# Table of Contents



# Prob1

```
clc;
clear all;
close all;

T=75;

Psat1= exp(14.2724-(2945.47/(T+224.00)));
Psat2= exp(14.2043-(2972.64/(T+209.00)));
Psat3= exp(14.5463-(2940.46/(T+237.22)));
Psat1
Psat2
Psat3

i=1
for x1=0:0.1:1
    P(i)=(x1*Psat2)+((1-x1)*Psat1)      %x1 is liquid composition of more volatile
  i=i+1
end
 x1=[0:0.1:1]
 figure
plot(x1,P,'-r')
xlabel('x1')
ylabel('P(in mm Hg)')
title('P vs x1')
  i=1
for x1=0:0.1:1
    M(i)=x1*Psat2;
   i=i+1
end
```

```
M
y1=M./P

figure
plot(y1,P,'-b')
xlabel('y1')
ylabel('P(in mm Hg)')
title('P vs y1')
```

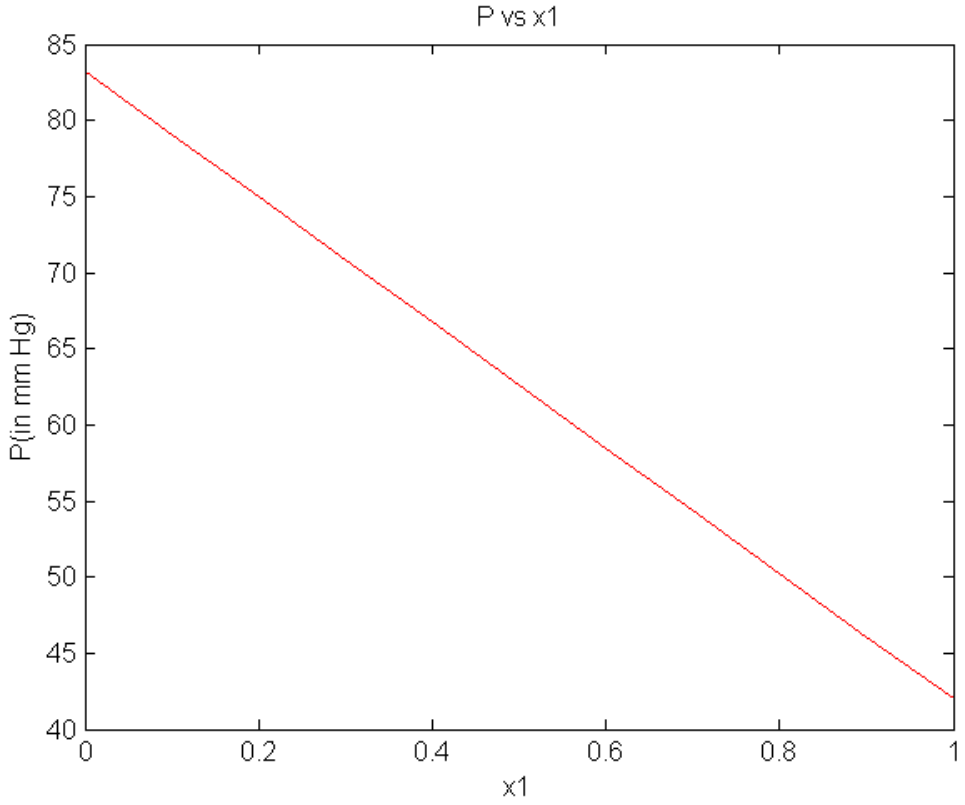
```
Psat1 =

   83.2069


Psat2 =

   41.9827


Psat3 =

  168.7451


i =

     1


P =

   83.2069


i =

     2


P =

   83.2069   79.0844


i =

     3


P =

   83.2069   79.0844   74.9620
```

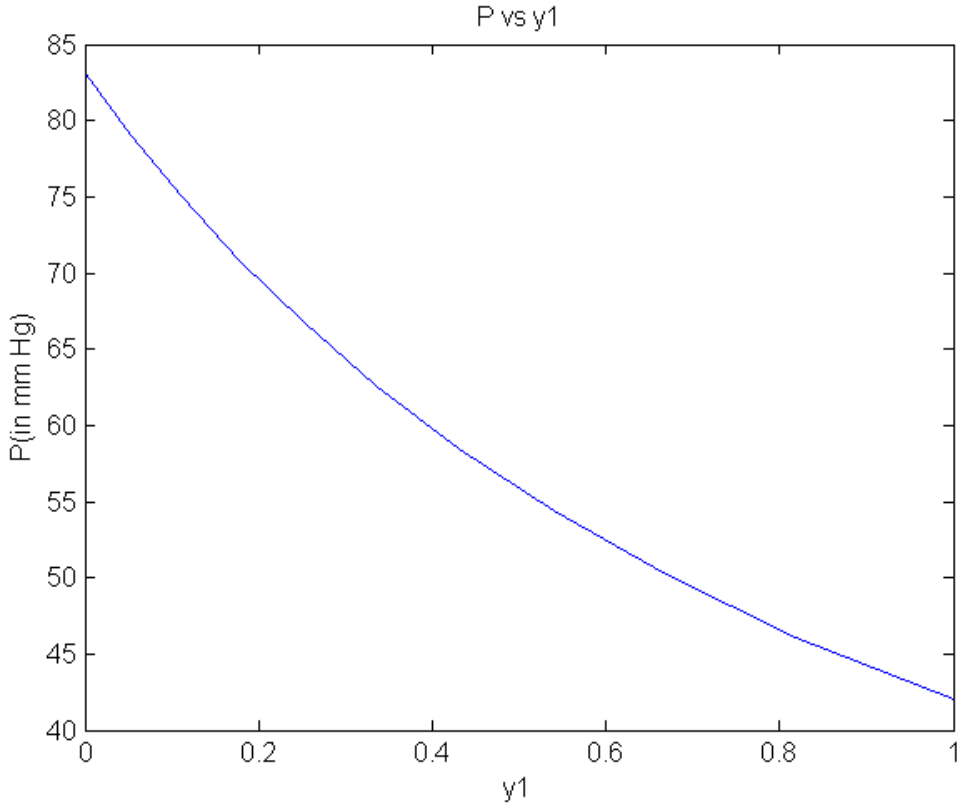
```
i =

     4

P =

   83.2069   79.0844   74.9620   70.8396

i =

     5

P =

   83.2069   79.0844   74.9620   70.8396   66.7172

i =

     6

P =

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948

i =

     7

P =

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948   58.4724

i =

     8

P =

  Columns 1 through 7

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948   58.4724

  Column 8
```

```
   54.3500

i =

     9

P =

  Columns 1 through 7

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948   58.4724

  Columns 8 through 9

   54.3500   50.2275

i =

    10

P =

  Columns 1 through 7

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948   58.4724

  Columns 8 through 10

   54.3500   50.2275   46.1051

i =

    11

P =

  Columns 1 through 7

   83.2069   79.0844   74.9620   70.8396   66.7172   62.5948   58.4724

  Columns 8 through 11

   54.3500   50.2275   46.1051   41.9827

i =

    12
```

```
x1 =

  Columns 1 through 7

         0    0.1000    0.2000    0.3000    0.4000    0.5000    0.6000

  Columns 8 through 11

    0.7000    0.8000    0.9000    1.0000

i =

     1

i =

     2

i =

     3

i =

     4

i =

     5

i =

     6

i =

     7

i =

     8

i =
```

```
     9

i =

    10

i =

    11

i =

    12

M =

  Columns 1 through 7

         0    4.1983    8.3965   12.5948   16.7931   20.9914   25.1896

  Columns 8 through 11

   29.3879   33.5862   37.7844   41.9827

y1 =

  Columns 1 through 7

         0    0.0531    0.1120    0.1778    0.2517    0.3354    0.4308

  Columns 8 through 11

    0.5407    0.6687    0.8195    1.0000
```


P vs x1
P(in mm Hg)
x1
85
80
75
70
65
60
55
50
45
40
0
0.2
0.4
0.6
0.8
1


P vs y1
P(in mm Hg)
y1
85
80
75
70
65
60
55
50
45
40
0
0.2
0.4
0.6
0.8
1

# b part

```
%Psat1= exp(14.2724-(2945.47/(T+224.00)));
%Psat3= exp(14.5463-(2940.46/(T+237.22)));

N=525.043
i=1
for x1=0.1:0.1:1
for T=50:1:200
    K=(x1*exp(14.2724-(2945.47/(T+224.00))))+((1-x1)*exp(14.5463-(2940.46/(T+237.2
   if (abs(K-N)<7)
       break
   end
end
temp(i)= T;
i=i+1;
end
temp
x1=[0.1:0.1:1]
figure
plot(x1,temp,'-k')
xlabel('x1')
ylabel('T in °C')
title('T vs x1')

 i=1
for x1=0.1:0.1:1
    M(i)=x1*exp(14.2724-(2945.47/(T+224.00)));
   i=i+1
end
M
y1=M./K
% figure
% plot(y1,temp,'-k')
% xlabel('y1')
% ylabel('T in °C')
% title('T vs y1')
```

```
N =

  525.0430


i =

     1


K =

   70.2925
```

```
K =

   72.8467

K =

   75.4751

K =

   78.1793

K =

   80.9607

K =

   83.8211

K =

   86.7619

K =

   89.7849

K =

   92.8916

K =

   96.0838

K =

   99.3631

K =

  102.7311
```

```
K =

  106.1897

K =

  109.7404

K =

  113.3851

K =

  117.1255

K =

  120.9635

K =

  124.9006

K =

  128.9389

K =

  133.0800

K =

  137.3259

K =

  141.6783

K =
```

```
  146.1392

K =

  150.7104

K =

  155.3938

K =

  160.1913

K =

  165.1049

K =

  170.1364

K =

  175.2879

K =

  180.5612

K =

  185.9584

K =

  191.4815

K =

  197.1325

K =
```

```
  202.9133

K =

  208.8260

K =

  214.8727

K =

  221.0555

K =

  227.3762

K =

  233.8372

K =

  240.4404

K =

  247.1880

K =

  254.0820

K =

  261.1247

K =

  268.3181
```

```
K =

  275.6644

K =

  283.1657

K =

  290.8243

K =

  298.6422

K =

  306.6218

K =

  314.7652

K =

  323.0745

K =

  331.5521

K =

  340.2001

K =

  349.0209

K =

  358.0166
```

```
K =

  367.1894

K =

  376.5418

K =

  386.0758

K =

  395.7939

K =

  405.6983

K =

  415.7913

K =

  426.0752

K =

  436.5523

K =

  447.2249

K =

  458.0954

K =

  469.1661
```

```
K =

  480.4393

K =

  491.9173

K =

  503.6026

K =

  515.4974

K =

  527.6041

K =

   66.2455

K =

   68.6659

K =

   71.1571

K =

   73.7206

K =

   76.3579

K =
```

```
   79.0704

K =

   81.8598

K =

   84.7277

K =

   87.6755

K =

   90.7049

K =

   93.8175

K =

   97.0150

K =

  100.2989

K =

  103.6710

K =

  107.1329

K =

  110.6864

K =
```

```
  114.3330

K =

  118.0746

K =

  121.9129

K =

  125.8496

K =

  129.8866

K =

  134.0255

K =

  138.2682

K =

  142.6166

K =

  147.0724

K =

  151.6375

K =

  156.3137
```

```
K =

  161.1030

K =

  166.0071

K =

  171.0281

K =

  176.1677

K =

  181.4280

K =

  186.8109

K =

  192.3183

K =

  197.9522

K =

  203.7146

K =

  209.6075

K =

  215.6328
```

```
K =

  221.7926

K =

  228.0889

K =

  234.5237

K =

  241.0991

K =

  247.8172

K =

  254.6801

K =

  261.6897

K =

  268.8482

K =

  276.1578

K =

  283.6204

K =

  291.2383
```

```
K =

  299.0136

K =

  306.9484

K =

  315.0449

K =

  323.3052

K =

  331.7315

K =

  340.3260

K =

  349.0909

K =

  358.0284

K =

  367.1407

K =

  376.4299

K =
```

```
  385.8984

K =

  395.5483

K =

  405.3819

K =

  415.4014

K =

  425.6091

K =

  436.0072

K =

  446.5980

K =

  457.3838

K =

  468.3668

K =

  479.5494

K =

  490.9338

K =
```

```
  502.5222

K =

  514.3171

K =

  526.3207

K =

   62.1984

K =

   64.4851

K =

   66.8391

K =

   69.2619

K =

   71.7550

K =

   74.3198

K =

   76.9577

K =

   79.6704
```

```
K =

   82.4593

K =

   85.3260

K =

   88.2720

K =

   91.2989

K =

   94.4082

K =

   97.6016

K =

  100.8807

K =

  104.2472

K =

  107.7026

K =

  111.2486

K =

  114.8869
```

```
K =

  118.6192

K =

  122.4472

K =

  126.3727

K =

  130.3973

K =

  134.5228

K =

  138.7510

K =

  143.0837

K =

  147.5226

K =

  152.0695

K =

  156.7264

K =

  161.4949
```

```
K =

  166.3770

K =

  171.3745

K =

  176.4894

K =

  181.7233

K =

  187.0784

K =

  192.5565

K =

  198.1595

K =

  203.8893

K =

  209.7479

K =

  215.7373

K =
```

```
  221.8594

K =

  228.1162

K =

  234.5098

K =

  241.0420

K =

  247.7150

K =

  254.5307

K =

  261.4912

K =

  268.5986

K =

  275.8548

K =

  283.2620

K =

  290.8223

K =
```

```
  298.5376

K =

  306.4102

K =

  314.4422

K =

  322.6355

K =

  330.9924

K =

  339.5150

K =

  348.2055

K =

  357.0659

K =

  366.0984

K =

  375.3052

K =

  384.6885
```

```
K =

  394.2505

K =

  403.9932

K =

  413.9190

K =

  424.0300

K =

  434.3284

K =

  444.8164

K =

  455.4962

K =

  466.3702

K =

  477.4404

K =

  488.7091

K =

  500.1785
```

```
K =

  511.8510

K =

  523.7287

K =

   58.1514

K =

   60.3043

K =

   62.5211

K =

   64.8033

K =

   67.1521

K =

   69.5691

K =

   72.0556

K =

   74.6132

K =

   77.2432
```

```
K =

   79.9471

K =

   82.7264

K =

   85.5827

K =

   88.5175

K =

   91.5322

K =

   94.6285

K =

   97.8080

K =

  101.0721

K =

  104.4225

K =

  107.8609

K =
```

```
  111.3888

K =

  115.0079

K =

  118.7199

K =

  122.5263

K =

  126.4290

K =

  130.4296

K =

  134.5298

K =

  138.7314

K =

  143.0361

K =

  147.4456

K =

  151.9617

K =
```

```
  156.5863

K =

  161.3210

K =

  166.1678

K =

  171.1284

K =

  176.2046

K =

  181.3984

K =

  186.7115

K =

  192.1458

K =

  197.7033

K =

  203.3857

K =

  209.1951
```

```
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  215.1333

K =

  221.2023

K =

  227.4040

K =

  233.7403

K =

  240.2132

K =

  246.8247

K =

  253.5767

K =

  260.4713

K =

  267.5105

K =

  274.6962

K =

  282.0304
```

```
K =

  289.5153

K =

  297.1528

K =

  304.9450

K =

  312.8939

K =

  321.0017

K =

  329.2703

K =

  337.7018

K =

  346.2985

K =

  355.0622

K =

  363.9952

K =

  373.0996
```

```
K =

  382.3774

K =

  391.8308

K =

  401.4619

K =

  411.2729

K =

  421.2659

K =

  431.4431

K =

  441.8065

K =

  452.3585

K =

  463.1010

K =

  474.0364

K =
```

```
  485.1668

K =

  496.4943

K =

  508.0212

K =

  519.7496

K =

   54.1044

K =

   56.1235

K =

   58.2031

K =

   60.3446

K =

   62.5493

K =

   64.8184

K =

   67.1535

K =
```

```
   69.5559

K =

   72.0270

K =

   74.5682

K =

   77.1809

K =

   79.8666

K =

   82.6268

K =

   85.4629

K =

   88.3764

K =

   91.3688

K =

   94.4417

K =

   97.5965
```

```
K =

  100.8349

K =

  104.1584

K =

  107.5686

K =

  111.0670

K =

  114.6554

K =

  118.3352

K =

  122.1082

K =

  125.9760

K =

  129.9402

K =

  134.0026

K =

  138.1648
```

```
K =

  142.4286

K =

  146.7956

K =

  151.2675

K =

  155.8462

K =

  160.5334

K =

  165.3308

K =

  170.2402

K =

  175.2635

K =

  180.4023

K =

  185.6586

K =

  191.0342
```

```
K =

  196.5308

K =

  202.1504

K =

  207.8949

K =

  213.7659

K =

  219.7656

K =

  225.8957

K =

  232.1582

K =

  238.5549

K =

  245.0878

K =

  251.7589

K =
```

```
   258.5700

K =

   265.5232

K =

   272.6203

K =

   279.8634

K =

   287.2545

K =

   294.7954

K =

   302.4883

K =

   310.3351

K =

   318.3378

K =

   326.4985

K =

   334.8192

K =
```

```
  343.3019

K =

  351.9487

K =

  360.7615

K =

  369.7426

K =

  378.8939

K =

  388.2175

K =

  397.7155

K =

  407.3899

K =

  417.2429

K =

  427.2766

K =

  437.4930
```

```
K =

  447.8943

K =

  458.4825

K =

  469.2599

K =

  480.2284

K =

  491.3903

K =

  502.7476

K =

  514.3025

K =

  526.0572

K =

   50.0574

K =

   51.9427

K =

   53.8851
```

```
K =

   55.8859

K =

   57.9464

K =

   60.0678

K =

   62.2514

K =

   64.4987

K =

   66.8108

K =

   69.1893

K =

   71.6354

K =

   74.1505

K =

   76.7360

K =

   79.3935
```

```
K =

   82.1242

K =

   84.9296

K =

   87.8112

K =

   90.7705

K =

   93.8089

K =

   96.9280

K =

  100.1292

K =

  103.4142

K =

  106.7844

K =

  110.2414

K =
```

```
  113.7868

K =

  117.4222

K =

  121.1491

K =

  124.9692

K =

  128.8841

K =

  132.8954

K =

  137.0049

K =

  141.2141

K =

  145.5247

K =

  149.9384

K =

  154.4570

K =
```

```
  159.0821

K =

  163.8155

K =

  168.6589

K =

  173.6140

K =

  178.6826

K =

  183.8666

K =

  189.1675

K =

  194.5874

K =

  200.1279

K =

  205.7909

K =

  211.5782
```

```
K =

  217.4916

K =

  223.5331

K =

  229.7043

K =

  236.0073

K =

  242.4439

K =

  249.0160

K =

  255.7254

K =

  262.5741

K =

  269.5639

K =

  276.6969

K =

  283.9749
```

```
K =

  291.3999

K =

  298.9738

K =

  306.6986

K =

  314.5762

K =

  322.6086

K =

  330.7977

K =

  339.1457

K =

  347.6544

K =

  356.3258

K =

  365.1620

K =

  374.1650
```

```
K =

  383.3368

K =

  392.6793

K =

  402.1947

K =

  411.8850

K =

  421.7522

K =

  431.7983

K =

  442.0254

K =

  452.4356

K =

  463.0309

K =

  473.8134

K =
```

```
  484.7852

K =

  495.9483

K =

  507.3047

K =

  518.8567

K =

   46.0104

K =

   47.7619

K =

   49.5671

K =

   51.4273

K =

   53.3435

K =

   55.3171

K =

   57.3493

K =
```

```
    59.4414

K =

    61.5947

K =

    63.8104

K =

    66.0898

K =

    68.4344

K =

    70.8453

K =

    73.3241

K =

    75.8720

K =

    78.4904

K =

    81.1808

K =

    83.9444
```

```
K =

   86.7829

K =

   89.6976

K =

   92.6899

K =

   95.7614

K =

   98.9135

K =

  102.1476

K =

  105.4654

K =

  108.8683

K =

  112.3579

K =

  115.9357

K =

  119.6033
```

```
K =

  123.3623

K =

  127.2141

K =

  131.1606

K =

  135.2031

K =

  139.3435

K =

  143.5832

K =

  147.9240

K =

  152.3675

K =

  156.9154

K =

  161.5693

K =

  166.3311
```

```
K =

  171.2023

K =

  176.1846

K =

  181.2799

K =

  186.4899

K =

  191.8162

K =

  197.2607

K =

  202.8251

K =

  208.5112

K =

  214.3209

K =

  220.2558

K =
```

```
  226.3178

K =

  232.5087

K =

  238.8304

K =

  245.2847

K =

  251.8734

K =

  258.5984

K =

  265.4615

K =

  272.4647

K =

  279.6098

K =

  286.8986

K =

  294.3331

K =
```

```
   301.9152

K =

   309.6468

K =

   317.5298

K =

   325.5662

K =

   333.7578

K =

   342.1066

K =

   350.6146

K =

   359.2836

K =

   368.1157

K =

   377.1128

K =

   386.2770
```

```
K =

  395.6100

K =

  405.1140

K =

  414.7910

K =

  424.6428

K =

  434.6716

K =

  444.8793

K =

  455.2679

K =

  465.8394

K =

  476.5958

K =

  487.5392

K =

  498.6716
```

```
K =

  509.9949

K =

  521.5113

K =

   41.9634

K =

   43.5811

K =

   45.2491

K =

   46.9686

K =

   48.7407

K =

   50.5665

K =

   52.4472

K =

   54.3842

K =

   56.3785
```

```
K =

   58.4315

K =

   60.5443

K =

   62.7182

K =

   64.9546

K =

   67.2547

K =

   69.6198

K =

   72.0512

K =

   74.5503

K =

   77.1184

K =

   79.7569

K =
```

```
   82.4672

K =

   85.2506

K =

   88.1086

K =

   91.0425

K =

   94.0538

K =

   97.1440

K =

  100.3145

K =

  103.5668

K =

  106.9023

K =

  110.3226

K =

  113.8291

K =
```

```
  117.4234

K =

  121.1071

K =

  124.8816

K =

  128.7485

K =

  132.7094

K =

  136.7659

K =

  140.9195

K =

  145.1719

K =

  149.5247

K =

  153.9795

K =

  158.5380
```

```
K =

  163.2017

K =

  167.9725

K =

  172.8518

K =

  177.8415

K =

  182.9432

K =

  188.1586

K =

  193.4894

K =

  198.9374

K =

  204.5042

K =

  210.1917

K =

  216.0015
```

```
K =

  221.9355

K =

  227.9953

K =

  234.1829

K =

  240.4999

K =

  246.9482

K =

  253.5295

K =

  260.2457

K =

  267.0987

K =

  274.0901

K =

  281.2219

K =

  288.4959
```

```
K =

  295.9140

K =

  303.4780

K =

  311.1897

K =

  319.0511

K =

  327.0641

K =

  335.2304

K =

  343.5521

K =

  352.0310

K =

  360.6689

K =

  369.4679

K =
```

```
  378.4298

K =

  387.5565

K =

  396.8501

K =

  406.3123

K =

  415.9451

K =

  425.7506

K =

  435.7305

K =

  445.8869

K =

  456.2217

K =

  466.7369

K =

  477.4344

K =
```

```
  488.3162

K =

  499.3843

K =

  510.6406

K =

  522.0871

K =

   37.9163

K =

   39.4003

K =

   40.9311

K =

   42.5099

K =

   44.1378

K =

   45.8158

K =

   47.5451
```

```
K =

   49.3269

K =

   51.1624

K =

   53.0526

K =

   54.9987

K =

   57.0021

K =

   59.0639

K =

   61.1853

K =

   63.3676

K =

   65.6120

K =

   67.9198

K =

   70.2924
```

```
K =

   72.7309

K =

   75.2368

K =

   77.8113

K =

   80.4557

K =

   83.1715

K =

   85.9600

K =

   88.8226

K =

   91.7607

K =

   94.7756

K =

   97.8689

K =

  101.0418
```

```
K =

  104.2960

K =

  107.6327

K =

  111.0536

K =

  114.5600

K =

  118.1535

K =

  121.8356

K =

  125.6077

K =

  129.4715

K =

  133.4284

K =

  137.4801

K =
```

```
  141.6280

K =

  145.8737

K =

  150.2188

K =

  154.6650

K =

  159.2138

K =

  163.8668

K =

  168.6257

K =

  173.4921

K =

  178.4676

K =

  183.5539

K =

  188.7526

K =
```

```
  194.0656

K =

  199.4943

K =

  205.0405

K =

  210.7060

K =

  216.4924

K =

  222.4014

K =

  228.4348

K =

  234.5943

K =

  240.8817

K =

  247.2987

K =

  253.8471
```

```
K =

  260.5286

K =

  267.3450

K =

  274.2981

K =

  281.3898

K =

  288.6217

K =

  295.9957

K =

  303.5136

K =

  311.1773

K =

  318.9885

K =

  326.9491

K =

  335.0609
```

```
K =

  343.3258

K =

  351.7456

K =

  360.3221

K =

  369.0573

K =

  377.9530

K =

  387.0110

K =

  396.2332

K =

  405.6216

K =

  415.1780

K =

  424.9042

K =

  434.8022
```

```
K =

  444.8739

K =

  455.1212

K =

  465.5459

K =

  476.1500

K =

  486.9354

K =

  497.9039

K =

  509.0576

K =

  520.3983

K =

   33.8693

K =

   35.2195

K =
```

```
   36.6131

K =

   38.0513

K =

   39.5349

K =

   41.0652

K =

   42.6430

K =

   44.2697

K =

   45.9462

K =

   47.6736

K =

   49.4532

K =

   51.2860

K =

   53.1732

K =
```

```
   55.1159

K =

   57.1154

K =

   59.1728

K =

   61.2894

K =

   63.4664

K =

   65.7049

K =

   68.0064

K =

   70.3719

K =

   72.8029

K =

   75.3006

K =

   77.8662
```

```
K =

   80.5012

K =

   83.2069

K =

   85.9845

K =

   88.8354

K =

   91.7611

K =

   94.7628

K =

   97.8420

K =

  101.0001

K =

  104.2384

K =

  107.5585

K =

  110.9618
```

```
K =

  114.4496

K =

  118.0235

K =

  121.6850

K =

  125.4354

K =

  129.2764

K =

  133.2094

K =

  137.2359

K =

  141.3575

K =

  145.5757

K =

  149.8921

K =

  154.3082
```

```
K =

  158.8255

K =

  163.4457

K =

  168.1704

K =

  173.0011

K =

  177.9394

K =

  182.9870

K =

  188.1456

K =

  193.4166

K =

  198.8018

K =

  204.3029

K =
```

```
  209.9214

K =

  215.6591

K =

  221.5177

K =

  227.4988

K =

  233.6040

K =

  239.8353

K =

  246.1941

K =

  252.6823

K =

  259.3016

K =

  266.0536

K =

  272.9403

K =
```

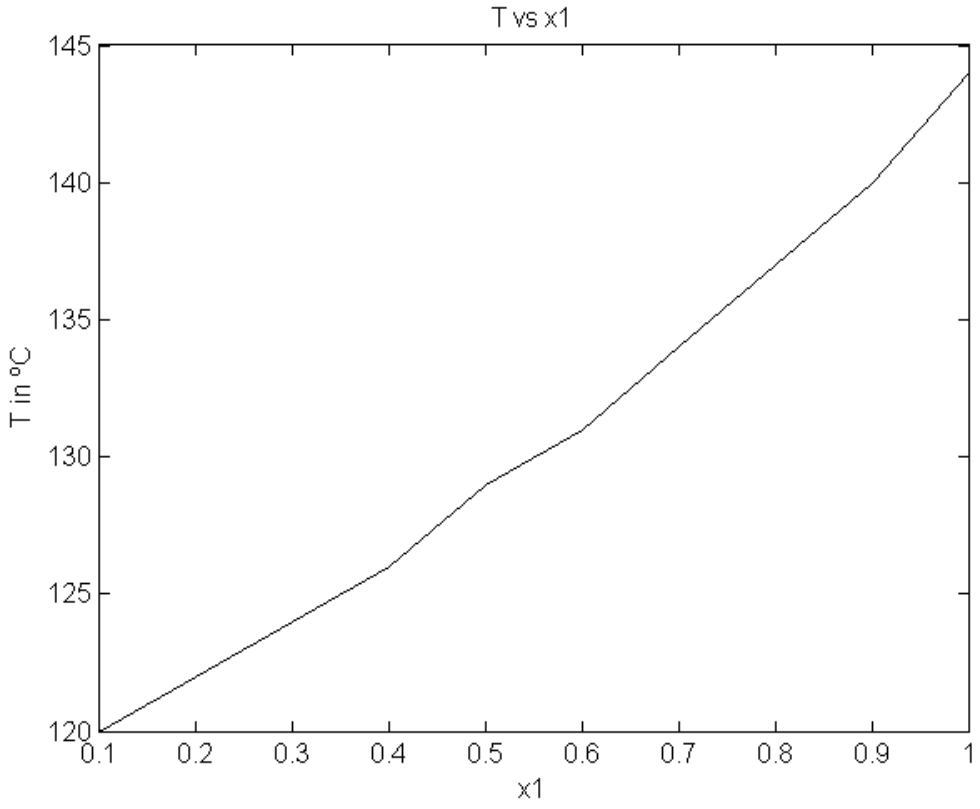
```
  279.9632

K =

  287.1241

K =

  294.4249

K =

  301.8672

K =

  309.4529

K =

  317.1836

K =

  325.0613

K =

  333.0877

K =

  341.2645

K =

  349.5936

K =

  358.0768
```

```
K =

  366.7159

K =

  375.5127

K =

  384.4690

K =

  393.5867

K =

  402.8676

K =

  412.3134

K =

  421.9261

K =

  431.7075

K =

  441.6594

K =

  451.7836

K =

  462.0821
```

```
K =

  472.5566

K =

  483.2091

K =

  494.0413

K =

  505.0552

K =

  516.2526

K =

  527.6354

temp =

   120   122   124   126   129   131   134   137   140   144

x1 =

  Columns 1 through 7

    0.1000    0.2000    0.3000    0.4000    0.5000    0.6000    0.7000

  Columns 8 through 10

    0.8000    0.9000    1.0000

i =

     1

i =
```

```
     2

i =

     3

i =

     4

i =

     5

i =

     6

i =

     7

i =

     8

i =

     9

i =

    10

i =

    11

M =

  Columns 1 through 7

   52.7635  105.5271  158.2906  211.0541  263.8177  316.5812  369.3448
```

```
  Columns 8 through 11

  422.1083  474.8718  527.6354   41.9827

y1 =

  Columns 1 through 7

    0.1000    0.2000    0.3000    0.4000    0.5000    0.6000    0.7000

  Columns 8 through 11

    0.8000    0.9000    1.0000    0.0796
```




# Prob 2

```
clc;
clear all;
close all;
a=1;                %aX+bY+c=0
b=1;                %X+Y+1=0
L=sqrt((a^2)+(b^2));
X=2;
Y=3;
```

```
Ans=((a*X+b*Y+1)/L)     %minimum distance from a line X+Y+1=0
```

```
Ans =

    4.2426
```

# Problem 3 : Program to solve ODE d2m/dx2 + m =0

```
clc
clear all
close all

[X,M] = ode15s(@diff3,[0 3.142],[2 3]) % x values range from 0 to 3.1412
% M(1) : m , M(2) : dm/dx
% m(0)=2 , dm/dx(0)= 3

plot(X,M(:,1)) % plotting x vs m
xlabel('x');
ylabel('m(x)');
```

```
clc
clear all
close all


X =

         0
    0.0358
    0.0716
    0.1073
    0.2162
    0.3250
    0.4338
    0.5426
    0.7091
    0.8756
    1.0421
    1.2086
    1.3751
    1.6354
    1.8956
    2.1559
    2.4161
    2.6183
    2.8205
    3.0226
    3.1420
```

```
M =

    2.0000    3.0000
    2.1051    2.9253
    2.2074    2.8470
    2.3069    2.7651
    2.5919    2.4974
    2.8470    2.2014
    3.0688    1.8798
    3.2545    1.5361
    3.4641    0.9762
    3.5783    0.3888
    3.5936   -0.2096
    3.5095   -0.8024
    3.3282   -1.3730
    2.8643   -2.1841
    2.2074   -2.8489
    1.4010   -3.3226
    0.4991   -3.5730
   -0.2288   -3.6009
   -0.9475   -3.4820
   -1.6278   -3.2213
   -1.9998   -3.0045
```

# Problem 4

```
d0 = [15 15 15];% Intial guess for d0 in mm
A = [];
b = [];
Aeq = [];
beq = [];
for i = 1:1:3
    lb(i) = 0;% The lower bound and the upper bound
    ub(i) = Inf;
end
d = fmincon(@costfun,d0,A,b,Aeq,beq,lb,ub,@costcond)

    Warning: The default trust-region-reflective algorithm does not solve prob
    with the constraints you have specified. FMINCON will use the active-set
    algorithm instead. For information on applicable algorithms, see Choosing
    Algorithm in the documentation.
    Warning: Your current settings will run a different algorithm (interior-po
    in a future release.

    Local minimum possible. Constraints satisfied.

    fmincon stopped because the size of the current search direction is less t
    twice the default value of the step size tolerance and constraints are
    satisfied to within the default value of the constraint tolerance.
```

```
Active inequalities (to within options.TolCon = 1e-06):
  lower      upper     ineqlin   ineqnonlin
                                      2
                                      3

d =

  232.6569  203.0895  152.8280
```

# Problem 5 : Program to calculate angle req to hit bulls eye

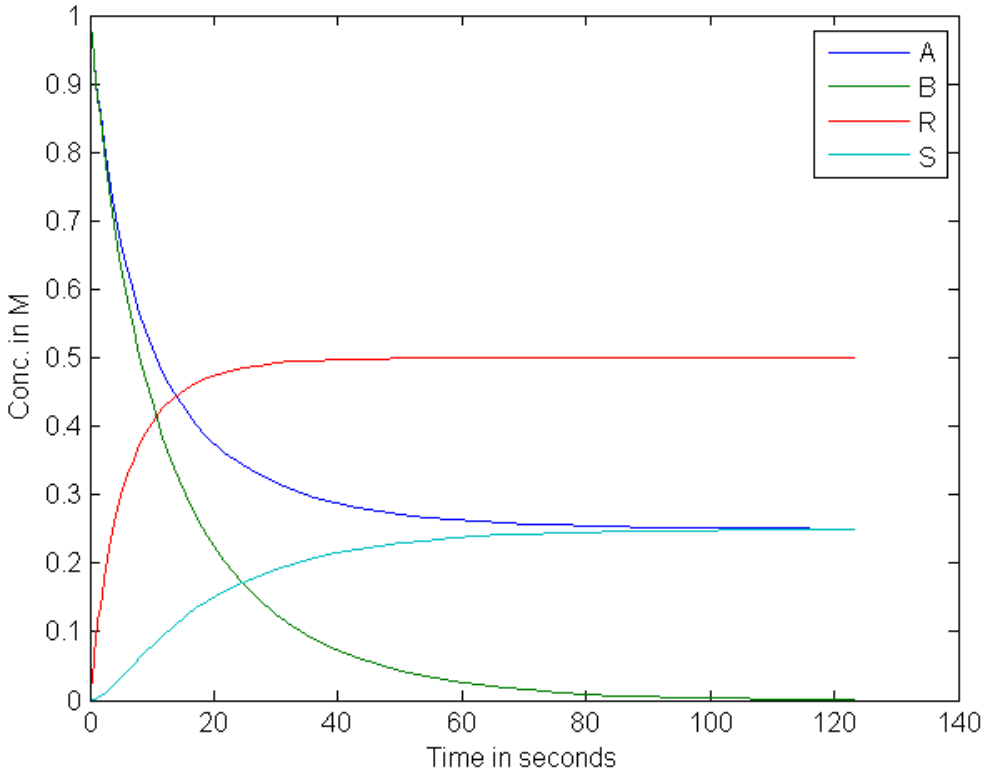
```
clc
clear all
close all

y=10;  % Height of target
x=300; % x co-ordinate of target
u=100;  % velocity of water balloon
g=9.81;

% Solve the equation for projectile motion :
%y = tan(theta)*x-g*x^2/(2*u^2*cos^2(theta))
% Let a = tan(theta)
% j = g*x^2/(2*u^2)
 % Eqn : ja^2+xa-(j+y)=0

 j = g*x^2/(2*u^2);
 p= [j x -(j+y)]; % Coefficients of the quadratic equation
 a=roots(p);      % Calculating roots of the equation

 theta = atand(a);% in degrees.

 for i=1:2
     if(theta(i)>=0)
         angle=theta(i) % Angle to be thrown is the positive root of theta
     end
     i=i+1;
 end
```

```
angle =

    9.9779
```

# Problem 6 : Program to find concentrations of reagents and products as a function of time in a reaction

```
clear all
close all
clc

global k1
global k2
k1=0.1;
k2=0.05;

[T,C] = ode15s(@as6,[0 3600],[1 1 0 0]); % Calculating for time till 3600s
% cA0=1, cB0=1, cR0=0, cS0=0

plot(T(1:58),C(1:58,:));  % Plotting conc profiles till 2minutes.
xlabel('Time in seconds');
ylabel('Conc. in M');
legend('A','B','R','S');


[maxR,maxIndex]=max(C(:,3)); % Finding max conc of R and its index
maxR % Max conc of R

maxTmin=T(maxIndex)/60 % Time at which conc of R is maximum
```

```
maxR =

    0.5003


maxTmin =

   21.6708
```




# Prob 7 :Program to find nearest point for a given point in a particular region

```
clc
clear all
close all


X= [ 2 2 6 -3 0 11 -4 1 1];
Y= [ 2 1 1 -2 0 10 -4 1 4];

cen = [1 1];
for i=1:9
    pt=[X(i),Y(i)]
    m=(Y(i)-1)/(X(i)-1);
     syms x y
    if(distance(pt,cen)>=5) % closest point lies on outer circle
              [xans,yans]= solve(y == 1+m*(x-1), (x-1)^2+(y-1)^2==25);
              xans=eval(xans);
              yans=eval(yans);
              pt1=[xans,yans];
              if(distance(pt1(1,:),pt)<distance(pt1(2,:),pt))
                  Ans=pt1(1,:)
              else
```

```
                    Ans=pt1(2,:)
                end

        end
        if(distance(pt,cen)==0)
                    disp('All points on smaller circle')

        end
                if (distance(pt,cen)==3)
                    xans=X(i)
                    yans=Y(i)
                end


        if(distance(pt,cen)<=3)
            [xans,yans]= solve(y == 1+m*(x-1), (x-1)^2+(y-1)^2==9);
                    xans=eval(xans);
                    yans=eval(yans);
                    pt1=[xans,yans];
                    if(distance(pt1(1,:),pt)<distance(pt1(2,:),pt))
                        Ans=pt1(1,:)
                    else
                        Ans=pt1(2,:)
                    end
         end



end
```

```
pt =

     2     2


Ans =

    3.1213    3.1213


pt =

     2     1


Ans =

     4     1


pt =
```

```
     6     1

Ans =

     6     1

pt =

    -3    -2

pt =

     0     0

Ans =

   -1.1213   -1.1213

pt =

    11    10

Ans =

    4.7165    4.3448

pt =

    -4    -4

Ans =

   -2.5355   -2.5355

pt =

     1     1

All points on smaller circle
Warning: Explicit solution could not be found.

Error using sym/eval (line 15)
Error: This statement is incomplete.

Error in CH12B083_CH12B084_AS6 (line 212)
```

```
xans=eval(xans);
```

# Prob 8 a

```
clear all
close all
clc

Y_input = input('Enter the value of Y input: ');
b = [-Y_input;0;0;0];
A = eye(4);
A = -2.5.*A;
for i = 1:3
    A(i,i) = -2.5;
    A(i,i+1) = 1.5;
    A(i+1,i) = 1;
end
y = A\b;
Y_output = y(4)
```

# Question 8(b): 5-Stage Extraction Equilibrium with feed ratio 0.75:

```
clear all
close all
clc

Y_input = input('Enter the value of Y input: ');
b = [-Y_input;0;0;0;0];
A = eye(5);
A = -3.25.*A;
for i = 1:4
    A(i,i) = -3.25;
    A(i,i+1) = 2.25;
    A(i+1,i) = 1;
end
y = A\b;
Y_output = y(5)
```

# Question 8(c): 5-Stage Extraction Equilibrium with feed ratio 1:

```
clear all
close all
clc

Y_input = input('Enter the value of Y input: ');
b = [-Y_input;0;0;0;0];
A = eye(5);
A = -4.*A;
```

```
for i = 1:4
    A(i,i) = -4;
    A(i,i+1) = 3;
    A(i+1,i) = 1;
end
y = A\b;
Y_output = y(5)
```

# Question 8(d): 6-Stage Extraction Equilibrium with feed ratio 0.75:

```
clear all
close all
clc

Y_input = input('Enter the value of Y input: ');
b = [-Y_input;0;0;0;0;0];
A = eye(6);
A = -3.25.*A;
for i = 1:5
    A(i,i) = -3.25;
    A(i,i+1) = 2.25;
    A(i+1,i) = 1;
end
y = A\b;
Y_output = y(6)
```

# Question 8(e): 6-Stage Extraction Equilibrium with feed ratio 1:

```
clear all
close all
clc

Y_input = input('Enter the value of Y input: ');
b = [-Y_input;0;0;0;0;0];
A = eye(6);
A = -4.*A;
for i = 1:5
    A(i,i) = -4;
    A(i,i+1) = 3;
    A(i+1,i) = 1;
end
y = A\b;
Y_output = y(6)


clc
clear all
close all
```

# Prob 10

Assume dp/dx=-1 and M1=10^(-3) Guiding equation dp/dx=M* d/dy(du/dy)

```
syms  u(y)
k=dsolve(diff(u, 2) == -10^(3), u(-1) == 0, u(1)==0) % Finding out the parametric
k1  = inline(char(k)); % To convert char to double
y=-1:0.01:1;
k=length(y)
for(i=1:1:k)


        m(i)=k1(y(i)); % Finding out the functional value at every point and stori

end
figure(5)
plot(m,y)
title('M1=M2')
xlabel('Velocity')
ylabel('y')
```

# Q10 b

Assume dp/dx=-1 and M1=10^(-3) M2=2*10^(-3) Guiding equation dp/dx=M* d/dy(du/dy) The way this question was solved is that I declared du1/dy= a at y=0 and du2/dy= 0.5a and using u1=u2 at y=0 I solved for a= 500/3

```
syms a u1(y)
Du1=diff(u1); % Split it up into two region from y=1 to 0 and y=0 to -1
k1=dsolve(diff(u1, 2) == -10^(3), u1(1) == 0,Du1(0) == 500/3)
syms a u2(y)
Du2=diff(u2);
k2=dsolve(diff(u2, 2) == -0.5*10^(3), u2(-1) == 0, Du2(0)==0.5*500/3)
k11=inline(char(k1));
k22=inline(char(k2));
y1=0:0.01:1;
k=length(y1)
for(i=1:1:k)


        m1(i)=k11(y1(i)); % Finding out the functional value at every point and st

end
y2=-1:0.01:0;
k=length(y2)
for(i=1:1:k)


        m2(i)=k22(y2(i)); % Finding out the functional value at every point and st

end
 figure(4)
plot(m1,y1)
```

```
hold on
plot(m2,y2)
title('M1=0.5M2')
xlabel('Velocity')
ylabel('Y')
```

*Published with MATLAB® 8.0*