

Prova 2 Física

Gabaritos

```
In [61]: import numpy as np
def q1(a,b):
    print(a,b)
    print('certo=',np.linalg.solve(a,b))
    m=list(abs(a[:,0]))
    i=m.index(max(m))
    guarda=a[i].copy()
    a[i]=a[0].copy()
    a[0]=guarda.copy()
    guarda=b[i]
    b[i]=b[0]
    b[0]=guarda
    print('matriz apos pivoteamento col 1 \n',a,b)
    pivot=a[1,0]/a[0,0]
    for j in range(3):
        a[1,j]=a[1,j]-(pivot*a[0,j])
    b[1]=b[1]-pivot*b[0]
    pivot=a[2,0]/a[0,0]
    for j in range(3):
        a[2,j]=a[2,j]-(pivot*a[0,j])
    b[2]=b[2]-pivot*b[0]
    print('matriz após zerar col 1 \n',a,b)
    if abs(a[1,1])<abs(a[2,1]):
        guarda=a[1].copy()
        a[1]=a[2].copy()
        a[2]=guarda.copy()
        guarda=b[1]
        b[1]=b[2]
        b[2]=guarda
    print('matriz após pivoteamento col 2 \n',a,b)
    pivot=a[2,1]/a[1,1]
    for j in range(3):
        a[2,j]=a[2,j]-(pivot*a[1,j])
    b[2]=b[2]-pivot*b[1]
    print('matriz após zerar col 2 \n',a,b)
    z=b[2]/a[2,2]
    y=(b[1]-a[1,2]*z)/a[1,1]
    x=(b[0]-(a[0,1]*y+a[0,2]*z))/a[0,0]
    print('resposta \n',np.around(a,4),np.around(b,4))
    print('x = ',round(x,4),round(y,4),round(z,4))
a=np.array([[9.3,6,2],[-5.2,5.9,4.2],[8.1,-8.4,-4]])
b=[135.7,-6.1,17.8]
q1(a,b)
```

```

[[ 9.3  6.  2. ]
 [-5.2  5.9  4.2]
 [ 8.1 -8.4 -4. ]] [135.7, -6.1, 17.8]
certo= [9.90171596 6.8956066 1.12020097]
matriz apos pivoteamento col 1
[[ 9.3  6.  2. ]
 [-5.2  5.9  4.2]
 [ 8.1 -8.4 -4. ]] [135.7, -6.1, 17.8]
matriz após zerar col 1
[[ 9.3      6.      2.      ]
 [ 0.      9.25483871  5.31827957]
 [ 0.     -13.62580645 -5.74193548]] [135.7, 69.77526881720429, -100.3903225
8064513]
matriz após pivoteamento col 2
[[ 9.3      6.      2.      ]
 [ 0.     -13.62580645 -5.74193548]
 [ 0.      9.25483871  5.31827957]] [135.7, -100.39032258064513, 69.7752688
1720429]
matriz após zerar col 2
[[ 9.3      6.      2.      ]
 [ 0.     -13.62580645 -5.74193548]
 [ 0.      0.      1.41827652]] [135.7, -100.39032258064513, 1.58875473
4848493]
resposta
[[ 9.3      6.      2.      ]
 [ 0.     -13.6258 -5.7419]
 [ 0.      0.      1.4183]] [ 135.7    -100.3903    1.5888]
x = 9.9017 6.8956 1.1202

```

```

In [62]: import numpy as np
def q2(aa,bb,x0,epsila):
    print(aa,bb)
    print('certo=',np.linalg.solve(aa,bb))
    jj=[0,0,0]
    for i in range(3):
        m=list(abs(aa[i,:]))
        jj[i]=m.index(max(m))
    a=np.array([aa[jj.index(0),:],aa[jj.index(1),:],aa[jj.index(2),:]])
    b=[bb[jj.index(0)],bb[jj.index(1)],bb[jj.index(2)]]
    print('depois=')
    print(a,b)
    for i in range(3):
        diva=a[i,i]
        for j in range(3):
            a[i,j]=a[i,j]/diva
            b[i]=b[i]/diva
    x=[0]*3
    erro=[0]*3
    print('resposta')
    for k in range(1,6):
        for i in range(3):
            soma=b[i]
            for j in range(3):
                if i!=j:
                    soma=soma-a[i,j]*x0[j]
            x[i]=soma
            erro[i]=abs(x0[i]-x[i])
    print(k,round(x[0],4),round(x[1],4),round(x[2],4),' ',end='')
    print('erro=',max(erro))
    if max(erro)<epsila:
        return
    x0=x.copy()
a=np.array([[ -4.6, -12.4, 6], [ -9.6, 0.4, -7.2], [ 2.5, -7.4, -11.2]])

```

```
b=[-23.2,-100.4,-20.7]
q2(a,b,[8.0,0.5,3.3],0.001)
```

```
[[ -4.6 -12.4  6. ]
 [ -9.6  0.4 -7.2]
 [  2.5 -7.4 -11.2]] [-23.2, -100.4, -20.7]
certo= [8.0017196  0.50096683 3.30331647]
depois=
[[ -9.6  0.4 -7.2]
 [ -4.6 -12.4  6. ]
 [  2.5 -7.4 -11.2]] [-100.4, -23.2, -20.7]
resposta
1 8.0042 0.5 3.3036          erro= 0.0041666666666668206
2 8.0015 0.5002 3.3045      erro= 0.00267857142857153
3 8.0008 0.5016 3.3038      erro= 0.0014436923963132564
4 8.0014 0.5015 3.3027      erro= 0.0011078735824812114
5 8.0022 0.5008 3.3029      erro= 0.0008270854243477288
```

```
In [63]: import numpy as np
def q3(aa,bb,x0,epsila):
    print(aa,bb)
    print('certo=',np.linalg.solve(aa,bb))
    jj=[0,0,0,0]
    for i in range(4):
        m=list(abs(aa[i,:]))
        jj[i]=m.index(max(m))
    a=np.array([aa[jj.index(0),:],aa[jj.index(1),:],aa[jj.index(2),:],aa[jj.index(3),:]])
    b=[bb[jj.index(0)],bb[jj.index(1)],bb[jj.index(2)],bb[jj.index(3)]]
    print('depois=')
    print(a,b)
    for i in range(4):
        diva=a[i,i]
        for j in range(4):
            a[i,j]=a[i,j]/diva
            b[i]=b[i]/diva
    erro=[0.0]*4
    print('resposta')
    for k in range(5):
        x=x0.copy()
        for i in range(4):
            soma=b[i]
            for j in range(4):
                if i!=j:
                    soma=soma-a[i,j]*x0[j]
            x0[i]=soma
            erro[i]=abs(x0[i]-x[i])
        print(k,round(x[0],4),round(x[1],4),round(x[2],4),round(x[3],4),' ','erro')
        if max(erro)<epsila:
            return
a=np.array([[6.4,2.6,-17,7],[-8.3,-23.1,-6.4,-7.5],[-3.7,3.1,-0.2,-0.3],[-3,4.2,-9,140.1]])
b=[-34.3,-89.1,30.2,140.1]
q3(a,b,[-6.5,2.9,3.1,7.5],0.001)
```

```

[[ 6.4  2.6 -17.   7. ]
 [-8.3 -23.1 -6.4 -7.5]
 [-3.7  3.1 -0.2 -0.3]
 [-3.   4.2 -9.3 18.3]] [-34.3, -89.1, 30.2, 140.1]
certo= [-6.50648039  2.90174055  3.09946574  7.49826666]
depois=
[[ -3.7  3.1 -0.2 -0.3]
 [-8.3 -23.1 -6.4 -7.5]
 [ 6.4  2.6 -17.   7. ]
 [-3.   4.2 -9.3 18.3]] [30.2, -89.1, -34.3, 140.1]
resposta
0 -6.5 2.9 3.1 7.5      erro= 0.00810810810810736
1 -6.5081 2.9016 3.0995 7.4981      erro= 0.0015337056802824378
2 -6.5066 2.9018 3.0994 7.4982      erro= 0.00016941041148310632

```

Victor Santin

```

In [64]: a=np.array([[ -2.5, -5, 1.1], [-0.6, -1.3, -8.3], [0.4, 9.5, -7.4]])
b=[20.3, -65.2, -72.9]
q1(a,b)

[[-2.5 -5.   1.1]
 [-0.6 -1.3 -8.3]
 [ 0.4  9.5 -7.4]] [20.3, -65.2, -72.9]
certo= [-2.11303058 -1.20032647  8.19617383]
matriz apos pivoteamento col 1
[[-2.5 -5.   1.1]
 [-0.6 -1.3 -8.3]
 [ 0.4  9.5 -7.4]] [20.3, -65.2, -72.9]
matriz após zerar col 1
[[-2.5  -5.   1.1 ]
 [ 0.   -0.1  -8.564]
 [ 0.    8.7  -7.224]] [20.3, -70.072, -69.652]
matriz após pivoteamento col 2
[[-2.5  -5.   1.1 ]
 [ 0.    8.7  -7.224]
 [ 0.   -0.1  -8.564]] [20.3, -69.652, -70.072]
matriz após zerar col 2
[[-2.50000000e+00 -5.00000000e+00  1.10000000e+00]
 [ 0.00000000e+00  8.70000000e+00 -7.22400000e+00]
 [ 0.00000000e+00  1.38777878e-17 -8.64703448e+00]] [20.3, -69.652, -70.8725977011
4943]
resposta
[[-2.5  -5.   1.1 ]
 [ 0.    8.7  -7.224]
 [ 0.    0.   -8.647]] [ 20.3  -69.652  -70.8726]
x = -2.113 -1.2003 8.1962

```

```

In [65]: a=np.array([[ -9.9, 18.1, 7.6], [-9.9, -0.9, -7.2], [-6.7, 2.3, -10]])
b=[113.2, 0.5, 28.6]
q2(a,b,[0.4, 7.1, -1.5], 0.001)

```

```

[[ -9.9  18.1   7.6]
 [ -9.9  -0.9  -7.2]
 [ -6.7   2.3 -10. ]] [113.2, 0.5, 28.6]
certo= [ 0.38750539  7.09116691 -1.48866022]
depois=
[[ -9.9  -0.9  -7.2]
 [ -9.9  18.1   7.6]
 [ -6.7   2.3 -10. ]] [0.5, 113.2, 28.6]
resposta
1 0.3949 7.1028 -1.495      erro= 0.005050505050505083
2 0.3911 7.0979 -1.491      erro= 0.004861878453038315
3 0.3886 7.0941 -1.4895      erro= 0.003813927560455177
4 0.3878 7.0921 -1.4887      erro= 0.0019811649661036768
5 0.3875 7.0914 -1.4887      erro= 0.0007312870479205813

```

```

In [66]: a=np.array([[ -3.7, -11.4, -0.2, 6.2], [ -6.3, 1.5, 14, 4.5], [ -2.5, -4.1, 9.8, 17.4], [21.2, 9.1,
b=[83.9, -75.4, 16.3, 63.9]
q3(a,b,[6.2, -8.9, -1.9, 0.8],0.001)

```

```

[[ -3.7 -11.4  -0.2   6.2]
 [ -6.3   1.5  14.   4.5]
 [ -2.5  -4.1   9.8  17.4]
 [ 21.2   9.1  -3.9   7.6]] [83.9, -75.4, 16.3, 63.9]
certo= [ 6.20127919 -8.90490927 -1.89762636  0.79826484]
depois=
[[ 21.2   9.1  -3.9   7.6]
 [ -3.7 -11.4  -0.2   6.2]
 [ -6.3   1.5  14.   4.5]
 [ -2.5  -4.1   9.8  17.4]] [63.9, 83.9, -75.4, 16.3]
resposta
0 6.2 -8.9 -1.9 0.8      erro= 0.0028963919232047886
1 6.1981 -8.9029 -1.8998 0.7995      erro= 0.0014468230408839489
2 6.1996 -8.9036 -1.8989 0.7991      erro= 0.0006425346265892529

```

Leonardo Amorim

```

In [67]: a=np.array([[7.8,4,7.3],[-0.4,-3.1,-3],[-1.1,-5.4,-0.3]])
b=[-35.2,13.1,45.3]
q1(a,b)

```

```

[[ 7.8  4.   7.3]
 [-0.4 -3.1 -3. ]
 [-1.1 -5.4 -0.3]] [-35.2, 13.1, 45.3]
certo= [-4.48754664 -7.70789795  4.19650077]
matriz apos pivoteamento col 1
[[ 7.8  4.   7.3]
 [-0.4 -3.1 -3. ]
 [-1.1 -5.4 -0.3]] [-35.2, 13.1, 45.3]
matriz após zerar col 1
[[ 7.8      4.      7.3      ]
 [ 0.      -2.89487179 -2.62564103]
 [ 0.      -4.83589744  0.72948718]] [-35.2, 11.294871794871794, 40.33589743589
743]
matriz após pivoteamento col 2
[[ 7.8      4.      7.3      ]
 [ 0.      -4.83589744  0.72948718]
 [ 0.      -2.89487179 -2.62564103]] [-35.2, 40.33589743589743, 11.294871794871
794]
matriz após zerar col 2
[[ 7.8      4.      7.3      ]
 [ 0.      -4.83589744  0.72948718]
 [ 0.      0.      -3.06232768]] [-35.2, 40.33589743589743, -12.85106044538
7057]
resposta
[[ 7.8      4.      7.3      ]
 [ 0.      -4.8359  0.7295]
 [ 0.      0.      -3.0623]] [-35.2      40.3359 -12.8511]
x = -4.4875 -7.7079 4.1965

```

```

In [68]: a=np.array([[ -8.3,5.9, -15.9],[8.2,-16.2,6.6],[12.3,3.8, -6.5]])
b=[ -128.1,132.5, -146.1]
q2(a,b,[ -5.3, -7.6,8],0.001)

```

```

[[ -8.3  5.9 -15.9]
 [  8.2 -16.2  6.6]
 [ 12.3  3.8 -6.5]] [-128.1, 132.5, -146.1]
certo= [-5.30047097 -7.60156241  8.00281075]
depois=
[[ 12.3  3.8 -6.5]
 [  8.2 -16.2  6.6]
 [ -8.3  5.9 -15.9]] [-146.1, 132.5, -128.1]
resposta
1 -5.3024 -7.6025 8.0031      erro= 0.0031446540880502027
2 -5.3 -7.6024 8.0035      erro= 0.0024246315139606622
3 -5.2998 -7.601 8.0023      erro= 0.0013727194065520365
4 -5.3009 -7.6015 8.0027      erro= 0.0010838162669397633
5 -5.3006 -7.6018 8.0031      erro= 0.0004097666490903151

```

```

In [69]: a=np.array([[8.8,27.6,9.5, -7.3],[ -2.7, -2, -14.4, -8.8],[7.1, -6.3,2.7,17.8],[ -14.9, -7
b=[ -258.6,121,44.4,16.5]
q3(a,b,[5.8, -9.4, -6.9, -2.1],0.001)

```

```

[[ 8.8 27.6 9.5 -7.3]
 [-2.7 -2. -14.4 -8.8]
 [ 7.1 -6.3 2.7 17.8]
 [-14.9 -7.8 -3.4 -2.9]] [-258.6, 121, 44.4, 16.5]
certo= [ 5.79336125 -9.3939383 -6.90469379 -2.09393275]
depois=
[[-14.9 -7.8 -3.4 -2.9]
 [ 8.8 27.6 9.5 -7.3]
 [-2.7 -2. -14.4 -8.8]
 [ 7.1 -6.3 2.7 17.8]] [16.5, -258.6, 121, 44.4]
resposta
0 5.8 -9.4 -6.9 -2.1 erro= 0.0033557046979861838
1 5.7966 -9.3982 -6.901 -2.0973 erro= 0.0016134618659489064
2 5.7954 -9.3968 -6.9026 -2.0961 erro= 0.0010884050208268548
3 5.7948 -9.3957 -6.9034 -2.0953 erro= 0.0006456635005012146

```

Leandro Cesar

```

In [70]: a=np.array([[6.5,6.3,-8.8],[-7.2,4.3,5.2],[-5.2,-2,-1.6]])
b=[91.8,-111.5,-9.4]
q1(a,b)

[[ 6.5 6.3 -8.8]
 [-7.2 4.3 5.2]
 [-5.2 -2. -1.6]] [91.8, -111.5, -9.4]
certo= [ 6.30468635 -4.49679138 -8.99424141]
matriz apos pivoteamento col 1
[[-7.2 4.3 5.2]
 [ 6.5 6.3 -8.8]
 [-5.2 -2. -1.6]] [-111.5, 91.8, -9.4]
matriz após zerar col 1
[[-7.2 4.3 5.2 ]
 [ 0. 10.18194444 -4.10555556]
 [ 0. -5.10555556 -5.35555556]] [-111.5, -8.859722222222231, 71.1277777777
7777]
matriz após pivoteamento col 2
[[-7.2 4.3 5.2 ]
 [ 0. 10.18194444 -4.10555556]
 [ 0. -5.10555556 -5.35555556]] [-111.5, -8.859722222222231, 71.1277777777
7777]
matriz após zerar col 2
[[-7.2 4.3 5.2 ]
 [ 0. 10.18194444 -4.10555556]
 [ 0. 0. -7.41421361]] [-111.5, -8.859722222222231, 66.6852271177
1925]
resposta
[[-7.2 4.3 5.2 ]
 [ 0. 10.1819 -4.1056]
 [ 0. 0. -7.4142]] [-111.5 -8.8597 66.6852]
x = 6.3047 -4.4968 -8.9942

```

```

In [71]: a=np.array([[-5.9,8.9,-16.6],[-5.9,-2.4,2.7],[-4.6,13.8,-7.7]])
b=[131.5,-84.5,101.5]
q2(a,b,[8.4,5.8,-7.8],0.001)

```

```

[[ -5.9   8.9 -16.6]
 [ -5.9  -2.4   2.7]
 [ -4.6  13.8  -7.7]] [131.5, -84.5, 101.5]
certo= [ 8.39442576  5.80498031 -7.79293899]
depois=
[[ -5.9  -2.4   2.7]
 [ -4.6  13.8  -7.7]
 [ -5.9   8.9 -16.6]] [-84.5, 101.5, 131.5]
resposta
1 8.3932 5.8029 -7.7976      erro= 0.006779661016951266
2 8.3931 5.802  -7.7936      erro= 0.003963680810197268
3 8.3953 5.8042 -7.7941      erro= 0.0021862451993737153
4 8.3942 5.8046 -7.7937      erro= 0.0011014611211557224
5 8.3942 5.8045 -7.7931      erro= 0.0006434992629564817

```

```

In [72]: a=np.array([[ -7.5,5.6, -2.2,16.8],[-13.6,4.9,7.6,0.6],[-3.4,-3.9,9.2,0.9],[-4.7,16.6,
b=[ -106.3,-56.6,-46.4,-86.7]
q3(a,b,[ -0.4,-2.9,-5.8,-6.3],0.001)

```

```

[[ -7.5   5.6  -2.2  16.8]
 [-13.6   4.9   7.6   0.6]
 [ -3.4  -3.9   9.2   0.9]
 [ -4.7  16.6  -2.7   8.9]] [-106.3, -56.6, -46.4, -86.7]
certo= [-0.40921513 -2.90452853 -5.8094142  -6.30264672]
depois=
[[ -13.6   4.9   7.6   0.6]
 [ -4.7  16.6  -2.7   8.9]
 [ -3.4  -3.9   9.2   0.9]
 [ -7.5   5.6  -2.2  16.8]] [-56.6, -86.7, -46.4, -106.3]
resposta
0 -0.4 -2.9 -5.8 -6.3      erro= 0.006193909268788822
1 -0.4022 -2.9024 -5.8062 -6.2998      erro= 0.004328407677905877
2 -0.4065 -2.9048 -5.8088 -6.3013      erro= 0.0023702084556284087
3 -0.4089 -2.9051 -5.8097 -6.3024      erro= 0.0006315068570746929

```

Franciane Lopes

```

In [73]: a=np.array([[ -1,2.8,-9.9],[-2.1,-7.3,-8.3],[6.5,-6.4,1.4]])
b=[ -28.1,2.2,81.5]
q1(a,b)

```



```

[[-1.  2.8 -9.9]
 [-2.1 -7.3 -8.3]
 [ 6.5 -6.4  1.4]] [-28.1, 2.2, 81.5]
certo= [ 8.60831248 -3.7957054  0.89532448]
matriz apos pivoteamento col 1
[[ 6.5 -6.4  1.4]
 [-2.1 -7.3 -8.3]
 [-1.  2.8 -9.9]] [81.5, 2.2, -28.1]
matriz após zerar col 1
[[ 6.5      -6.4      1.4      ]
 [ 0.      -9.36769231 -7.84769231]
 [ 0.      1.81538462 -9.68461538]] [81.5, 28.53076923076923, -15.561538461538
463]
matriz após pivoteamento col 2
[[ 6.5      -6.4      1.4      ]
 [ 0.      -9.36769231 -7.84769231]
 [ 0.      1.81538462 -9.68461538]] [81.5, 28.53076923076923, -15.561538461538
463]
matriz após zerar col 2
[[ 6.5      -6.4      1.4      ]
 [ 0.      -9.36769231 -7.84769231]
 [ 0.      0.      -11.20543603]] [81.5, 28.53076923076923, -10.032501231
72935]
resposta
[[ 6.5      -6.4      1.4      ]
 [ 0.      -9.3677 -7.8477]
 [ 0.      0.      -11.2054]] [ 81.5      28.5308 -10.0325]
x = 8.6083 -3.7957 0.8953

```

```

In [74]: a=np.array([[-8.1,-5.6,15.5],[-17.4,-8.6,-7.2],[-9.1,-12.3,-2.5]])
b=[131.1,136.7,137.6]
q2(a,b,[-5.1,-8,2.9],0.001)

```

```

[[ -8.1 -5.6 15.5]
 [-17.4 -8.6 -7.2]
 [ -9.1 -12.3 -2.5]] [131.1, 136.7, 137.6]
certo= [-5.10155442 -8.00229305  2.90093988]
depois=
[[-17.4 -8.6 -7.2]
 [ -9.1 -12.3 -2.5]
 [ -8.1 -5.6 15.5]] [136.7, 137.6, 131.1]
resposta
1 -5.1023 -8.0033 2.9026      erro= 0.003252032520324022
2 -5.1018 -8.0021 2.9002      erro= 0.0023762626947729792
3 -5.1014 -8.002 2.9009      erro= 0.0007068875568720934

```

```

In [75]: a=np.array([[8.8,7.3,-26.4,-8.3],[9.7,-2,3.2,-4.1],[-2.4,12.8,-5.4,4],[4.3,1.6,-3.6,-10.5]])
b=[216.7,76.1,-51.5,64.9]
q3(a,b,[8.4,-4.7,-6.3,-1.3],0.001)

```

```

[[ 8.8  7.3 -26.4 -8.3]
 [ 9.7 -2.   3.2 -4.1]
 [-2.4 12.8 -5.4  4. ]
 [ 4.3  1.6 -3.6 -10.5]] [216.7, 76.1, -51.5, 64.9]
certo= [ 8.40692718 -4.69969702 -6.29849167 -1.29477698]
depois=
[[ 9.7 -2.   3.2 -4.1]
 [-2.4 12.8 -5.4  4. ]
 [ 8.8  7.3 -26.4 -8.3]
 [ 4.3  1.6 -3.6 -10.5]] [76.1, -51.5, 216.7, 64.9]
resposta
0 8.4 -4.7 -6.3 -1.3      erro= 0.005154639175257714
1 8.4052 -4.699 -6.2973 -1.2958      erro= 0.0010590035031388112
2 8.4062 -4.699 -6.2982 -1.2951      erro= 0.000646047837182806

```

Bruna Herzog

```
In [76]: a=np.array([[4.1,4.9,-5.5],[6,-1.4,7.6],[9.1,-5.3,1.9]])
b=[19,-22.8,-27.2]
q1(a,b)

[[ 4.1  4.9 -5.5]
 [ 6.  -1.4  7.6]
 [ 9.1 -5.3  1.9]] [19, -22.8, -27.2]
certo= [-0.9980889  2.81101502 -1.69421652]
matriz apos pivoteamento col 1
[[ 9.1 -5.3  1.9]
 [ 6.  -1.4  7.6]
 [ 4.1  4.9 -5.5]] [-27.2, -22.8, 19]
matriz após zerar col 1
[[ 9.1      -5.3      1.9      ]
 [ 0.      2.09450549  6.34725275]
 [ 0.      7.28791209 -6.35604396]] [-27.2, -4.865934065934066, 31.254945054945054]
matriz após pivoteamento col 2
[[ 9.1      -5.3      1.9      ]
 [ 0.      7.28791209 -6.35604396]
 [ 0.      2.09450549  6.34725275]] [-27.2, 31.254945054945054, -4.865934065934066]
matriz após zerar col 2
[[ 9.1      -5.3      1.9      ]
 [ 0.      7.28791209 -6.35604396]
 [ 0.      0.      8.17394451]] [-27.2, 31.254945054945054, -13.848431845597107]
resposta
[[ 9.1      -5.3      1.9      ]
 [ 0.      7.2879 -6.356 ]
 [ 0.      0.      8.1739]] [-27.2      31.2549 -13.8484]
x = -0.9981 2.811 -1.6942
```

```
In [77]: a=np.array([[-5.2,0.4,7.1],[13,9.2,3.7],[9.8,20,-9.3]])
b=[-55,-9.7,-25.9]
q2(a,b,[4.3,-5.4,-4.3],0.001)

[[-5.2  0.4  7.1]
 [13.   9.2  3.7]
 [ 9.8 20.  -9.3]] [-55, -9.7, -25.9]
certo= [ 4.29641639 -5.3977488 -4.29570919]
depois=
[[13.   9.2  3.7]
 [ 9.8 20.  -9.3]
 [-5.2  0.4  7.1]] [-9.7, -25.9, -55]
resposta
1 4.2992 -5.4015 -4.293      erro= 0.007042253521125197
2 4.2983 -5.3978 -4.2934      erro= 0.0036515709642461758
3 4.2958 -5.3976 -4.2943      erro= 0.0024478939911656283
4 4.2959 -5.3968 -4.2961      erro= 0.0018063050981940165
5 4.2959 -5.3977 -4.2961      erro= 0.0008819404617232962
```

```
In [78]: a=np.array([[3.5,13.9,-7.6,-1.1],[8.7,-1.4,-16.2,-5.8],[14.9,3.8,-8.5,1.4],[-1.3,2
b=[-76.6,-98.7,-166.6,71.7]
q3(a,b,[-7.1,-1.5,5.2,-7.8],0.001)
```

```

[[ 3.5 13.9 -7.6 -1.1]
 [ 8.7 -1.4 -16.2 -5.8]
 [14.9 3.8 -8.5 1.4]
 [-1.3 2.7 -7.9 -13.8]] [-76.6, -98.7, -166.6, 71.7]
certo= [-7.10049411 -1.49670351 5.20002048 -7.79642166]
depois=
[[ 14.9 3.8 -8.5 1.4]
 [ 3.5 13.9 -7.6 -1.1]
 [ 8.7 -1.4 -16.2 -5.8]
 [-1.3 2.7 -7.9 -13.8]] [-166.6, -76.6, -98.7, 71.7]
resposta
0 -7.1 -1.5 5.2 -7.8      erro= 0.00270870551880642
1 -7.0993 -1.4973 5.202 -7.7978      erro= 0.0012009197753639622
2 -7.0991 -1.4961 5.2012 -7.7971      erro= 0.0008137628689217635

```

Ewerton Souza

```

In [79]: a=np.array([[5.3,-9.5,-2.2],[4.3,3.7,-1.8],[3,9.2,4.2]])
b=[-43.6,65.1,87.3]
q1(a,b)

[[ 5.3 -9.5 -2.2]
 [ 4.3 3.7 -1.8]
 [ 3.  9.2 4.2]] [-43.6, 65.1, 87.3]
certo= [ 6.30700268  8.8036672 -3.00351102]
matriz apos pivoteamento col 1
[[ 5.3 -9.5 -2.2]
 [ 4.3 3.7 -1.8]
 [ 3.  9.2 4.2]] [-43.6, 65.1, 87.3]
matriz após zerar col 1
[[ 5.3      -9.5      -2.2      ]
 [ 0.      11.40754717 -0.01509434]
 [ 0.      14.57735849  5.44528302]] [-43.6, 100.47358490566037, 111.9792452830
1887]
matriz após pivoteamento col 2
[[ 5.3      -9.5      -2.2      ]
 [ 0.      14.57735849  5.44528302]
 [ 0.      11.40754717 -0.01509434]] [-43.6, 111.97924528301887, 100.4735849056
6037]
matriz após zerar col 2
[[ 5.3      -9.5      -2.2      ]
 [ 0.      14.57735849  5.44528302]
 [ 0.      0.      -4.27631375]] [-43.6, 111.97924528301887, 12.84395547501
9413]
resposta
[[ 5.3      -9.5      -2.2      ]
 [ 0.      14.5774  5.4453]
 [ 0.      0.      -4.2763]] [-43.6  111.9792  12.844 ]
x = 6.307 8.8037 -3.0035

```

```

In [80]: a=np.array([[10.5,-6.2,-3.9],[-9.7,15.9,-4.6],[4.2,9.6,15.3]])
b=[14.9,54.8,-16.3]
q2(a,b,[2.1,3.6,-3.9],0.001)

```

```

[[10.5 -6.2 -3.9]
 [-9.7 15.9 -4.6]
 [ 4.2  9.6 15.3]] [14.9, 54.8, -16.3]
certo= [ 2.09543278  3.59725644 -3.89767839]
depois=
[[10.5 -6.2 -3.9]
 [-9.7 15.9 -4.6]
 [ 4.2  9.6 15.3]] [14.9, 54.8, -16.3]
resposta
1 2.0962 3.5994 -3.9007      erro= 0.003809523809523707
2 2.0956 3.5969 -3.8992      erro= 0.0025131394276782792
3 2.0946 3.5969 -3.8975      erro= 0.0017454571749357939
4 2.0953 3.5968 -3.8972      erro= 0.0006731438518845501

```

```

In [81]: a=np.array([[25.9,-9.8,-7.2,-7.8],[8.2,0.1,12.5,3.8],[0.8,7.6,5.1,14.4],[-2.6,-14.1,5.3,-5. ]])
b=[-221.1,9.3,-71.1,65.6]
q3(a,b,[-7.7,3.3,8.6,-9.3],0.001)

[[ 25.9  -9.8  -7.2  -7.8]
 [  8.2   0.1  12.5   3.8]
 [  0.8   7.6   5.1  14.4]
 [ -2.6 -14.1   5.3  -5. ]] [-221.1, 9.3, -71.1, 65.6]
certo= [-7.70012045  3.29206229  8.59330124 -9.29065371]
depois=
[[ 25.9  -9.8  -7.2  -7.8]
 [ -2.6 -14.1   5.3  -5. ]
 [  8.2   0.1  12.5   3.8]
 [  0.8   7.6   5.1  14.4]] [-221.1, 65.6, 9.3, -71.1]
resposta
0 -7.7 3.3 8.6 -9.3      erro= 0.005839486599063193
1 -7.6981 3.2975 8.5948 -9.2942      erro= 0.003924895329940892
2 -7.6987 3.2936 8.5934 -9.2916      erro= 0.001212547022845456
3 -7.6998 3.2924 8.5934 -9.2909      erro= 0.0002594592843383481

```

Fernando Fernandes

```

In [82]: a=np.array([[7.4,3.8,-1.8],[5,-5.5,9],[7.1,-7.9,-7.5]])
b=[-81,5,-100.2]
q1(a,b)

```

```

[[ 7.4  3.8 -1.8]
 [ 5.  -5.5  9. ]
 [ 7.1 -7.9 -7.5]] [-81, 5, -100.2]
certo= [-9.2989109 -0.6996846  5.29403213]
matriz apos pivoteamento col 1
[[ 7.4  3.8 -1.8]
 [ 5.  -5.5  9. ]
 [ 7.1 -7.9 -7.5]] [-81, 5, -100.2]
matriz após zerar col 1
[[ 7.4      3.8      -1.8      ]
 [ 0.      -8.06756757  10.21621622]
 [ 0.     -11.54594595  -5.77297297]] [-81, 59.729729729729726, -22.483783783
783792]
matriz após pivoteamento col 2
[[ 7.4      3.8      -1.8      ]
 [ 0.     -11.54594595  -5.77297297]
 [ 0.     -8.06756757  10.21621622]] [-81, -22.483783783783792, 59.729729729
729726]
matriz após zerar col 2
[[ 7.4      3.8      -1.8      ]
 [ 0.     -11.54594595  -5.77297297]
 [ 0.         0.      14.25      ]] [-81, -22.483783783783792, 75.439957865
16854]
resposta
[[ 7.4      3.8      -1.8      ]
 [ 0.     -11.5459  -5.773 ]
 [ 0.         0.      14.25  ]] [-81.      -22.4838  75.44  ]
x = -9.2989 -0.6997 5.294

```

```

In [83]: a=np.array([[2.5,12.5,8.7],[-2.9,-0.3,-0.6],[7.4,-1.2,10.3]])
b=[73.8,11.8,-84.8]
q2(a,b,[-4.2,9.6,-4.1],0.001)

```

```

[[ 2.5 12.5  8.7]
 [-2.9 -0.3 -0.6]
 [ 7.4 -1.2 10.3]] [73.8, 11.8, -84.8]
certo= [-4.21564508  9.59156283 -4.0868302 ]
depois=
[[-2.9 -0.3 -0.6]
 [ 2.5 12.5  8.7]
 [ 7.4 -1.2 10.3]] [11.8, 73.8, -84.8]
resposta
1 -4.2138 9.5976 -4.0971      erro= 0.013793103448276334
2 -4.2141 9.5983 -4.0875      erro= 0.009629996652160244
3 -4.2162 9.5917 -4.0871      erro= 0.00663161057917705
4 -4.2156 9.5919 -4.0864      erro= 0.0007131894454825982

```

```

In [84]: a=np.array([[-5.6,-4.3,7,17.5],[-6.3,2.7,13.5,4.2],[13.5,4.6,-7.5,0.5],[7.6,-17.4,
b=[121.7,65.6,-19.6,-18.6]
q3(a,b,[0.4,-0.5,3.4,5.6],0.001)

```

```

[[ -5.6  -4.3   7.   17.5]
 [ -6.3   2.7  13.5   4.2]
 [ 13.5   4.6  -7.5   0.5]
 [  7.6 -17.4  -8.1  -0.5]] [121.7, 65.6, -19.6, -18.6]
certo= [ 0.40411061 -0.50118237  3.40653002  5.59784144]
depois=
[[ 13.5   4.6  -7.5   0.5]
 [  7.6 -17.4  -8.1  -0.5]
 [ -6.3   2.7  13.5   4.2]
 [ -5.6  -4.3   7.   17.5]] [-19.6, -18.6, 65.6, 121.7]
resposta
0 0.4 -0.5 3.4 5.6      erro= 0.0037037037037035425
1 0.4 -0.5 3.4037 5.5979      erro= 0.0021336468743877735
2 0.4021 -0.5007 3.4055 5.5977      erro= 0.001247063807942983
3 0.4034 -0.501 3.4062 5.5978      erro= 0.0004835263866191375

```

Fernanda Siqueira

```

In [85]: a=np.array([[7.1,-5.9,1.8],[-6.6,7.5,2.5],[-4.5,-3.9,7.2]])
b=[52,-10.5,60.2]
q1(a,b)

[[ 7.1 -5.9  1.8]
 [-6.6  7.5  2.5]
 [-4.5 -3.9  7.2]] [52, -10.5, 60.2]
certo= [ 3.5926228 -1.50267562  9.79255107]
matriz apos pivoteamento col 1
[[ 7.1 -5.9  1.8]
 [-6.6  7.5  2.5]
 [-4.5 -3.9  7.2]] [52, -10.5, 60.2]
matriz após zerar col 1
[[ 7.1          -5.9          1.8          ]
 [ 0.          2.01549296  4.17323944]
 [ 0.          -7.63943662  8.34084507]] [52, 37.83802816901408, 93.15774647887324]
matriz após pivoteamento col 2
[[ 7.1          -5.9          1.8          ]
 [ 0.          -7.63943662  8.34084507]
 [ 0.          2.01549296  4.17323944]] [52, 93.15774647887324, 37.83802816901408]
matriz após zerar col 2
[[ 7.1          -5.9          1.8          ]
 [ 0.          -7.63943662  8.34084507]
 [ 0.           0.          6.37378319]] [52, 93.15774647887324, 62.41559734513273]
resposta
[[ 7.1   -5.9    1.8   ]
 [ 0.    -7.6394  8.3408]
 [ 0.     0.      6.3738]] [52.    93.1577 62.4156]
x =  3.5926 -1.5027 9.7926

```

```

In [86]: a=np.array([[3.1,5.1,-10.1],[-4,-13,-8.5],[-15.2,-6.3,7]])
b=[7.5,-4.5,-20.1]
q2(a,b,[1.1,0.2,-0.3],0.001)

```

```

[[ 3.1  5.1 -10.1]
 [ -4. -13.  -8.5]
 [-15.2 -6.3  7. ]] [7.5, -4.5, -20.1]
certo= [ 1.09824069  0.20551064 -0.30171778]
depois=
[[-15.2 -6.3  7. ]
 [ -4. -13.  -8.5]
 [ 3.1  5.1 -10.1]] [-20.1, -4.5, 7.5]
resposta
1 1.1013 0.2038 -0.304      erro= 0.003960396039603908
2 1.0979 0.206 -0.3016     erro= 0.0034179961518419066
3 1.0981 0.2055 -0.3016     erro= 0.00048221460264988303

```

```

In [87]: a=np.array([[ -7.5,1.4, -3.1,2.7],[1,0.6,2.3,-0.6],[ -2,-18.6,-7.2,9.1],[ -2.3,-2.5,-9
b=[96.4,-16.9,64.3,-101.4]
q3(a,b,[ -8.3,2.6,-2.1,8.9],0.001)

```

```

[[ -7.5  1.4  -3.1  2.7]
 [  1.    0.6   2.3  -0.6]
 [ -2.  -18.6  -7.2   9.1]
 [ -2.3  -2.5  -9.3 -15. ]] [96.4, -16.9, 64.3, -101.4]
certo= [-8.29726422  2.60091309 -2.09731535  8.89909719]
depois=
[[ -7.5  1.4  -3.1  2.7]
 [ -2.  -18.6  -7.2   9.1]
 [  1.    0.6   2.3  -0.6]
 [ -2.3  -2.5  -9.3 -15. ]] [96.4, 64.3, -16.9, -101.4]
resposta
0 -8.3 2.6 -2.1 8.9      erro= 0.0040000000000001336
1 -8.296 2.6023 -2.098 8.8991      erro= 0.001146677464598067
2 -8.2967 2.6011 -2.0976 8.8992      erro= 0.0003488185409743494

```

Felipe Almeida

```

In [88]: a=np.array([[ -9.1,2.9,-3.9],[ -0.9,5.2,-5.5],[ -9.8,8.8,2.7]])
b=[ -63.5,14.8,-38.9]
q1(a,b)

```

```

[[-9.1  2.9 -3.9]
 [-0.9  5.2 -5.5]
 [-9.8  8.8  2.7]] [-63.5, 14.8, -38.9]
certo= [8.30656902 4.70722346 0.40029998]
matriz apos pivoteamento col 1
[[-9.8  8.8  2.7]
 [-0.9  5.2 -5.5]
 [-9.1  2.9 -3.9]] [-38.9, 14.8, -63.5]
matriz após zerar col 1
[[-9.8      8.8      2.7      ]
 [ 0.      4.39183673 -5.74795918]
 [ 0.     -5.27142857 -6.40714286]] [-38.9, 18.372448979591837, -27.3785714285
71433]
matriz após pivoteamento col 2
[[-9.8      8.8      2.7      ]
 [ 0.     -5.27142857 -6.40714286]
 [ 0.      4.39183673 -5.74795918]] [-38.9, -27.378571428571433, 18.3724489795
91837]
matriz após zerar col 2
[[ -9.8      8.8      2.7      ]
 [  0.     -5.27142857 -6.40714286]
 [  0.      0.      -11.08600465]] [-38.9, -27.378571428571433, -4.4377274
48703068]
resposta
[[ -9.8      8.8      2.7      ]
 [  0.     -5.2714  -6.4071]
 [  0.      0.     -11.086 ]] [-38.9  -27.3786  -4.4377]
x = 8.3066 4.7072 0.4003

```

```

In [89]: a=np.array([[3,8.6,13.6],[1.3,-5.2,-3.4],[-7.9,2.1,-5.1]])
b=[-7.2,39.2,-79.5]
q2(a,b,[5.3,-8.7,3.8],0.001)

```

```

[[ 3.   8.6 13.6]
 [ 1.3 -5.2 -3.4]
 [-7.9  2.1 -5.1]] [-7.2, 39.2, -79.5]
certo= [ 5.28904847 -8.70736086  3.81001162]
depois=
[[-7.9  2.1 -5.1]
 [ 1.3 -5.2 -3.4]
 [ 3.   8.6 13.6]] [-79.5, 39.2, -7.2]
resposta
1 5.2975 -8.6981 3.8029      erro= 0.002941176470588225
2 5.2961 -8.7006 3.8023      erro= 0.002555988315481983
3 5.2958 -8.7005 3.8042      erro= 0.0019223609599632319
4 5.2946 -8.7019 3.8042      erro= 0.0013206547013506764
5 5.2943 -8.7022 3.8053      erro= 0.0011040014615484317

```

```

In [90]: a=np.array([[-5.3,1.6,-9.8,-2],[-0.2,-7.4,5.9,-0.3],[10.7,0.9,4.9,-4.8],[-6.9,4.2,
b=[5.3,50.7,61.7,111.3]
q3(a,b,[2.5,-7.4,-1.1,-9.8],0.001)

```



```

[[ -5.3  1.6 -9.8 -2. ]
 [ -0.2 -7.4  5.9 -0.3]
 [ 10.7  0.9  4.9 -4.8]
 [ -6.9  4.2  3.7 -16.7]] [5.3, 50.7, 61.7, 111.3]
certo= [ 2.49547197 -7.39713424 -1.09822407 -9.79941015]
depois=
[[ 10.7  0.9  4.9 -4.8]
 [ -0.2 -7.4  5.9 -0.3]
 [ -5.3  1.6 -9.8 -2. ]
 [ -6.9  4.2  3.7 -16.7]] [61.7, 50.7, 5.3, 111.3]
resposta
0 2.5 -7.4 -1.1 -9.8      erro= 0.0037383177570093906
1 2.4963 -7.3985 -1.0988 -9.8002      erro= 0.0010171613395089096
2 2.4955 -7.3975 -1.0981 -9.7995      erro= 0.0004769965403301768

```

Filipe Rocha

```

In [91]: a=np.array([[ -0.8,2.6,4.4],[0.9,3.9,3.7],[7.5,-0.4,9]])
b=[ -7.6,2.7,68.9]
q1(a,b)

[[ -0.8  2.6  4.4]
 [  0.9  3.9  3.7]
 [  7.5 -0.4  9. ]] [-7.6, 2.7, 68.9]
certo= [ 7.97954969 -2.01836656  0.91622564]
matriz apos pivoteamento col 1
[[ 7.5 -0.4  9. ]
 [ 0.9  3.9  3.7]
 [-0.8  2.6  4.4]] [68.9, 2.7, -7.6]
matriz após zerar col 1
[[ 7.5      -0.4      9.      ]
 [ 0.      3.948      2.62      ]
 [ 0.      2.55733333  5.36      ]] [68.9, -5.5680000000000005, -0.25066666666
66648]
matriz após pivoteamento col 2
[[ 7.5      -0.4      9.      ]
 [ 0.      3.948      2.62      ]
 [ 0.      2.55733333  5.36      ]] [68.9, -5.5680000000000005, -0.25066666666
66648]
matriz após zerar col 2
[[ 7.5      -0.4      9.      ]
 [ 0.      3.948      2.62      ]
 [ 0.      0.      3.66288416]] [68.9, -5.5680000000000005, 3.356028368794
328]
resposta
[[ 7.5      -0.4      9.      ]
 [ 0.      3.948      2.62      ]
 [ 0.      0.      3.6629]] [68.9  -5.568  3.356]
x = 7.9795 -2.0184 0.9162

```

```

In [92]: a=np.array([[ -9,7.6,1.1],[-7.8,-15,6.1],[-5.8,-9.3,-16.9]])
b=[ -112.5,94.7,-122.5]
q2(a,b,[7.7,-6.9,8.4],0.001)

```

```

[[ -9.    7.6    1.1]
 [ -7.8 -15.    6.1]
 [ -5.8 -9.3 -16.9]] [-112.5, 94.7, -122.5]
certo= [ 7.70019094 -6.90020928  8.40300822]
depois=
[[ -9.    7.6    1.1]
 [ -7.8 -15.    6.1]
 [ -5.8 -9.3 -16.9]] [-112.5, 94.7, -122.5]
resposta
1 7.7 -6.9013 8.403      erro= 0.002958579881656931
2 7.6992 -6.9001 8.4037   erro= 0.0012031558185396918
3 7.7003 -6.8994 8.4033   erro= 0.0011056760902912188
4 7.7009 -6.9002 8.4025   erro= 0.0007623751321084171

```

```

In [93]: a=np.array([[5.2,8.9,14.9,0.2],[-21,-4.3,-6.5,9.9],[7,7.5,-7.9,-24.4],[9.1,-26.9,9.
b=[-140.5,165.4,-210.8,-53.5]
q3(a,b,[-0.2,-3.5,-7.4,9.9],0.001)

```

```

[[ 5.2  8.9 14.9  0.2]
 [-21.  -4.3 -6.5  9.9]
 [ 7.    7.5 -7.9 -24.4]
 [ 9.1 -26.9  9.   -8. ]] [-140.5, 165.4, -210.8, -53.5]
certo= [-0.20007682 -3.50028489 -7.40185052  9.90253872]
depois=
[[-21.  -4.3 -6.5  9.9]
 [ 9.1 -26.9  9.   -8. ]
 [ 5.2  8.9 14.9  0.2]
 [ 7.    7.5 -7.9 -24.4]] [165.4, -53.5, -140.5, -210.8]
resposta
0 -0.2 -3.5 -7.4 9.9      erro= 0.002175195541285646
1 -0.2019 -3.4995 -7.4016 9.9022      erro= 0.0014335355370640457
2 -0.2005 -3.5002 -7.4017 9.9024      erro= 0.00028567574357474257

```

Fernando Batista

```

In [94]: a=np.array([[-4.4,-7,-9.4],[3.8,2.5,-1],[8.3,-1.4,0.5]])
b=[17.1,54.1,66.2]
q1(a,b)

```

```

[[-4.4 -7. -9.4]
 [ 3.8  2.5 -1. ]
 [ 8.3 -1.4  0.5]] [17.1, 54.1, 66.2]
certo= [ 9.20112072  4.00954219 -9.1118858 ]
matriz apos pivoteamento col 1
[[ 8.3 -1.4  0.5]
 [ 3.8  2.5 -1. ]
 [-4.4 -7. -9.4]] [66.2, 54.1, 17.1]
matriz após zerar col 1
[[ 8.3      -1.4      0.5      ]
 [ 0.      3.14096386 -1.22891566]
 [ 0.      -7.74216867 -9.13493976]] [66.2, 23.791566265060247, 52.193975903614
465]
matriz após pivoteamento col 2
[[ 8.3      -1.4      0.5      ]
 [ 0.      -7.74216867 -9.13493976]
 [ 0.      3.14096386 -1.22891566]] [66.2, 52.193975903614465, 23.791566265060
247]
matriz após zerar col 2
[[ 8.3      -1.4      0.5      ]
 [ 0.      -7.74216867 -9.13493976]
 [ 0.      0.      -4.93492063]] [66.2, 52.193975903614465, 44.966433239962
66]
resposta
[[ 8.3      -1.4      0.5      ]
 [ 0.      -7.7422 -9.1349]
 [ 0.      0.      -4.9349]] [66.2    52.194  44.9664]
x =  9.2011 4.0095 -9.1119

```

```

In [95]: a=np.array([[ -15.4,5.9,9.4],[ -4,-0.8,-5],[ -8.3,14,5.2]])
b=[ -79.2,-31.6,22.2]
q2(a,b,[7.2,6,-0.4],0.001)

```

```

[[-15.4  5.9  9.4]
 [ -4.   -0.8 -5. ]
 [ -8.3 14.   5.2]] [-79.2, -31.6, 22.2]
certo= [ 7.19857964  6.00169368 -0.3991347 ]
depois=
[[-15.4  5.9  9.4]
 [ -8.3 14.   5.2]
 [ -4.   -0.8 -5. ]] [-79.2, 22.2, -31.6]
resposta
1 7.1974 6.0029 -0.4      erro= 0.0028571428571426694
2 7.1985 6.0013 -0.3984   erro= 0.0016207792207794114
3 7.1989 6.0014 -0.399    erro= 0.000629313543599741

```

```

In [96]: a=np.array([[ -8.8,7.1,1.1,18.5],[6.4,8.9,24.4,7.4],[1.8,-12.4,-5.8,4.3],[22.3,5.9,
b=[207.3,-32.5,-15,53.4]
q3(a,b,[ -3.1,5.8,-5,7.8],0.001)

```

```

[[ -8.8  7.1  1.1 18.5]
 [  6.4  8.9 24.4  7.4]
 [  1.8 -12.4 -5.8  4.3]
 [ 22.3  5.9 -9.7  5.1]] [207.3, -32.5, -15, 53.4]
certo= [-3.10047546  5.80401966 -5.00148759  7.80048177]
depois=
[[ 22.3  5.9 -9.7  5.1]
 [  1.8 -12.4 -5.8  4.3]
 [  6.4  8.9 24.4  7.4]
 [ -8.8  7.1  1.1 18.5]] [53.4, -15, -32.5, 207.3]
resposta
0 -3.1 5.8 -5 7.8      erro= 0.003421090698682683
1 -3.0987 5.8034 -5.0016 7.8016      erro= 0.0019637384945840886
2 -3.1006 5.8044 -5.0019 7.8003      erro= 0.0005393173249661487

```

Franco Teixeira

```
In [97]: a=np.array([[-4.5,-5.7,-7.],[6.3,8.7,1.8],[-5.1,1.9,-2.9]])
b=[61.2,-72.7,25]
q1(a,b)

[[-4.5 -5.7 -7. ]
 [ 6.3  8.7  1.8]
 [-5.1  1.9 -2.9]] [61.2, -72.7, 25]
certo= [-5.29918239 -4.10682136 -1.99211392]
matriz apos pivoteamento col 1
[[ 6.3  8.7  1.8]
 [-4.5 -5.7 -7. ]
 [-5.1  1.9 -2.9]] [-72.7, 61.2, 25]
matriz após zerar col 1
[[ 6.3          8.7          1.8          ]
 [ 0.          0.51428571 -5.71428571]
 [ 0.          8.94285714 -1.44285714]] [-72.7, 9.271428571428572, -33.85238095238
0955]
matriz após pivoteamento col 2
[[ 6.3          8.7          1.8          ]
 [ 0.          8.94285714 -1.44285714]
 [ 0.          0.51428571 -5.71428571]] [-72.7, -33.852380952380955, 9.27142857142
8572]
matriz após zerar col 2
[[ 6.3          8.7          1.8          ]
 [ 0.          8.94285714 -1.44285714]
 [ 0.          0.          -5.6313099 ]] [-72.7, -33.852380952380955, 11.2182108626
19806]
resposta
[[ 6.3          8.7          1.8          ]
 [ 0.          8.9429 -1.4429]
 [ 0.          0.          -5.6313]] [-72.7    -33.8524   11.2182]
x = -5.2992 -4.1068 -1.9921
```

```
In [98]: a=np.array([[3,-5.5,8.7],[-6,-12.7,5.6],[14.6,9.1,-3.7]])
b=[57.8,20.4,-22.2]
q2(a,b,[-1,2.7,8.7],0.001)

[[ 3.   -5.5   8.7]
 [-6.  -12.7   5.6]
 [14.6   9.1  -3.7]] [57.8, 20.4, -22.2]
certo= [-1.00001503  2.70047731  8.69570923]
depois=
[[ 14.6   9.1  -3.7]
 [-6.   -12.7   5.6]
 [ 3.   -5.5   8.7]] [-22.2, 20.4, 57.8]
resposta
1 -0.9986  2.7024  8.6954      erro= 0.004597701149423372
2 -1.0013  2.6997  8.6964      erro= 0.0026745121668474425
3 -0.9993  2.7014  8.6956      erro= 0.0019257322857733072
4 -1.0006  2.7001  8.6961      erro= 0.0012552593021855074
5 -0.9997  2.7009  8.6957      erro= 0.0008852668707679534
```

```
In [99]: a=np.array([[-9.9,4.9,17,-1.2],[-4.4,-0.7,-9.2,-14.6],[-2.2,6.6,-3.4,-0.3],[7.6,-0
b=[193.1,30.3,20.6,-87.6]
q3(a,b,[-8.9,2.7,5.2,-2.8],0.001)
```

```

[[ -9.9  4.9 17.  -1.2]
 [ -4.4 -0.7 -9.2 -14.6]
 [ -2.2  6.6 -3.4 -0.3]
 [  7.6 -0.5 -4.6 -1.9]] [193.1, 30.3, 20.6, -87.6]
certo= [-8.90172914  2.70448999  5.19786381 -2.79766314]
depois=
[[  7.6 -0.5 -4.6 -1.9]
 [ -2.2  6.6 -3.4 -0.3]
 [ -9.9  4.9 17.  -1.2]
 [ -4.4 -0.7 -9.2 -14.6]] [-87.6, 20.6, 193.1, 30.3]
resposta
0 -8.9 2.7 5.2 -2.8      erro= 0.005622009569377973
1 -8.9013 2.7056 5.1976 -2.7977      erro= 0.001289503425295102
2 -8.9018 2.7043 5.1979 -2.7976      erro= 0.0001556074586011036

```

Mauricio Schavarski

```

In [100... a=np.array([[ -7.5,1, -4.1],[2.7, -6.6,1.9],[0.7,8,7.4]])
b=[ -37.2,40.9, -87.4]
q1(a,b)

[[-7.5  1.  -4.1]
 [ 2.7 -6.6  1.9]
 [ 0.7  8.   7.4]] [-37.2, 40.9, -87.4]
certo= [ 8.29340276 -4.90393564 -7.29376984]
matriz apos pivoteamento col 1
[[-7.5  1.  -4.1]
 [ 2.7 -6.6  1.9]
 [ 0.7  8.   7.4]] [-37.2, 40.9, -87.4]
matriz após zerar col 1
[[-7.5      1.      -4.1      ]
 [ 0.      -6.24      0.424      ]
 [ 0.      8.09333333  7.01733333]] [-37.2, 27.507999999999996, -90.872]
matriz após pivoteamento col 2
[[-7.5      1.      -4.1      ]
 [ 0.      8.09333333  7.01733333]
 [ 0.      -6.24      0.424      ]] [-37.2, -90.872, 27.507999999999996]
matriz após zerar col 2
[[-7.5      1.      -4.1      ]
 [ 0.      8.09333333  7.01733333]
 [ 0.      0.      5.83439868]] [-37.2, -90.872, -42.55476112026359]
resposta
[[-7.5      1.      -4.1      ]
 [ 0.      8.0933  7.0173]
 [ 0.      0.      5.8344]] [-37.2      -90.872      -42.5548]
x = 8.2934 -4.9039 -7.2938

```

```

In [101... a=np.array([[8.6,3.2,3.5],[-8.1,18.9,-9.7],[2.8,-8.6,12.3]])
b=[81.3,-168.6,101.1]
q2(a,b,[8.9,-3,4.1],0.001)

```

```

[[ 8.6  3.2  3.5]
 [-8.1 18.9 -9.7]
 [ 2.8 -8.6 12.3]] [81.3, -168.6, 101.1]
certo= [ 8.90580567 -3.00373206  4.09200394]
depois=
[[ 8.6  3.2  3.5]
 [-8.1 18.9 -9.7]
 [ 2.8 -8.6 12.3]] [81.3, -168.6, 101.1]
resposta
1 8.9012 -3.0021 4.0959      erro= 0.00406504065040636
2 8.9036 -3.0037 4.0942      erro= 0.0024418754708008805
3 8.9049 -3.0036 4.0925      erro= 0.001666149356783997
4 8.9055 -3.0039 4.0923      erro= 0.0006218188868469809

```

```

In [102... a=np.array([[ -8.8, -5.6, 9, 24.1], [ -16.6, 2.4, -7.3, -5.4], [ -7.9, 0.5, 14, 3.7], [ -5.3, -19.4,
b=[ -139.6, 190.4, -86.4, -129.5]
q3(a,b,[ -5.9, 3.6, -8.6, -3.9],0.001)

```

```

[[ -8.8  -5.6   9.   24.1]
 [-16.6   2.4  -7.3  -5.4]
 [ -7.9   0.5  14.   3.7]
 [ -5.3 -19.4   8.8   3.9]] [-139.6, 190.4, -86.4, -129.5]
certo= [-5.89945512  3.60278861 -8.59879771 -3.89835724]
depois=
[[ -16.6   2.4  -7.3  -5.4]
 [ -5.3 -19.4   8.8   3.9]
 [ -7.9   0.5  14.   3.7]
 [ -8.8  -5.6   9.   24.1]] [190.4, -129.5, -86.4, -139.6]
resposta
0 -5.9 3.6 -8.6 -3.9      erro= 0.002046551448799505
1 -5.8988 3.6017 -8.598 -3.8987      erro= 0.0014893350629807678
2 -5.8999 3.6032 -8.599 -3.8983      erro= 0.0005531886192535751

```

```

In [103... # Giovanna Mendes

```

```

In [104... a=np.array([[ -7.7, -7.5, 4], [ -3.9, 2.7, 0.6], [ 1.2, 9.3, 3.7]])
b=[100.2, 11.8, -36.8]
q1(a,b)

```

```

[[-7.7 -7.5  4. ]
 [-3.9  2.7  0.6]
 [ 1.2  9.3  3.7]] [100.2, 11.8, -36.8]
certo= [-5.79582622 -5.00380208  4.51090563]
matriz apos pivoteamento col 1
[[-7.7 -7.5  4. ]
 [-3.9  2.7  0.6]
 [ 1.2  9.3  3.7]] [100.2, 11.8, -36.8]
matriz após zerar col 1
[[-7.70000000e+00 -7.50000000e+00  4.00000000e+00]
 [-4.44089210e-16  6.49870130e+00 -1.42597403e+00]
 [ 0.00000000e+00  8.13116883e+00  4.32337662e+00]] [100.2, -38.95064935064934, -2
1.184415584415582]
matriz após pivoteamento col 2
[[-7.70000000e+00 -7.50000000e+00  4.00000000e+00]
 [ 0.00000000e+00  8.13116883e+00  4.32337662e+00]
 [-4.44089210e-16  6.49870130e+00 -1.42597403e+00]] [100.2, -21.184415584415582, -
38.95064935064934]
matriz após zerar col 2
[[-7.70000000e+00 -7.50000000e+00  4.00000000e+00]
 [ 0.00000000e+00  8.13116883e+00  4.32337662e+00]
 [-4.44089210e-16  0.00000000e+00 -4.88136080e+00]] [100.2, -21.184415584415582, -
22.01935793004312]
resposta
[[-7.7    -7.5    4.    ]
 [ 0.      8.1312  4.3234]
 [-0.      0.     -4.8814]] [100.2    -21.1844 -22.0194]
x = -5.7958 -5.0038 4.5109

```

```

In [105... a=np.array([[4.1,13.3,-8.3],[-9.2,5.5,16.2],[5.3,3.3,0.8]])
b=[-11.8,60.8,-8.6]
q2(a,b,[-2.6,1.1,1.9],0.001)

```

```

[[ 4.1 13.3 -8.3]
 [-9.2  5.5 16.2]
 [ 5.3  3.3  0.8]] [-11.8, 60.8, -8.6]
certo= [-2.59612962  1.10173671  1.90469479]
depois=
[[ 5.3  3.3  0.8]
 [ 4.1 13.3 -8.3]
 [-9.2  5.5 16.2]] [-8.6, -11.8, 60.8]
resposta
1 -2.5943 1.1 1.9031      erro= 0.005660377358490454
2 -2.5948 1.1002 1.9063      erro= 0.0032145352900068147
3 -2.5954 1.1023 1.906      erro= 0.002149678879238337
4 -2.5967 1.1023 1.9049      erro= 0.0012892591321729263
5 -2.5965 1.102 1.9042      erro= 0.0007256729560083386

```

```

In [106... a=np.array([[-4,7,-22.1,-9.9],[20.7,6.3,7.4,6.9],[-9.1,13.7,-2.1,1.7],[-3.2,1.3,-5
b=[-264.8,13,-25.2,-145.4]
q3(a,b,[-3.7,-4.4,7,9.5],0.001)

```

```

[[ -4.    7.  -22.1  -9.9]
 [ 20.7   6.3   7.4   6.9]
 [ -9.1  13.7  -2.1   1.7]
 [ -3.2   1.3  -5.5 -11.9]] [-264.8, 13, -25.2, -145.4]
certo= [-3.70102521 -4.40255154  7.00349389  9.49586111]
depois=
[[ 20.7   6.3   7.4   6.9]
 [ -9.1  13.7  -2.1   1.7]
 [ -4.    7.  -22.1  -9.9]
 [ -3.2   1.3  -5.5 -11.9]] [13, -25.2, -264.8, -145.4]
resposta
0 -3.7 -4.4 7 9.5      erro= 0.004203251172466338
1 -3.7019 -4.4042 7.0013 9.4969      erro= 0.0018388787903145243
2 -3.7001 -4.4024 7.0029 9.4959      erro= 0.0007735957369980895

```

In [107... *# Mariana Savioli*

```

In [108... a=np.array([[ -1.4, -5.4, 8.9], [ -8.8, -6.4, 7.9], [ -8.5, 3.5, 9.4]])
b=[ -53.8, -114.9, -155.5]
q1(a,b)

[[ -1.4  -5.4   8.9]
 [ -8.8  -6.4   7.9]
 [ -8.5   3.5   9.4]] [-53.8, -114.9, -155.5]
certo= [ 9.60620024 -3.39321874 -6.59266302]
matriz apos pivoteamento col 1
[[ -8.8  -6.4   7.9]
 [ -1.4  -5.4   8.9]
 [ -8.5   3.5   9.4]] [-114.9, -53.8, -155.5]
matriz após zerar col 1
[[ -8.8         -6.4         7.9         ]
 [  0.         -4.38181818  7.64318182]
 [  0.          9.68181818  1.76931818]] [-114.9, -35.52045454545454, -44.517045454
54545]
matriz após pivoteamento col 2
[[ -8.8         -6.4         7.9         ]
 [  0.          9.68181818  1.76931818]
 [  0.         -4.38181818  7.64318182]] [-114.9, -44.51704545454545, -35.520454545
45454]
matriz após zerar col 2
[[ -8.8         -6.4         7.9         ]
 [  0.          9.68181818  1.76931818]
 [  0.           0.         8.44394366]] [-114.9, -44.51704545454545, -55.668075117
37089]
resposta
[[ -8.8   -6.4    7.9   ]
 [  0.    9.6818  1.7693]
 [  0.     0.    8.4439]] [-114.9   -44.517   -55.6681]
x = 9.6062 -3.3932 -6.5927

```

```

In [109... a=np.array([[2.4, -8.4, 4], [-17.4, 8.2, 7.3], [9.3, -3.7, 14]])
b=[ -72.4, 97.6, -81.5]
q2(a,b, [-3.2, 6.8, -1.9], 0.001)

```



```

[[ 2.4 -8.4 4. ]
 [-17.4 8.2 7.3]
 [ 9.3 -3.7 14. ]] [-72.4, 97.6, -81.5]
certo= [-3.20051711 6.80079632 -1.89801747]
depois=
[[-17.4 8.2 7.3]
 [ 2.4 -8.4 4. ]
 [ 9.3 -3.7 14. ]] [97.6, -72.4, -81.5]
resposta
1 -3.2017 6.8 -1.8986      erro= 0.0017241379310348748
2 -3.2011 6.8002 -1.8974   erro= 0.001145320197044386
3 -3.2006 6.8009 -1.8978   erro= 0.0007166314801780871

```

```

In [110... a=np.array([[0.1,7.4,9.9,-1.7],[-12.3,1.5,-8.1,-2.1],[6.1,2.8,3.8,-12.8],[0.3,4.8,
b=[-13,-41.9,-116.5,-52.4]
q3(a,b,[-2,-6.4,4.9,8.2],0.001)

```

```

[[ 0.1 7.4 9.9 -1.7]
 [-12.3 1.5 -8.1 -2.1]
 [ 6.1 2.8 3.8 -12.8]
 [ 0.3 4.8 -2.3 -1.2]] [-13, -41.9, -116.5, -52.4]
certo= [-1.99810683 -6.39489316 4.89582403 8.20390459]
depois=
[[-12.3 1.5 -8.1 -2.1]
 [ 0.3 4.8 -2.3 -1.2]
 [ 0.1 7.4 9.9 -1.7]
 [ 6.1 2.8 3.8 -12.8]] [-41.9, -52.4, -13, -116.5]
resposta
0 -2 -6.4 4.9 8.2      erro= 0.006300813008130568
1 -2.0008 -6.3937 4.8943 8.2024      erro= 0.004116471764542107
2 -1.9967 -6.3961 4.8964 8.2045      erro= 0.002068797606048056
3 -1.9988 -6.3944 4.8956 8.2036      erro= 0.0009355174426444179

```

```

In [111... # João Vitor Andrade

```

```

In [112... a=np.array([[-5.9,5.7,2.4],[2.3,-3.8,-2.7],[-4.1,-1.9,8.5]])
b=[36,-15.4,14.6]
q1(a,b)

```

```

[[-5.9  5.7  2.4]
 [ 2.3 -3.8 -2.7]
 [-4.1 -1.9  8.5]] [36, -15.4, 14.6]
certo= [-4.99649337  1.31204211 -0.39914621]
matriz apos pivoteamento col 1
[[-5.9  5.7  2.4]
 [ 2.3 -3.8 -2.7]
 [-4.1 -1.9  8.5]] [36, -15.4, 14.6]
matriz após zerar col 1
[[-5.9      5.7      2.4      ]
 [ 0.      -1.5779661 -1.76440678]
 [ 0.      -5.86101695  6.83220339]] [36, -1.3661016949152565, -10.416949152542
37]
matriz após pivoteamento col 2
[[-5.9      5.7      2.4      ]
 [ 0.      -5.86101695  6.83220339]
 [ 0.      -1.5779661 -1.76440678]] [36, -10.41694915254237, -1.36610169491525
65]
matriz após zerar col 2
[[-5.9      5.7      2.4      ]
 [ 0.      -5.86101695  6.83220339]
 [ 0.      0.      -3.60384615]] [36, -10.41694915254237, 1.438461538461535
6]
resposta
[[-5.9      5.7      2.4      ]
 [ 0.      -5.861      6.8322]
 [ 0.      0.      -3.6038]] [ 36.      -10.4169      1.4385]
x = -4.9965 1.312 -0.3991

```

In [113...

```

a=np.array([[0.5,2.8,4.8],[-4.6,-2,-1.7],[-6.1,-13.2,-5.1]])
b=[53.8,14,-95.2]
q2(a,b,[-9.5,8.9,7],0.001)

```

```

[[ 0.5  2.8  4.8]
 [-4.6 -2.  -1.7]
 [-6.1 -13.2 -5.1]] [53.8, 14, -95.2]
certo= [-9.50116766  8.89458459  7.00953062]
depois=
[[ -4.6  -2.  -1.7]
 [ -6.1 -13.2 -5.1]
 [ 0.5  2.8  4.8]] [14, -95.2, 53.8]
resposta
1 -9.5 8.8977 7.0062      erro= 0.0062500000000000533
2 -9.5013 8.8953 7.0076      erro= 0.002414772727270531
3 -9.5008 8.8954 7.0091      erro= 0.0015462882905126207
4 -9.5014 8.8946 7.009      erro= 0.0008561930913622007

```

In [114...

```

a=np.array([[-17.7,-6.6,2,8.5],[-0.2,-9.7,16,5.9],[0.8,-8.1,-5.8,0.3],[-7.6,1.9,9.6]])
b=[-267.2,-127.2,-19.3,86]
q3(a,b,[9.1,4.4,-2,-8.6],0.001)

```

```

[[-17.7 -6.6  2.    8.5]
 [ -0.2 -9.7 16.    5.9]
 [  0.8 -8.1 -5.8  0.3]
 [ -7.6  1.9  9.6 -19.3]] [-267.2, -127.2, -19.3, 86]
certo= [ 9.10050533  4.39498618 -1.99991195 -8.60168505]
depois=
[[-17.7 -6.6  2.    8.5]
 [  0.8 -8.1 -5.8  0.3]
 [ -0.2 -9.7 16.    5.9]
 [ -7.6  1.9  9.6 -19.3]] [-267.2, -19.3, -127.2, 86]
resposta
0 9.1 4.4 -2 -8.6      erro= 0.004994071284090573
1 9.0994 4.395 -2.0005 -8.6016      erro= 0.001047143341688539
2 9.1005 4.3954 -1.9997 -8.6015      erro= 0.0006118624865578681

```

In [115... *# Carlos Favero*

```

In [116... a=np.array([[0.8,0.6,9.4],[-6,6.3,5.6],[-8.9,8.8,-0.4]])
b=[-3.7,54.9,81.5]
q1(a,b)

[[ 0.8  0.6  9.4]
 [-6.   6.3  5.6]
 [-8.9  8.8 -0.4]] [-3.7, 54.9, 81.5]
certo= [-4.60386244  4.59178043 -0.29489131]
matriz apos pivoteamento col 1
[[-8.9  8.8 -0.4]
 [-6.   6.3  5.6]
 [ 0.8  0.6  9.4]] [81.5, 54.9, -3.7]
matriz após zerar col 1
[[-8.9      8.8      -0.4      ]
 [ 0.      0.36741573  5.86966292]
 [ 0.      1.39101124  9.36404494]] [81.5, -0.04382022471909863, 3.62584269662
92134]
matriz após pivoteamento col 2
[[-8.9      8.8      -0.4      ]
 [ 0.      1.39101124  9.36404494]
 [ 0.      0.36741573  5.86966292]] [81.5, 3.6258426966292134, -0.043820224719
09863]
matriz após zerar col 2
[[-8.9      8.8      -0.4      ]
 [ 0.      1.39101124  9.36404494]
 [ 0.      0.      3.39628433]] [81.5, 3.6258426966292134, -1.001534733441
0303]
resposta
[[-8.9      8.8      -0.4      ]
 [ 0.      1.391  9.364 ]
 [ 0.      0.      3.3963]] [81.5      3.6258 -1.0015]
x = -4.6039 4.5918 -0.2949

```

```

In [117... a=np.array([[-6.1,-1.5,-8.2],[-3.6,13,8.2],[-16.7,7,7.7]])
b=[-47.5,-51.1,-97.2]
q2(a,b,[5.3,-4.1,2.6],0.001)

```

```

[[ -6.1  -1.5  -8.2]
 [ -3.6  13.   8.2]
 [-16.7   7.   7.7]] [-47.5, -51.1, -97.2]
certo= [ 5.29946654 -4.10392823  2.60111542]
depois=
[[-16.7   7.   7.7]
 [ -3.6  13.   8.2]
 [ -6.1  -1.5  -8.2]] [-97.2, -51.1, -47.5]
resposta
1 5.3006 -4.1031 2.6      erro= 0.0030769230769234213
2 5.2993 -4.1029 2.6001   erro= 0.00128972823583684
3 5.2994 -4.1033 2.601    erro= 0.0009290986507290988

```

In [118... `a=np.array([[4.3,9.8,-9.5,-25.1],[6.3,-7.7,0.6,-0.4],[-6.6,0.5,1.1,3.9],[-2.2,8.8,17.5,-5.8]],[23.5,-32.5,-166.2,-23.6])`
`b=[-23.6,-32.5,23.5,-166.2]`
`q3(a,b,[-2.3,1.4,-9,4.5],0.001)`

```

[[ 4.3  9.8 -9.5 -25.1]
 [ 6.3 -7.7  0.6 -0.4]
 [-6.6  0.5  1.1  3.9]
 [-2.2  8.8 17.5 -5.8]] [-23.6, -32.5, 23.5, -166.2]
certo= [-2.29192799  1.41013995 -9.00127502  4.50502764]
depois=
[[-6.6  0.5  1.1  3.9]
 [ 6.3 -7.7  0.6 -0.4]
 [-2.2  8.8 17.5 -5.8]
 [ 4.3  9.8 -9.5 -25.1]] [23.5, -32.5, -166.2, -23.6]
resposta
0 -2.3 1.4 -9 4.5      erro= 0.0076151121605667615
1 -2.2955 1.4076 -9.0021 4.5038      erro= 0.002443633827283964
2 -2.293 1.4093 -9.0014 4.5045      erro= 0.0007083536902667831

```

In [119... `# Eduardo Somer`

In [120... `a=np.array([[5.6,-6.3,4.5],[5.2,4.3,2.3],[-7.2,7.8,-6]])`
`b=[-53.7,14.5,66.1]`
`q1(a,b)`

```

[[ 5.6 -6.3  4.5]
 [ 5.2  4.3  2.3]
 [-7.2  7.8 -6. ]] [-53.7, 14.5, 66.1]
certo= [-4.75117371  7.05503391  3.85628586]
matriz apos pivoteamento col 1
[[-7.2  7.8 -6. ]
 [ 5.2  4.3  2.3]
 [ 5.6 -6.3  4.5]] [66.1, 14.5, -53.7]
matriz após zerar col 1
[[-7.2      7.8      -6.      ]
 [ 0.      9.93333333 -2.03333333]
 [ 0.     -0.23333333 -0.16666667]] [66.1, 62.23888888888889, -2.28888888888889
056]
matriz após pivoteamento col 2
[[-7.2      7.8      -6.      ]
 [ 0.      9.93333333 -2.03333333]
 [ 0.     -0.23333333 -0.16666667]] [66.1, 62.23888888888889, -2.28888888888889
056]
matriz após zerar col 2
[[-7.2      7.8      -6.      ]
 [ 0.      9.93333333 -2.03333333]
 [ 0.      0.      -0.21442953]] [66.1, 62.23888888888889, -0.8269015659955
365]
resposta
[[-7.2      7.8      -6.      ]
 [ 0.      9.9333 -2.0333]
 [ 0.      0.     -0.2144]] [66.1    62.2389 -0.8269]
x = -4.7512 7.055 3.8563

```

In [121...

```

a=np.array([[ -9.8,15.9,5],[ -4.4,-4.5,-9.5],[ -10.3,-3.3,-5.6]])
b=[ -191.8,5.9,-47.2]
q2(a,b,[7.2,-7.5,-0.4],0.001)

```

```

[[ -9.8  15.9   5. ]
 [ -4.4  -4.5  -9.5]
 [-10.3  -3.3  -5.6]] [-191.8, 5.9, -47.2]
certo= [ 7.20560592 -7.49307474 -0.40903471]
depois=
[[-10.3  -3.3  -5.6]
 [ -9.8  15.9   5. ]
 [ -4.4  -4.5  -9.5]] [-47.2, -191.8, 5.9]
resposta
1 7.2029 -7.4994 -0.4032      erro= 0.0031578947368430255
2 7.2044 -7.4966 -0.4048      erro= 0.002788249245571528
3 7.2044 -7.4951 -0.4068      erro= 0.002022624459645961
4 7.2051 -7.4945 -0.4075      erro= 0.000688722089263738

```

In [122...

```

a=np.array([[ -0.4,-6.7,-8.5,-16.6],[7.1,-5.7,17.2,-3.7],[9.1,-14.2,1.7,3.2],[19,3.
b=[200.5,-74.4,-9.5,189.4]
q3(a,b,[3.8,0.3,-7.6,-8.4],0.001)

```

```

[[ -0.4  -6.7  -8.5 -16.6]
 [  7.1  -5.7  17.2  -3.7]
 [  9.1 -14.2   1.7   3.2]
 [ 19.    3.5  -9.2  -5.5]] [200.5, -74.4, -9.5, 189.4]
certo= [ 3.80074624  0.30184483 -7.60132893 -8.39947969]
depois=
[[ 19.    3.5  -9.2  -5.5]
 [  9.1 -14.2   1.7   3.2]
 [  7.1  -5.7  17.2  -3.7]
 [ -0.4  -6.7  -8.5 -16.6]] [189.4, -9.5, -74.4, 200.5]
resposta
0 3.8 0.3 -7.6 -8.4      erro= 0.002420311341734094
1 3.8016 0.3024 -7.6016 -8.3996      erro= 0.0011007793476180971
2 3.8005 0.3016 -7.6013 -8.3994      erro= 0.0003422849261531802

```

In [123... *# Gabriel Francisco*

```

In [124... a=np.array([[ -0.8,4.6,1.2],[ -4.8,-9,-5.2],[9.3,-1.4,-8.7]])
b=[31.2,-96.2,-48.7]
q1(a,b)

[[-0.8  4.6  1.2]
 [-4.8 -9.  -5.2]
 [ 9.3 -1.4 -8.7]] [31.2, -96.2, -48.7]
certo= [2.29711407 5.30391552 7.19973323]
matriz apos pivoteamento col 1
[[ 9.3 -1.4 -8.7]
 [-4.8 -9.  -5.2]
 [-0.8  4.6  1.2]] [-48.7, -96.2, 31.2]
matriz após zerar col 1
[[ 9.3      -1.4      -8.7      ]
 [ 0.      -9.72258065 -9.69032258]
 [ 0.      4.47956989  0.4516129 ]] [-48.7, -121.33548387096775, 27.0107526881
7204]
matriz após pivoteamento col 2
[[ 9.3      -1.4      -8.7      ]
 [ 0.      -9.72258065 -9.69032258]
 [ 0.      4.47956989  0.4516129 ]] [-48.7, -121.33548387096775, 27.0107526881
7204]
matriz após zerar col 2
[[ 9.3      -1.4      -8.7      ]
 [ 0.      -9.72258065 -9.69032258]
 [ 0.      0.        -4.01309445]] [-48.7, -121.33548387096775, -28.893209466
9321]
resposta
[[ 9.3      -1.4      -8.7      ]
 [ 0.      -9.7226 -9.6903]
 [ 0.      0.        -4.0131]] [ -48.7      -121.3355  -28.8932]
x = 2.2971 5.3039 7.1997

```

```

In [125... a=np.array([[ -9.4,-10.9,1.2],[ -5.4,3.8,9.3],[13.5,9.5,3.5]])
b=[6.3,74,-44.7]
q2(a,b,[ -8,6.4,0.7],0.001)

```

```

[[ -9.4 -10.9  1.2]
 [ -5.4  3.8  9.3]
 [ 13.5  9.5  3.5]] [6.3, 74, -44.7]
certo= [-7.9916505  6.39152451  0.70508539]
depois=
[[ 13.5  9.5  3.5]
 [ -9.4 -10.9  1.2]
 [ -5.4  3.8  9.3]] [-44.7, 6.3, 74]
resposta
1 -7.9963 6.3982 0.6968      erro= 0.0037037037037039866
2 -7.9942 6.3946 0.6997      erro= 0.0035491543630055133
3 -7.9924 6.3931 0.7024      erro= 0.0026855260941820447
4 -7.9921 6.3919 0.704      erro= 0.0016328075017026933
5 -7.9916 6.3918 0.7047      erro= 0.0007092496890157562

```

```

In [126... a=np.array([[ -13.8,7, -3.8, -1.6],[3.5,12.7,6.1,3],[1.4, -1.2,7.7, -4.9],[ -3.4,5.4, -8.5, -17.6]])
b=[67.2, -207.2, -5.5,157.3]
q3(a,b,[ -7.3, -9.7, -5.8, -7.7],0.001)

[[ -13.8  7.  -3.8  -1.6]
 [  3.5 12.7  6.1  3. ]
 [  1.4 -1.2  7.7  -4.9]
 [ -3.4  5.4 -8.5 -17.6]] [67.2, -207.2, -5.5, 157.3]
certo= [-7.29892854 -9.69829344 -5.79990435 -7.70200231]
depois=
[[ -13.8  7.  -3.8  -1.6]
 [  3.5 12.7  6.1  3. ]
 [  1.4 -1.2  7.7  -4.9]
 [ -3.4  5.4 -8.5 -17.6]] [67.2, -207.2, -5.5, 157.3]
resposta
0 -7.3 -9.7 -5.8 -7.7      erro= 0.002535291301396292
1 -7.3 -9.6984 -5.7985 -7.7025      erro= 0.0017856654934220728
2 -7.2993 -9.6988 -5.8002 -7.7019      erro= 0.0006385119341931755

```

In []: