Math 4553, Solution to Homework 5

1. By typing the following command in Matlab or Octave

```
p = [-1; -2; 0; 0; 0];
A = [-2,1,1,0,0; -1,2,0,1,0; 1,0,0,0,1];
b = [2;7;3];
Id = eye(5);
beta = 0.9999;
x0 = [0.5; 0.5; 2.5; 6.5; 2.5];
T0 = diag(x0)
y0 = [1;1;1;1;1]
p0 = T0*p;
A0 = A*T0
d0 = (Id - A0'*inv(A0*A0')*A0) * (-p0)
negd = d0(d0<0);
alpha0 = min(-1./negd)
y1 = y0 + beta*alpha0*d0
x1 = T0*y1
```

We have the following output:

```
T0 =

    0.5000         0         0         0         0
         0    0.5000         0         0         0
         0         0    2.5000         0         0
         0         0         0    6.5000         0
         0         0         0         0    2.5000

y0 =

     1
     1
     1
     1
     1

A0 =

   -1.0000    0.5000    2.5000         0         0
   -0.5000    1.0000         0    6.5000         0
    0.5000         0         0         0    2.5000

d0 =

    0.4894
    0.9824
```

```
   -0.0007
   -0.1135
   -0.0979

alpha0 =

    8.8114

y1 =

    5.3122
    9.6554
    0.9938
    0.0001
    0.1376

x1 =

    2.6561
    4.8277
    2.4845
    0.0006
    0.3439
```

Therefore, the new point $\mathbf{x}^1 = [2.6561, 4.8277, 2.4845, 0.0006, 0.3439]^t$.

2. Define $f(x) = x^3 - x^2 - 1$. Then $f'(x) = 3x^2 - 2x$. Use the following table

k	x_k	$f(x_k)$	$f'(x_k)$	$x_{k+1} = x_k - f(x_k)/f'(x_k)$
0	1	-1	1	2
1	2	3	8	1.625
2	1.625	$\cdots$	$\cdots$	$\cdots$

Hence $x_2 = 1.625$.