Task

November 2, 2025

Alright, first, let's copy down what we're given and check

[34]:
```
import numpy as np

A = np.array(
    [[677, -52, -66, -639, 386],
     [603, -15, -234, -799, 722],
     [0, 23, 551, -305, 240],
     [574, 72, -439, -842, 474],
     [299, 111, 414, -399, -12]
    ]
)

print(A)
```

```
[[ 677  -52  -66 -639  386]
 [ 603  -15 -234 -799  722]
 [   0   23  551 -305  240]
 [ 574   72 -439 -842  474]
 [ 299  111  414 -399  -12]]
```

We want to find the eigenvalues of $\mathbf{A}$ We can suppose that as $dim(col(\mathbf{A})) = rank(\mathbf{A})$.
To be equal to n, then see where we get with that.
Let's also give ourself a few things here to set the loop up for later

[35]:
```
tolerance = 1e-4
eigenvalues_total = A.shape[0] # It's an nxn, so nbd to take n
eigenvalues_found = 0
eigenvalues_list = []
loop_counter = 0
A1 = A.copy()
```

That should conclude the setup. We're going to keep looping until we find them all

[36]:
```
while eigenvalues_found < eigenvalues_total:
    print(f"for iteration {loop_counter}")
    loop_counter += 1
    Mu = A[-1,-1] # Grab the bottom right most
```

```
    Q, R = np.linalg.qr(A1-Mu*np.identity(A1.shape[0])) # So, the QR␣
↪factorization of the matrix - Mu*I
    RQ = (R @ Q) # Multiply the two together
    A1 = RQ + Mu*np.identity(A1.shape[0]) # Then follow the process
    print(A1)

    # We want now to check our stopping conditions, if we find a lower diagonal␣
↪< tolerance, we're close enough
    for j in range(A1.shape[0] - 1): # 0 through dim(col(A)) - 1
        if (abs(A1[j+1, j])) < tolerance:
            print(f"avast, me hearties, an eigenvalue on yond horizon, that be␣
↪number {eigenvalues_found+1}")
            print(f"and it be values somewhat like {np.round(A1[-1,-1], 4)}") #␣
↪Rounding to tolerance
            eigenvalues_list.append(float(np.round(A1[-1,-1], 4))) # As a float␣
↪so python doesn't complain
            eigenvalues_found += 1

            # For a two by two we can take top-left and bottom-right
            if A1.shape[0] == 2:
                print(f"by Davey Jones, and another, that be number␣
↪{eigenvalues_found+1}")
                print(f"and it look to be about {np.round(A1[0,0], 4)}") # Grab␣
↪the top left too
                eigenvalues_list.append(float(np.round(A1[0,0], 4))) # As a␣
↪float so python doesn't complain
                eigenvalues_found += 2

            A1 = A1[:-1,:-1] # Drop the right column and bottom row
            break

print(f"we found {eigenvalues_found-1} being {eigenvalues_list}")
```

```
for iteration 0
[[  233.21720051  -527.88641731  1231.65697137 -1361.11727681
    463.38262248]
 [  -58.63319577  -129.78239862   279.03035221   218.30836578
    125.83874352]
 [  -40.30042787    93.21747411   545.31810086   494.02250728
   -135.86278097]
 [  -51.08530815   179.67754661   323.54814301  -303.59029032
    225.02323125]
 [   35.86033983    98.03288334    49.11021166   -64.09487423
     13.83738756]]
for iteration 1
[[  514.46143294  -227.35507225  -131.84707834 -1673.15734406
    171.78962156]
```

```
 [   38.7367553   -320.31387392   147.32863464  -246.64108523
    150.31593055]
 [  -96.72148486  -122.22332239   632.1107599   -800.82483006
     90.64912426]
 [  162.52933848     8.00468357  -341.146379    -535.38821045
   -256.78922653]
 [  -13.78970039    55.7739963     -9.12931723    20.27779175
     68.12989154]]
for iteration 2
[[   89.51573652    26.7158614    519.84952811 -1655.99187821
   -109.00144305]
 [ -288.70906467     5.07786809   747.93428698  -322.91688298
   -154.49670183]
 [ -312.86117026   360.69678613   612.54238681  -474.61783593
   -132.00458383]
 [ -134.13650154   128.51497613   125.93155579  -446.68984655
    197.93849916]
 [    2.76843684    16.45613854   -12.33631687    -5.30069525
     98.55385513]]
for iteration 3
[[ 7.48577961e+02  1.18367352e+02  2.46988554e+02  6.23725384e+02
  -1.32805850e+02]
 [ 1.96254386e+01 -2.29298211e+02 -2.43073441e+02  7.44767457e+02
   1.95808556e+01]
 [-6.21736746e+01 -1.99552534e+02  2.55788898e+02 -1.64760005e+03
   2.51346023e+02]
 [ 1.58925101e+02  7.83181719e+01  9.40325280e+01 -5.13889026e+02
  -1.98039682e+02]
 [-6.66309774e-01  7.90208427e+00  2.39774573e+00  2.99562604e+00
   9.78203777e+01]]
for iteration 4
[[ 8.67513584e+02  2.02658843e+02  2.06764001e+02  5.08777813e+02
   1.80436434e+02]
 [-8.16392397e+01 -1.83215278e+02  1.36432927e+02 -4.13411994e+02
  -1.87238112e+02]
 [-3.88437765e+02  5.33790685e+02  7.56716459e+01 -1.66870484e+03
  -1.50184435e+02]
 [-1.04407196e+02  8.99500794e+01 -6.11197674e+01 -5.01807431e+02
   1.52317985e+02]
 [ 9.64640930e-02  3.06848005e+00 -6.84399478e-01  9.28054237e-01
   1.00837479e+02]]
for iteration 5
[[ 6.79828595e+02 -6.76158895e+02 -1.88475690e+02  1.21243393e+03
  -2.28632841e+02]
 [-3.75118095e+01 -2.69090477e+02 -9.36403084e+02  9.48283064e+02
   1.25536708e+01]
 [-1.59903229e+01 -8.64148413e+01  2.24588186e+02 -5.73143086e+02
   2.29467727e+02]
```

```
 [ 4.18199255e+01  5.57141122e+01  1.17070561e+02 -3.76633601e+02
  -1.10535466e+02]
 [-1.11629579e-02  5.72656753e-01  6.95349775e-01  9.54978875e-01
   1.00307296e+02]]
for iteration 6
[[ 7.87476159e+02 -9.16578496e+02 -1.04434137e+02  8.70442005e+02
   2.38772877e+02]
 [ 8.88459666e+01 -8.15357180e+02 -7.95128955e+02  4.97357773e+02
  -9.78354613e+01]
 [-5.98363302e+01  3.99581845e+02  6.41914459e+02 -5.67281073e+02
  -2.21233221e+02]
 [-2.22490464e+01  1.08257157e+02  7.77225118e+01 -3.55714613e+02
   2.34937070e+01]
 [ 1.81173260e-03  1.95057032e-01  1.49744370e-01  4.38506412e-01
   1.00681175e+02]]
for iteration 7
[[ 6.65368745e+02 -1.02534776e+03 -7.42676964e+02  8.03126727e+02
  -2.42365265e+02]
 [-2.92131988e+01 -3.55453188e+02 -1.27256749e+03  4.18477871e+02
   2.89942436e+01]
 [-1.17626988e+01 -7.93268241e+01  2.45216770e+02 -2.30980619e+02
   2.38861867e+02]
 [ 7.95251683e+00  2.98017183e+01  3.42747438e+01 -2.96709137e+02
   1.86484465e+00]
 [-2.52760659e-04  2.87406561e-02  4.43627430e-02  1.91634051e-01
   1.00576810e+02]]
for iteration 8
[[ 7.29966874e+02 -1.18732638e+03 -5.13521666e+02  5.87340146e+02
   2.47181340e+02]
 [ 4.30208365e+01 -7.31979578e+02 -1.10798684e+03  1.79746426e+02
  -7.39548590e+01]
 [-1.29986353e+01  1.64103239e+02  5.64445372e+02 -1.81051900e+02
  -2.18731513e+02]
 [-3.48164070e+00  3.07797652e+01  4.36351699e+01 -3.04061202e+02
  -4.50720658e+01]
 [ 4.19791971e-05  7.95898927e-03  8.22247286e-03  7.61797882e-02
   1.00628534e+02]]
for iteration 9
[[ 6.66238956e+02 -1.13992424e+03 -8.39680559e+02  5.53576340e+02
  -2.46601542e+02]
 [-1.89104489e+01 -4.16658170e+02 -1.29082620e+03  1.61403843e+02
   3.84401191e+01]
 [-5.01740896e+00 -6.40566526e+01  3.04242388e+02 -1.31978727e+02
   2.27934274e+02]
 [ 1.32862804e+00  1.06573270e+01  2.81493229e+00 -2.95434289e+02
   4.77655485e+01]
 [-6.35961606e-06  1.35754418e-03  2.05719790e-03  3.01731979e-02
   1.00611115e+02]]
```

```
for iteration 10
[[ 7.04700607e+02 -1.23982136e+03 -6.38249582e+02  4.74040912e+02
   2.49118134e+02]
 [ 2.18518075e+01 -6.56479266e+02 -1.16205320e+03  7.22418523e+01
  -6.67096575e+01]
 [-4.13084774e+00  8.94460151e+01  5.10368508e+02 -1.03612580e+02
  -2.14407501e+02]
 [-5.65625443e-01  8.39971663e+00  1.75953777e+01 -3.00208508e+02
  -6.33570507e+01]
 [ 1.05554578e-06  3.42870536e-04  3.75336065e-04  1.17785147e-02
   1.00618660e+02]]
for iteration 11
[[ 6.69841505e+02 -1.18442015e+03 -8.35115657e+02  4.68921270e+02
  -2.48268282e+02]
 [-1.17871175e+01 -4.57638640e+02 -1.27231878e+03  7.77735662e+01
   4.42218166e+01]
 [-2.00190887e+00 -4.72617366e+01  3.44453199e+02 -9.72699201e+01
   2.21471019e+02]
 [ 2.25843262e-01  3.46488119e+00 -2.00310620e+00 -2.98271965e+02
   6.21693428e+01]
 [-1.65779149e-07  6.34352290e-05  9.38818875e-05  4.61831722e-03
   1.00615901e+02]]
for iteration 12
[[ 6.92719518e+02 -1.24924150e+03 -6.92146471e+02  4.40528072e+02
   2.49617241e+02]
 [ 1.17708331e+01 -6.12819458e+02 -1.18404281e+03  4.36507229e+01
  -6.30561893e+01]
 [-1.47463545e+00  5.39524016e+01  4.78646872e+02 -8.53201787e+01
  -2.13534993e+02]
 [-9.54636179e-02  2.36998744e+00  7.00168935e+00 -3.00163961e+02
  -6.79731260e+01]
 [ 2.73768679e-08  1.51695971e-05  1.68319412e-05  1.80270497e-03
   1.00617029e+02]]
for iteration 13
[[ 6.73121708e+02 -1.20480456e+03 -8.18008019e+02  4.41927698e+02
  -2.48987483e+02]
 [-7.19467914e+00 -4.85214534e+02 -1.25722421e+03  5.05179358e+01
   4.79190543e+01]
 [-7.92042829e-01 -3.35311966e+01  3.69909755e+02 -8.50612242e+01
   2.18520602e+02]
 [ 3.89322226e-02  1.08600322e+00 -1.74463121e+00 -2.99433530e+02
   6.67983492e+01]
 [-4.37429782e-09  2.94404657e-06  4.34016283e-06  7.05485037e-04
   1.00616601e+02]]
for iteration 14
[[ 6.86675637e+02 -1.24810748e+03 -7.21115009e+02  4.31394512e+02
   2.49724544e+02]
 [ 6.54551827e+00 -5.86475127e+02 -1.19748511e+03  3.65073975e+01
```

```
  -6.06712445e+01]
 [-5.49051792e-01  3.39495412e+01  4.58363611e+02 -8.07621180e+01
  -2.13754596e+02]
 [-1.63758692e-02  6.82881248e-01  2.83177527e+00 -3.00180893e+02
  -6.90591774e+01]
 [ 7.18984384e-10  6.78896070e-07  7.44235570e-07  2.75576383e-04
   1.00616772e+02]]
for iteration 15
[[ 6.75498775e+02 -1.21548241e+03 -8.03036790e+02  4.33222250e+02
  -2.49315139e+02]
 [-4.32622342e+00 -5.03661914e+02 -1.24686210e+03  4.12620947e+01
   5.03318807e+01]
 [-3.11960706e-01 -2.32611407e+01  3.86394431e+02 -8.08285877e+01
   2.17119643e+02]
 [ 6.74645851e-03  3.33694293e-01 -1.01255444e+00 -2.99847998e+02
   6.83487844e+01]
 [-1.15885069e-10  1.35882959e-07  2.03703169e-07  1.07776149e-04
   1.00616706e+02]]
for iteration 16
[[ 6.83492745e+02 -1.24480314e+03 -7.38342469e+02  4.29126687e+02
   2.49724582e+02]
 [ 3.70465398e+00 -5.69981549e+02 -1.20644984e+03  3.50121663e+01
  -5.89965504e+01]
 [-2.08264002e-01  2.18359917e+01  4.45027216e+02 -7.95970394e+01
  -2.14157777e+02]
 [-2.82764773e-03  1.99221758e-01  1.16983109e+00 -3.00155144e+02
  -6.92618753e+01]
 [ 1.89823437e-11  3.05674166e-08  3.21918408e-08  4.21159002e-05
   1.00616732e+02]]
avast, me hearties, an eigenvalue on yond horizon, that be number 1
and it be values somewhat like 100.6167
for iteration 17
[[ 6.77067733e+02 -1.22168807e+03 -7.92030420e+02 -4.30331991e+02]
 [-2.57401666e+00 -5.15917304e+02 -1.23983262e+03 -3.79490600e+01]
 [-1.22357690e-01 -1.59082027e+01  3.97231970e+02  7.93967791e+01]
 [-1.17089628e-03 -1.01338837e-01  5.18619501e-01 -2.99999131e+02]]
for iteration 18
[[ 6.81764810e+02 -1.24164327e+03 -7.49101337e+02  4.28665955e+02]
 [ 2.11869079e+00 -5.59441808e+02 -1.21251029e+03  3.48946094e+01]
 [-7.97362210e-02  1.42249043e+01  4.36189566e+02 -7.92715864e+01]
 [-4.89600152e-04  5.85689211e-02  4.93078682e-01 -3.00129299e+02]]
for iteration 19
[[ 6.78054101e+02 -1.22555929e+03 -7.84395936e+02 -4.29333875e+02]
 [-1.52044131e+00 -5.24021171e+02 -1.23505554e+03 -3.66777816e+01]
 [-4.78270325e-02 -1.07795649e+01  4.04407093e+02  7.89410447e+01]
 [-2.03285068e-04 -3.05581530e-02  2.50968839e-01 -3.00056754e+02]]
for iteration 20
[[ 6.80806260e+02 -1.23915247e+03 -7.55987513e+02  4.28628382e+02]
```

```
 [ 1.21946920e+00 -5.52629428e+02 -1.21660738e+03  3.50425074e+01]
 [-3.06828997e-02  9.33977747e+00  4.30319452e+02 -7.91513942e+01]
 [-8.48758780e-05  1.73028828e-02  2.11330565e-01 -3.00113016e+02]]
for iteration 21
[[ 6.78656974e+02 -1.22807842e+03 -7.79230567e+02 -4.28972651e+02]
 [-8.93760949e-01 -5.29366608e+02 -1.23180818e+03 -3.61437345e+01]
 [-1.86473626e-02 -7.26064713e+00  4.09172564e+02  7.88198061e+01]
 [-3.52926638e-05 -9.17472650e-03  1.17823427e-01 -3.00079662e+02]]
for iteration 22
[[ 6.80266347e+02 -1.23732770e+03 -7.60451672e+02  4.28663433e+02]
 [ 7.04756290e-01 -5.48195907e+02 -1.21937151e+03  3.51949624e+01]
 [-1.18415503e-02  6.16289701e+00  4.26417108e+02 -7.90847245e+01]
 [-1.47221556e-05  5.12777280e-03  9.17458523e-02 -3.00104279e+02]]
for iteration 23
[[ 6.79019161e+02 -1.22975507e+03 -7.75776694e+02 -4.28835049e+02]
 [-5.23694325e-01 -5.32889115e+02 -1.22960383e+03 -3.58938527e+01]
 [-7.25763463e-03 -4.87139110e+00  4.12342300e+02  7.88075878e+01]
 [-6.12667383e-06 -2.74719690e-03  5.43491722e-02 -3.00089078e+02]]
for iteration 24
[[ 6.79958982e+02 -1.23603659e+03 -7.63366152e+02  4.28695481e+02]
 [ 4.08361814e-01 -5.45297530e+02 -1.22123280e+03  3.53079516e+01]
 [-4.57813236e-03  4.07965543e+00  4.23821749e+02 -7.90375817e+01]
 [-2.55433413e-06  1.52269212e-03  4.02062610e-02 -3.00099933e+02]]
for iteration 25
[[ 6.79234400e+02 -1.23088311e+03 -7.73480538e+02 -4.28779850e+02]
 [-3.06207235e-01 -5.35210207e+02 -1.22811076e+03 -3.57631830e+01]
 [-2.82132443e-03 -3.26004834e+00  4.14452122e+02  7.88259728e+01]
 [-1.06348179e-06 -8.21208572e-04  2.48014498e-02 -3.00093047e+02]]
for iteration 26
[[ 6.79782717e+02 -1.23513999e+03 -7.65276947e+02  4.28715229e+02]
 [ 2.37023989e-01 -5.43396685e+02 -1.22248429e+03  3.53853986e+01]
 [-1.77192728e-03  2.70622615e+00  4.22095094e+02 -7.90023493e+01]
 [-4.43245873e-07  4.52748162e-04  1.77375978e-02 -3.00097857e+02]]
for iteration 27
[[ 6.79361422e+02 -1.23164538e+03 -7.71958311e+02 -4.28756604e+02]
 [-1.78792427e-01 -5.36740325e+02 -1.22710182e+03 -3.56879009e+01]
 [-1.09588115e-03 -2.17806832e+00  4.15856921e+02  7.88487766e+01]
 [-1.84590911e-07 -2.45218758e-04  1.12411897e-02 -3.00094751e+02]]
for iteration 28
[[ 6.79681125e+02 -1.23452417e+03 -7.66533190e+02  4.28725991e+02]
 [ 1.37728790e-01 -5.42147057e+02 -1.22332479e+03  3.54376059e+01]
 [-6.86289019e-04  1.79760050e+00  4.20946090e+02 -7.89763747e+01]
 [-7.69207882e-08  1.34729439e-04  7.86147046e-03 -3.00096889e+02]]
for iteration 29
[[ 6.79436044e+02 -1.23216106e+03 -7.70950415e+02 -4.28746380e+02]
 [-1.04300407e-01 -5.37749719e+02 -1.22642150e+03 -3.56412966e+01]
 [-4.25444763e-04 -1.45359940e+00  4.16792435e+02  7.88682749e+01]
 [-3.20386535e-08 -7.31743264e-05  5.07284698e-03 -3.00095492e+02]]
```

```
for iteration 30
[[ 6.79622373e+02 -1.23410415e+03 -7.67360752e+02  4.28731565e+02]
 [ 8.00895811e-02 -5.41323991e+02 -1.22388876e+03  3.54728609e+01]
 [-2.65927859e-04  1.19510940e+00  4.20181331e+02 -7.89577072e+01]
 [-1.33493504e-08  4.01144758e-05  3.49531672e-03 -3.00096445e+02]]
for iteration 31
[[ 6.79479752e+02 -1.23250976e+03 -7.70283343e+02 -4.28741710e+02]
 [-6.08081803e-02 -5.38416141e+02 -1.22596366e+03 -3.56110669e+01]
 [-1.65108802e-04 -9.69407828e-01  4.17415474e+02  7.88830582e+01]
 [-5.56068189e-09 -2.18260269e-05  2.28274498e-03 -3.00095817e+02]]
for iteration 32
[[ 6.79588318e+02 -1.23381901e+03 -7.67906762e+02  4.28734394e+02]
 [ 4.65947849e-02 -5.40781047e+02 -1.22426687e+03  3.54968026e+01]
 [-1.03073698e-04  7.95014803e-01  4.19672239e+02 -7.89445854e+01]
 [-2.31678736e-09  1.19478595e-05  1.55740144e-03 -3.00096242e+02]]
for iteration 33
[[ 6.79505303e+02 -1.23274526e+03 -7.69841824e+02 -4.28739508e+02]
 [-3.54377624e-02 -5.38856493e+02 -1.22565603e+03 -3.55909167e+01]
 [-6.40613873e-05 -6.46194684e-01  4.17830419e+02  7.88936658e+01]
 [-9.65107511e-10 -6.50832024e-06  1.02530607e-03 -3.00095961e+02]]
for iteration 34
[[ 6.79568548e+02 -1.23362609e+03 -7.68267460e+02  4.28735822e+02]
 [ 2.71167175e-02 -5.40422431e+02 -1.22452019e+03  3.55131356e+01]
 [-3.99590493e-05  5.29065346e-01  4.19333302e+02 -7.89355134e+01]
 [-4.02084781e-10  3.55939695e-06  6.94931705e-04 -3.00096151e+02]]
for iteration 35
[[ 6.79520220e+02 -1.23290410e+03 -7.69549510e+02 -4.28738439e+02]
 [-2.06470214e-02 -5.39147701e+02 -1.22544962e+03 -3.55772898e+01]
 [-2.48516792e-05 -4.30611065e-01  4.18106774e+02  7.89010577e+01]
 [-1.67501873e-10 -1.94036959e-06  4.59955499e-04 -3.00096025e+02]]
for iteration 36
[[ 6.79557059e+02 -1.23349591e+03 -7.68505991e+02  4.28736547e+02]
 [ 1.57844117e-02 -5.40185309e+02 -1.22468981e+03  3.55243046e+01]
 [-1.54930584e-05  3.52170688e-01  4.19107628e+02 -7.89293146e+01]
 [-6.97834083e-11  1.06053719e-06  3.10387929e-04 -3.00096110e+02]]
for iteration 37
[[ 6.79528922e+02 -1.23301107e+03 -7.69355899e+02 -4.28737908e+02]
 [-1.20274580e-02 -5.39340427e+02 -1.22531127e+03 -3.55680127e+01]
 [-9.63986652e-06 -2.86891620e-01  4.18290826e+02  7.89061226e+01]
 [-2.90711001e-11 -5.78427551e-07  2.06169707e-04 -3.00096053e+02]]
for iteration 38
[[ 6.79550378e+02 -1.23340824e+03 -7.68663874e+02  4.28736919e+02]
 [ 9.18925182e-03 -5.40028377e+02 -1.22480330e+03  3.55319457e+01]
 [-6.00752018e-06  2.34460440e-01  4.18957358e+02 -7.89251134e+01]
 [-1.21112365e-11  3.16021377e-07  1.38723303e-04 -3.00096091e+02]]
for iteration 39
[[ 6.79533995e+02 -1.23308301e+03 -7.69227603e+02 -4.28737637e+02]
 [-7.00552936e-03 -5.39468066e+02 -1.22521864e+03 -3.55616825e+01]
```

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 [-3.73901417e-06 -1.91113626e-01  4.18413405e+02  7.89095578e+01]
 [-5.04547419e-12 -1.72417076e-07  9.23633399e-05 -3.00096066e+02]]
avast, me hearties, an eigenvalue on yond horizon, that be number 2
and it be values somewhat like -300.0961
for iteration 40
[[ 6.79546491e+02 -1.23334929e+03  7.68768364e+02]
 [ 5.35022335e-03 -5.39924433e+02  1.22487920e+03]
 [ 2.32957682e-06 -1.56111098e-01  4.18857276e+02]]
for iteration 41
[[ 6.79536951e+02 -1.23313134e+03 -7.69142516e+02]
 [-4.08014357e-03 -5.39552653e+02 -1.22515666e+03]
 [-1.45018638e-06 -1.27299429e-01  4.18495035e+02]]
for iteration 42
[[ 6.79544229e+02 -1.23330970e+03  7.68837708e+02]
 [ 3.11523031e-03 -5.39855539e+02  1.22492995e+03]
 [ 9.03388807e-07 -1.03951255e-01  4.18790644e+02]]
for iteration 43
[[ 6.79538674e+02 -1.23316376e+03 -7.69086088e+02]
 [-2.37622927e-03 -5.39608741e+02 -1.22511522e+03]
 [-5.62441998e-07 -8.47882135e-02  4.18549401e+02]]
for iteration 44
[[ 6.79542912e+02 -1.23328315e+03  7.68883695e+02]
 [ 1.81395269e-03 -5.39809848e+02  1.22496385e+03]
 [ 3.50334413e-07 -6.92224040e-02  4.18746270e+02]]
for iteration 45
[[ 6.79539677e+02 -1.23318550e+03 -7.69048647e+02]
 [-1.38384336e-03 -5.39645952e+02 -1.22508753e+03]
 [-2.18133908e-07 -5.64712552e-02  4.18585609e+02]]
for iteration 46
[[ 6.79542145e+02 -1.23326536e+03  7.68914209e+02]
 [ 1.05626621e-03 -5.39779530e+02  1.22498650e+03]
 [ 1.35861939e-07 -4.60975156e-02  4.18716719e+02]]
for iteration 47
[[ 6.79540262e+02 -1.23320006e+03 -7.69023793e+02]
 [-8.05890521e-04 -5.39670650e+02 -1.22506903e+03]
 [-8.45985637e-08 -3.76104108e-02  4.18609722e+02]]
for iteration 48
[[ 6.79541699e+02 -1.23325345e+03  7.68934466e+02]
 [ 6.15075643e-04 -5.39759404e+02  1.22500162e+03]
 [ 5.26886907e-08 -3.06985302e-02  4.18697039e+02]]
for iteration 49
[[ 6.79540602e+02 -1.23320980e+03 -7.69007290e+02]
 [-4.69308989e-04 -5.39687050e+02 -1.22505668e+03]
 [-3.28094585e-08 -2.50484700e-02  4.18625782e+02]]
for iteration 50
[[ 6.79541439e+02 -1.23324548e+03  7.68947919e+02]
 [ 3.58169659e-04 -5.39746037e+02  1.22501171e+03]
 [ 2.04333723e-08 -2.04439007e-02  4.18683932e+02]]
```

```
for iteration 51
[[ 6.79540800e+02 -1.23321632e+03 -7.68996326e+02]
 [-2.73298674e-04 -5.39697943e+02 -1.22504844e+03]
 [-1.27242635e-08 -1.66820473e-02  4.18636477e+02]]
for iteration 52
[[ 6.79541288e+02 -1.23324015e+03  7.68956856e+02]
 [ 2.08570296e-04 -5.39737158e+02  1.22501844e+03]
 [ 7.92436943e-09 -1.36148858e-02  4.18675204e+02]]
for iteration 53
[[ 6.79540916e+02 -1.23322068e+03 -7.68989041e+02]
 [-1.59152478e-04 -5.39705182e+02 -1.22504294e+03]
 [-4.93474365e-09 -1.11100032e-02  4.18643600e+02]]
for iteration 54
[[ 6.79541199e+02 -1.23323659e+03  7.68962796e+02]
 [ 1.21455833e-04 -5.39731257e+02  1.22502294e+03]
 [ 3.07319928e-09 -9.06706941e-03  4.18669391e+02]]
for iteration 55
[[ 6.79540983e+02 -1.23322359e+03 -7.68984199e+02]
 [-9.26803035e-05 -5.39709993e+02 -1.22503927e+03]
 [-1.91379513e-09 -7.39906461e-03  4.18648344e+02]]
avast, me hearties, an eigenvalue on yond horizon, that be number 3
and it be values somewhat like 418.6483
for iteration 56
[[ 6.79541148e+02  1.23322343e+03]
 [-7.07237009e-05 -5.39710158e+02]]
avast, me hearties, an eigenvalue on yond horizon, that be number 4
and it be values somewhat like -539.7102
by Davey Jones, and another, that be number 5
and it look to be about 679.5411
we found 5 being [100.6167, -300.0961, 418.6483, -539.7102, 679.5411]
```

I have Jack's pulled up here on another window, hopefully the comments should underline that I'm more than capable of both understanding what it's doing to a point where I could have recreated… but, I'm also a large part of the reason he can do this, so, I'm ok with that