1

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py

question 1: [-2.0, -1.25, -0.5, 0.0, 0.5, 1.5, 2.5, 3.0]
```

2

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py



x vals: [0.8414709848078965, 1.8185948536513634, 0.4233600241796016, -3.02720
9981231713, -4.794621373315692, -1.6764929891935552, 4.598906191031523, 7.914
865972987054, 3.7090663671758093, -5.440211108893699]

y vals: [0.0, 0.3333333333333333, 0.5, 0.6, 0.6666666666666666, 0.71428571428
57143, 0.75, 0.7777777777777778, 0.8, 0.8181818181818182]

z vals: [0.8414709848078965, -0.18920062382698205, 0.04579094280463962, -0.01
799395729156658, -0.005294070003910922, -0.027549412595642104, -0.01946433985
223412, 0.014375406846824855, -0.007776394991042642, -0.005063656411097588]
```

3

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py



column vectors x & y: [(2.0, 0.0), (1.4142135623730951, 1.414213562373095), (
1.2246467991473532e-16, 2.0), (-1.414213562373095, 1.4142135623730951), (-2.0
, 2.4492935982947064e-16), (-1.4142135623730954, -1.414213562373095)]

radius candidates: [2.0, 2.0, 2.0, 2.0, 2.0, 2.0]
```

4

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py



x_50: [1.0, 0.5, 0.25, 0.125, 0.0625, 0.03125, 0.015625, 0.0078125, 0.00390625, 0.001953125, 0.0009765625, 0.0
0048828125, 0.000244140625, 0.0001220703125, 6.103515625e-05, 3.0517578125e-05, 1.52587890625e-05, 7.629394531
25e-06, 3.814697265625e-06, 1.9073486328125e-06, 9.5367431640625e-07, 4.76837158203125e-07, 2.384185791015625e
-07, 1.1920928955078125e-07, 5.960464477539063e-08, 2.980232238769531 2e-08, 1.4901161193847656e-08, 7.45058059
6923828e-09, 3.725290298461914e-09, 1.862645149230957e-09, 9.313225746154785e-10, 4.656612873077393e-10, 2.328
3064365386963e-10, 1.1641532182693481e-10, 5.820766091346741e-11, 2.9103830456733704e-11, 1.4551915228366852e-
11, 7.275957614183426e-12, 3.637978807091713e-12, 1.8189894035458565e-12, 9.094947017729282e-13, 4.5474735088
64641e-13, 2.2737367544323206e-13, 1.1368683772161603e-13, 5.684341886080802e-14, 2.842170943040401e-14, 1.4210
854715202004e-14, 7.105427357601002e-15, 3.552713678800501e-15, 1.776356839400250 5e-15, 8.881784197001252e-16]

limit_50: 1.0000000000000009

s_50: 1.9999999999999991


x_100: [1.0, 0.5, 0.25, 0.125, 0.0625, 0.03125, 0.015625, 0.0078125, 0.00390625, 0.001953125, 0.0009765625, 0.
00048828125, 0.000244140625, 0.0001220703125, 6.103515625e-05, 3.0517578125e-05, 1.52587890625e-05, 7.62939453
125e-06, 3.814697265625e-06, 1.90734863281 25e-06, 9.536743164062 5e-07, 4.76837158203125e-07, 2.384185791015625
e-07, 1.1920928955078125e-07, 5.960464477539063e-08, 2.9802322387695312e-08, 1.4901161193847656e-08, 7.4505805
96923828e-09, 3.7252902984619140e-09, 1.8626451492309570e-09, 9.313225746154785e-10, 4.656612873077393e-10, 2.32
83064365386963e-10, 1.1641532182693481e-10, 5.820766091346741e-11, 2.9103830456733704e-11, 1.4551915228366852e
-11, 7.275957614183426e-12, 3.637978807091713e-12, 1.8189894035458565e-12, 9.094947017729282e-13, 4.5474735088
64641e-13, 2.2737367544323206e-13, 1.1368683772161603e-13, 5.684341886080802e-14, 2.842170943040401e-14, 1.421
085471520200 4e-14, 7.105427357601002e-15, 3.552713678800501e-15, 1.776356839400250 5e-15, 8.881784197001252e-16
, 4.440892098500626e-16, 2.220446049250313e-16, 1.1102230246251565e-16, 5.551115123125783e-17, 2.7755575615628
914e-17, 1.3877878078145 57e-17, 6.938893903907228e-18, 3.469446951953614e-18, 1.734723475976807e-18, 8.673617
379884035e-19, 4.336808689942018e-19, 2.168404344971009e-19, 1.0842021724855044e-19, 5.421010862427522e-20, 2.
710505431213761e-20, 1.3552527156068805e-20, 6.776263578034403e-21, 3.388131789017201 4e-21, 1.6940658945086007
e-21, 8.470329472543003e-22, 4.235164736271502e-22, 2.117582368135751e-22, 1.0587911840678754e-22, 5.293955920
339377e-23, 2.6469779601696886e-23, 1.3234889800848443e-23, 6.617444900424222e-24, 3.308722450212111e-24, 1.65
43612251060553e-24, 8.271806125530277e-25, 4.1359030627651384e-25, 2.0679515313825692e-25, 1.0339757656912846e
-25, 5.169878828456423e-26, 2.5849394142282115e-26, 1.2924697071141057e-26, 6.462348535570529e-27, 3.231174267
7852644e-27, 1.6155871338926322e-27, 8.077935669463161e-28, 4.0389678347315804e-28, 2.0194839173657902e-28, 1.
0097419586828951e-28, 5.048709793414476e-29, 2.524354896707238e-29, 1.262177448353619e-29, 6.310887241768095e-
30, 3.155443620884047 2e-30, 1.5777218104420236e-30, 7.888609052210118e-31]

limit_100: 1.0

s_100: 2.0
```

5

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py



A: [[6, 37, 35], [32, 37, 24], [41, 7, 32], [46, 39, 45]]
Elements that are located in rows 3 to 4 and columns 2 to 3: [[7, 32], [39, 45]]

Post adding fourth column: [[6, 37, 35, 6], [32, 37, 24, 32], [41, 7, 32, 41], [46, 39, 45, 46]]

Post replacing submatrix with identity matrix: [[6, 37, 35, 6], [32, 1, 0, 0], [41, 0, 1, 0], [46, 0, 0, 1]]

Post removing first & last row: [[32, 1, 0, 0], [41, 0, 1, 0]]

Post rounding: [[32, 1, 0, 0], [41, 0, 1, 0]]

string out elements in row: ['32', '1', '0', '0', '41', '0', '1', '0']
```

6

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py

vector: [0.2, 0.4, 0.6000000000000001, 0.8, 1.0, 1.2, 1.4, 1.5999999999999999, 1.7999999999999998, 1.9999999999999998, 2.1999999999999997, 2.4, 2.6, 2.8000000000000003, 3.0000000000000004, 3.2000000000000006, 3.4000000000000001, 3.6000000000000001, 3.8000000000000001, 4.0000000000000001, 4.2000000000000001, 4.4000000000000001, 4.6000000000000001, 4.8000000000000002, 5.0000000000000002, 5.2000000000000002, 5.4000000000000002, 5.6000000000000002, 5.8000000000000025, 6.0000000000000003, 6.2000000000000003, 6.4000000000000003, 6.6000000000000003, 6.8000000000000003, 7.0000000000000036, 7.2000000000000004, 7.4000000000000004, 7.6000000000000004, 7.8000000000000004, 8.0000000000000004, 8.2000000000000003, 8.4000000000000002, 8.6000000000000001, 8.8, 9.0, 9.2, 9.399999999999999, 9.599999999999998, 9.799999999999997, 9.999999999999996, 10.199999999999996, 10.399999999999995, 10.599999999999994, 10.799999999999994, 10.999999999999993, 11.199999999999992, 11.399999999999991, 11.59999999999999, 11.799999999999989, 11.99999999999999]

matrix M: [[0.19866933079506122, 0.3894183423086505, 0.5646424733950355, 0.7173560908995228, 0.8414709848078965, 0.9320390859672263, 0.9854497299884601, 0.9995736030415052, 0.9738476308781953, 0.9092974268256818, 0.8084964038195903, 0.675463180551151, 0.5155013718214642, 0.33498815015590466, 0.14112000805986677, -0.0583741434275 8053, -0.2555411020268321, -0.4425204432948533, -0.6118578094272, -0.7568024953079288, -0.8715757724135886, -0.9516020738895163, -0.9936910036334646, -0.9961646088358406, -0.9589242746631379, -0.8834546557201524, -0.772764487555986, -0.6312666378723195, -0.464602179413755, -0.2794154981989233, -0.08308940281749375, 0.1165492048 5049629, 0.31154136351338124, 0.49411335113861127, 0.6569865987187918, 0.7936678638491553, 0.8987080958116285, 0.9679196720314874, 0.9985433453746052, 0.9893582466233812, 0.9407305566797719, 0.8545989080882795, 0.7343970 978741122, 0.5849171928917617, 0.4121184852417566, 0.22288991410024764, 0.02477542545335954, -0.17432678122297 79, -0.3664791292519251, -0.5440211108893669, -0.6998746875935399, -0.8278264690856507, -0.9227754216128046, -0.9809362300664901, -0.9999902065507035, -0.9791777291513188, -0.9193285256646792, -0.8228285949687139, -0.693 52508477713, -0.5365729180044439], [0.9800665778412416, 0.9210609940028851, 0.8253356149096782, 0.696706709347 1655, 0.5403023058681398, 0.3623577544766736, 0.169967142900241, -0.029199522301288593, -0.2272020946930869, -0.4161468365471422, -0.5885011172553455, -0.7373937155412454, -0.8568887533689473, -0.9422223406686583, -0.989 9924966004455, -0.998294775794753, -0.9667981925794609, -0.8967584163341465, -0.7909677119144161, -0.653643620 8636113, -0.4902608213406987, -0.30733286997841847, -0.1121525269350531, 0.08749898343944816, 0.28366218546322 797, 0.4685166713003787, 0.634692875942636, 0.7755658785102513, 0.8855195169413201, 0.9601702866503667, 0.9965 420970232177, 0.9931849187581923, 0.9502325919585285, 0.8693974903498235, 0.753902254343302 3, 0.60835131453225 18, 0.43854732757438714, 0.2512598425822514, 0.053955420562645316, -0.14550003380861704, -0.33915486098383785, -0.5192886541166871, -0.6787200473200137, -0.811093014061656, -0.9111302618846769, -0.9748436214041636, -0.99 96930420352065, -0.9846878557941273, -0.9304262721047546, -0.8390715290764543, -0.7142656520272026, -0.5609842 574272332, -0.3853381907718345 7, -0.19432990645534176, 0.00442569788043681, 0.20300486381874347, 0.3934908663 478827, 0.5682896297679663, 0.7204324789908314, 0.8438539587324865]]

Column Vector 1: [[0.19866933079506122], [0.3894183423086505], [0.5646424733950355], [0.7173560908995228], [0.8414709848078965], [0.9320390859672263], [0.9854497299884601], [0.9995736030415052], [0.9738476308781953], [0.9092974268256818]]

Column Vector 2: [[0.9800665778412416], [0.9210609940028851], [0.8253356149096782], [0.6967067093471655], [0.5403023058681398], [0.3623577544766736], [0.169967142900241], [-0.029199522301288593], [-0.2272020946930869], [-0.4161468365471422]]
```

7

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py


root 1: -0.21922359359558485

root 2: -2.2807764064044154
```

8

```
(labs_venv) Enriques-MacBook-Pro-2:hw_1 enriquegoudet$ python3 worksheet_1.py


result: [[58, 64], [139, 154]]
```

9