Kernel: SageMath 9.7

In [1]:
```
A = matrix( [[1, 2, 3], [2, 4, 2], [-1, 0 ,-2]])
pretty_print(A)
```

Out[1]:
$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 2 \\ -1 & 0 & -2 \end{pmatrix}$$

In [2]:
```
a1 = A[:,0]
a1
```

Out[2]:
```
[ 1]
[ 2]
[-1]
```

In [3]:
```
I3 = identity_matrix(3)
e1 = I3[:,0]
e1
```

Out[3]:
```
[1]
[0]
[0]
```

In [4]:
```
norma_a1 = a1.norm()
norma_a1
```

Out[4]:
```
2.449489742783178
```

In [5]:
```
u1 = a1+norma_a1*e1
R1= I3-2*u1*transpose(u1)/(norm(u1)**2)
pretty_print(u1, R1)
```

Out[5]:
$$\begin{pmatrix} 3.449489742783178 \\ 2.0 \\ -1.0 \end{pmatrix} \begin{pmatrix} -0.40824829046386224 & -0.8164965809277257 & 0.40824829(\\ -0.8164965809277257 & 0.5265986323710905 & 0.23670068{ \\ 0.40824829046386285 & 0.23670068381445472 & 0.8816496{ \end{pmatrix}$$

In [6]:
```
A2=R1*A
pretty_print(A2)
```

Out[6]:
$$\begin{pmatrix} -2.4494897427831765 & -4.082482904638628 & -3.674234614174764 \\ 5.828670879282072 \times 10^{-16} & 0.4734013676289106 & -1.8696938456699055 \\ -3.3306690738754696 \times 10^{-16} & 1.7632993161855446 & -0.06515307716504726 \end{pmatrix}$$

In [7]:
```
A2sub = A2[1:3, 1:3]
A2sub
```

Out[7]:
```
[  0.4734013676289106  -1.8696938456699055]
[  1.7632993161855446 -0.06515307716504726]
```

In [8]:
```
a2 = A2sub[:,0]
a2
```

Out[8]:
```
[0.4734013676289106]
[1.7632993161855446]
```

In [9]:
```
I2 = identity_matrix(2)
u2 = a2-norm(a2)*I2[:,0]
```

In [10]:
```
R2sub = I2-2*u2*transpose(u2)/(norm(u2)**2)
pretty_print(R2sub)
```

Out[10]:
$$\begin{pmatrix} 0.2592926078041501 & 0.9657988111082575 \\ 0.9657988111082575 & -0.25929260780415087 \end{pmatrix}$$

In [11]:
```
R2sub*A2sub
```

Out[11]:
```
[   1.8257418583505538   -0.5477225575051671]
[-8.19183954893134e-16   -1.7888543819998304]
```

In [14]:
```
 R2 = block_diagonal_matrix( matrix([[1]]), R2sub)
```

In [16]:
```
pretty_print(R2)
```

Out[16]:
$$\left(\begin{array}{c|cc} 1.0 & 0.0 & 0.0 \\ \hline 0.0 & 0.2592926078041501 & 0.9657988111082575 \\ 0.0 & 0.9657988111082575 & -0.25929260780415087 \end{array}\right)$$

In [17]:
```
 R2*R1*A
```

Out[17]:
```
[    -2.4494897427831765      -4.082482904638628      -3.674234614174764]
[-1.1102230246251565e-16       1.8257418583505538     -0.5477225575051672]
[  6.069760668988633e-16  -8.881784197001252e-16     -1.7888543819998304]
```

In [0]:
```
pretty_print?
```

Usando Rotações de Givens

In [18]:
```
A
```

Out[18]:
```
[ 1  2  3]
[ 2  4  2]
[-1  0 -2]
```

In [19]:
```
a1
```

Out[19]:
```
[ 1]
[ 2]
[-1]
```

In [29]:
```
P12 = identity_matrix(RR,3)
```

In [26]:
```
c = a1[0,0]/sqrt(a1[0,0]^2+a1[1,0]^2)
s = a1[1,0]/sqrt(a1[0,0]^2+a1[1,0]^2)
c, s
```

Out[26]:
```
(1/5*sqrt(5), 2/5*sqrt(5))
```

In [27]:
```
c^2+s^2
```

Out[27]:
```
1
```

In [30]:
```
P12[0,0]=c
P12[1,1]=c
P12[0,1]=s
P12[1,0]=-s
P12
```

Out[30]:
```
[ 0.447213595499958  0.894427190999916  0.000000000000000]
[-0.894427190999916  0.447213595499958  0.000000000000000]
[ 0.000000000000000  0.000000000000000   1.00000000000000]
```

In [31]:
```
P12*A
```

Out[31]:
```
[ 2.23606797749979  4.47213595499958  3.13049516849971]
[0.000000000000000 0.000000000000000 -1.78885438199983]
[-1.00000000000000 0.000000000000000 -2.00000000000000]
```

In [32]:
```
A2 = P12*A
```

In [34]:
```
a2 = A2[:,0]
a2
```

Out[34]:
```
[ 2.23606797749979]
[0.000000000000000]
[-1.00000000000000]
```

In [36]:
```
P13 = identity_matrix(RR, 3)
c = a2[0,0]/sqrt(a2[0,0]^2+a2[2,0]^2)
s = a2[2,0]/sqrt(a2[0,0]^2+a2[2,0]^2)
c, s
```

Out[36]:
```
(0.912870929175277, -0.408248290463863)
```

In [37]:
```
P13[0,0]=c
P13[2,2]=c
P13[0,2]=s
P13[2,0]=-s
P13
```

Out[37]:
```
[ 0.912870929175277  0.000000000000000 -0.408248290463863]
[ 0.000000000000000   1.00000000000000  0.000000000000000]
[ 0.408248290463863  0.000000000000000  0.912870929175277]
```

In [39]:
```
pretty_print(P13*A2)
```

Out[39]:
$$\begin{pmatrix} 2.44948974278318 & 4.08248290463863 & 3.67423461417477 \\ 0.000000000000000 & 0.000000000000000 & -1.78885438199983 \\ 0.000000000000000 & 1.82574185835055 & -0.547722557505166 \end{pmatrix}$$

Obtivemos assim uma factorização $A = QR$.

In [0]:
```
```