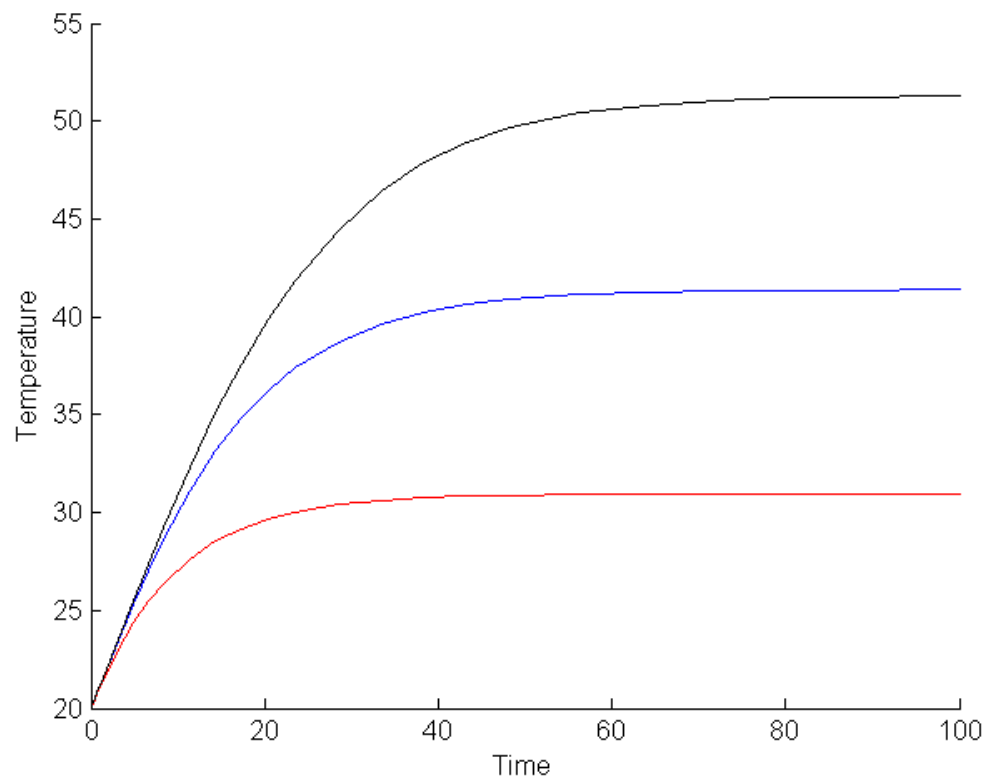
0

---

0.4604  
 0.9209  
 1.3813  
 3.1125  
 4.8436  
 6.5747  
 8.3058  
 11.3405  
 14.3752  
 17.4098  
 20.4445  
 23.4792  
 28.4389  
 33.3986  
 38.3583  
 43.3180  
 48.2777  
 56.2397  
 64.2017  
 72.1637  
 80.1257  
 88.0877  
 98.0877  
 100.0000

Y =

20.0000	20.0000	20.0000
20.5088	20.5277	20.5285
20.9945	21.0527	21.0556
21.4577	21.5739	21.5814
23.0328	23.4892	23.5435
24.3542	25.3159	25.4756
25.4568	27.0321	27.3669
26.3751	28.6236	29.2055
27.6240	31.0998	32.2702
28.5280	33.1750	35.0891
29.1863	34.8803	37.6274
29.6668	36.2638	39.8705
30.0171	37.3757	41.8220
30.3915	38.7224	44.4308
30.6145	39.6324	46.4026
30.7497	40.2397	47.8552
30.8319	40.6418	48.9057
30.8810	40.9059	49.6546
30.9193	41.1438	50.4102
30.9363	41.2618	50.8264
30.9451	41.3233	51.0552
30.9497	41.3554	51.1809
30.9515	41.3710	51.2485
30.9521	41.3785	51.2877
30.9521	41.3794	51.2928



## Problem 4

```
clc;
clear all;
close all;
A=zeros(51,51);
for i=1:3:49
    A(:,i)=100;
    A(:,i+1)=-200.1;
    A(:,i+2)=100;
end
B=zeros(51,1);
B(:,1)=-51;
x=A\B
```

*Warning: Matrix is singular to working precision.*

**x =**

NaN  
NaN  
NaN  
NaN  
NaN  
NaN  
NaN  
NaN

[illegible]

Published with MATLAB® 8.0