

Calculando Raízes

Mário Leite

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A raiz quadrada é um conceito matemático muito importante em vários assuntos ligados à “Teoria dos Números” e em muitos outros ramos da Matemática. Por exemplo, o chamado “Número de Deus” (ou “Razão Aurea”) depende da raiz quadrada de 5. Assim, as calculadoras de mão (agora os celulares) possuem recursos para calcular a raiz quadrada de um número não negativo com várias decimais. E quando se fala em equação do segundo grau logo vem à nossa mente a fórmula de Báskara, calculando as raízes com a extração de raízes quadradas; até para a equação do terceiro grau, que deveria ser a extração de raízes cúbicas, tenta-se reduzir ao grau dois para extrair raiz quadrada e não cúbica. Quer dizer: quando se fala em raiz de um número sempre se pensa na ‘RAIZ QUADRADA’. Mas, e se for necessário extrair a raiz de índice maior que 2; como fazer?! Na verdade, para extrair a raiz quadrada de um número real e não negativo, basta elevar esse número a $1/2$; só isto! Então, para extrair a raiz cúbica de um número basta elevar este número a $1/3$, para extrair a raiz quarta eleva-se o número a $1/4$ e assim por diante. Deste modo, para extrair a raiz de índice k de um número real N basta elevar esse número ao inverso de k : $N^{(1/k)}$. O programa “CalculaRaizes”, codificado em Python, mostra como extrair (até a *nona*) raiz dos números contidos numa determinada faixa desejada pelo usuário; e as **figura 1, 2 e 3** mostram exemplos de saídas desse programa para raízes quadradas, cúbicas quádruplas, respectivamente...

Código em Python 3.9

```
'''
CalculaRaizes.py
Mostras a raiz de indice desejado dos números de uma faixa.
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Data: 02/04/2023
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'''
lim1 = 1
lim2 = 0
cond = (lim1 > lim2) or ((lim1 < 1) or (lim2 < 2))
while(cond):
    lim1 = abs(int(input(" Entre com o limite inferior da faixa: ")))
    lim2 = abs(int(input(" Entre com o limite superior da faixa: ")))
    cond = (lim1 > lim2) or ((lim1 < 1) or (lim2 < 2))

k = 1
while((k < 2) or (k > 9)):
    k = abs(int(input(" Digite o índice da raiz [2,3,4,5,..9]: ")))

print()
print(f' Raízes de índice {k} dos números na faixa "{lim1}-{lim2}"')
for j in range(lim1, (lim2+1)):
    raiz = j**(1/k)
    raiz = round(raiz,16)
    raizS = str(raiz)
    raizS = raizS.ljust(18, "0") #formatda a raiz adequadamente
    print(f' {j:<3}: {raizS:<3}') #alinhamento à direita
#Fim do programa "CalculaRaizes" -----
```

```
IDLE Shell 3.11.2
File Edit Shell Debug Options Window Help
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: G:\BackupHD\HD-D\Cantinho da Programação\Códigos\Python\CalculaRaizes
.py
Entre com o limite inferior da faixa: 1
Entre com o limite superior da faixa: 100
Digite o índice da raiz [2,3,4,5,..9]: 2

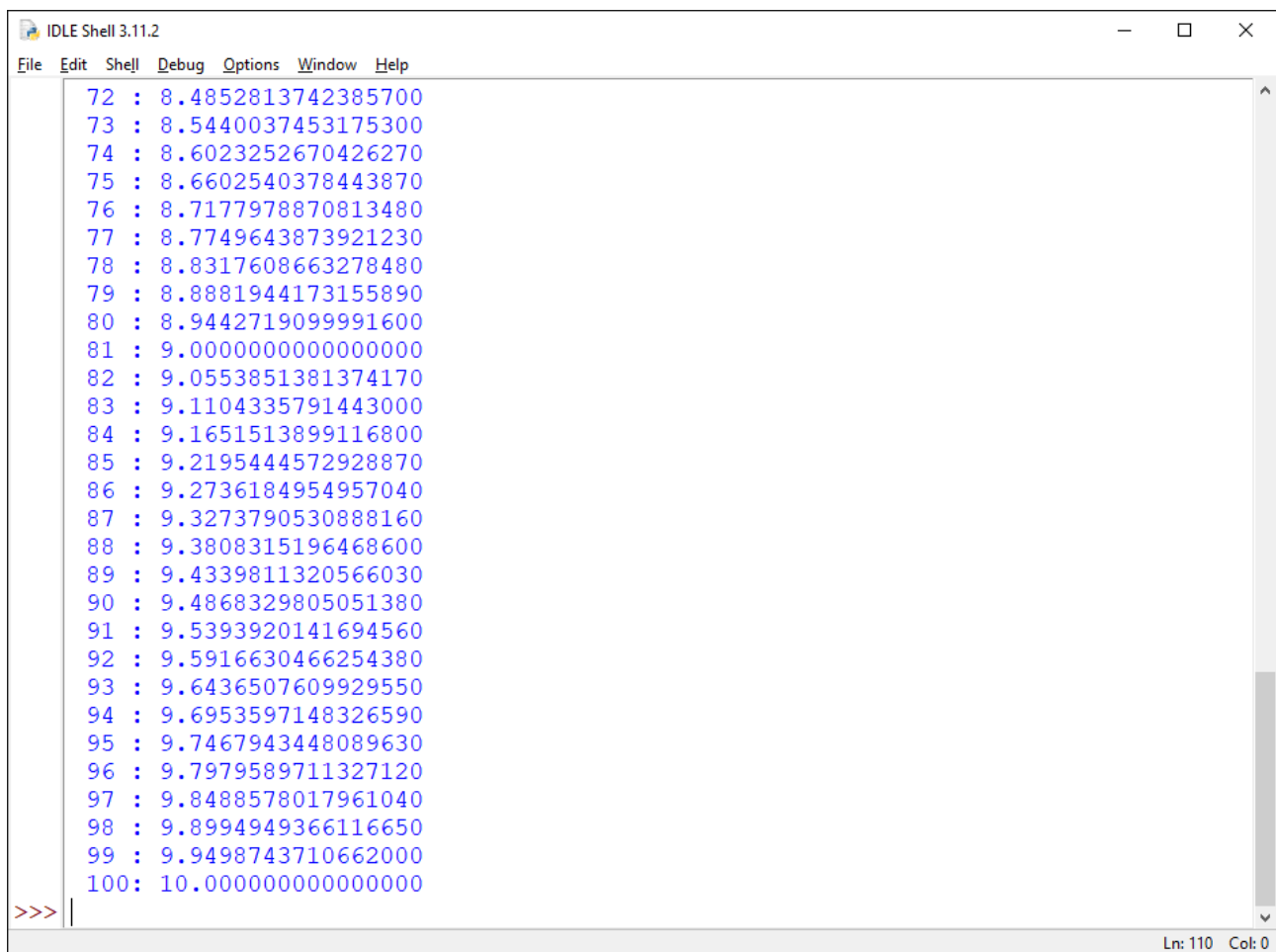
Raiz quadrada dos números naturais na faixa "1-100"
1 : 1.0000000000000000
2 : 1.4142135623730951
3 : 1.7320508075688772
4 : 2.0000000000000000
5 : 2.2360679774997900
6 : 2.4494897427831780
7 : 2.6457513110645907
8 : 2.8284271247461903
9 : 3.0000000000000000
10 : 3.1622776601683795
11 : 3.3166247903554000
12 : 3.4641016151377544
13 : 3.6055512754639890
14 : 3.7416573867739413
15 : 3.8729833462074170
16 : 4.0000000000000000
17 : 4.1231056256176610
18 : 4.2426406871192850
19 : 4.3588989435406740
20 : 4.4721359549995800
21 : 4.5825756949558400
22 : 4.6904157598234300
23 : 4.7958315233127190
24 : 4.8989794855663560
25 : 5.0000000000000000
26 : 5.0990195135927845
27 : 5.1961524227066320
28 : 5.2915026221291810
29 : 5.3851648071345040
30 : 5.4772255750516610
31 : 5.5677643628300215

Ln: 110 Col: 0
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Continua...

```
IDLE Shell 3.11.2
File Edit Shell Debug Options Window Help
32 : 5.6568542494923810
33 : 5.7445626465380290
34 : 5.8309518948453010
35 : 5.9160797830996160
36 : 6.0000000000000000
37 : 6.0827625302982190
38 : 6.1644140029689760
39 : 6.2449979983983980
40 : 6.3245553203367590
41 : 6.4031242374328485
42 : 6.4807406984078600
43 : 6.5574385243020000
44 : 6.6332495807108000
45 : 6.7082039324993690
46 : 6.7823299831252680
47 : 6.8556546004010440
48 : 6.9282032302755090
49 : 7.0000000000000000
50 : 7.0710678118654755
51 : 7.1414284285428500
52 : 7.2111025509279780
53 : 7.2801098892805180
54 : 7.3484692283495345
55 : 7.4161984870956630
56 : 7.4833147735478830
57 : 7.5498344352707500
58 : 7.6157731058639090
59 : 7.6811457478686080
60 : 7.7459666924148340
61 : 7.8102496759066540
62 : 7.8740078740118110
63 : 7.9372539331937720
64 : 8.0000000000000000
65 : 8.0622577482985500
66 : 8.1240384046359600
67 : 8.1853527718724500
68 : 8.2462112512353210
69 : 8.3066238629180750
70 : 8.3666002653407560
71 : 8.4261497731763590
Ln: 110 Col: 0
```

Continua...



```
72 : 8.4852813742385700
73 : 8.5440037453175300
74 : 8.6023252670426270
75 : 8.6602540378443870
76 : 8.7177978870813480
77 : 8.7749643873921230
78 : 8.8317608663278480
79 : 8.8881944173155890
80 : 8.9442719099991600
81 : 9.0000000000000000
82 : 9.0553851381374170
83 : 9.1104335791443000
84 : 9.1651513899116800
85 : 9.2195444572928870
86 : 9.2736184954957040
87 : 9.3273790530888160
88 : 9.3808315196468600
89 : 9.4339811320566030
90 : 9.4868329805051380
91 : 9.5393920141694560
92 : 9.5916630466254380
93 : 9.6436507609929550
94 : 9.6953597148326590
95 : 9.7467943448089630
96 : 9.7979589711327120
97 : 9.8488578017961040
98 : 9.8994949366116650
99 : 9.9498743710662000
100: 10.0000000000000000

>>> |
```

Ln: 110 Col: 0

Figura 1 - Rapizes quadradas

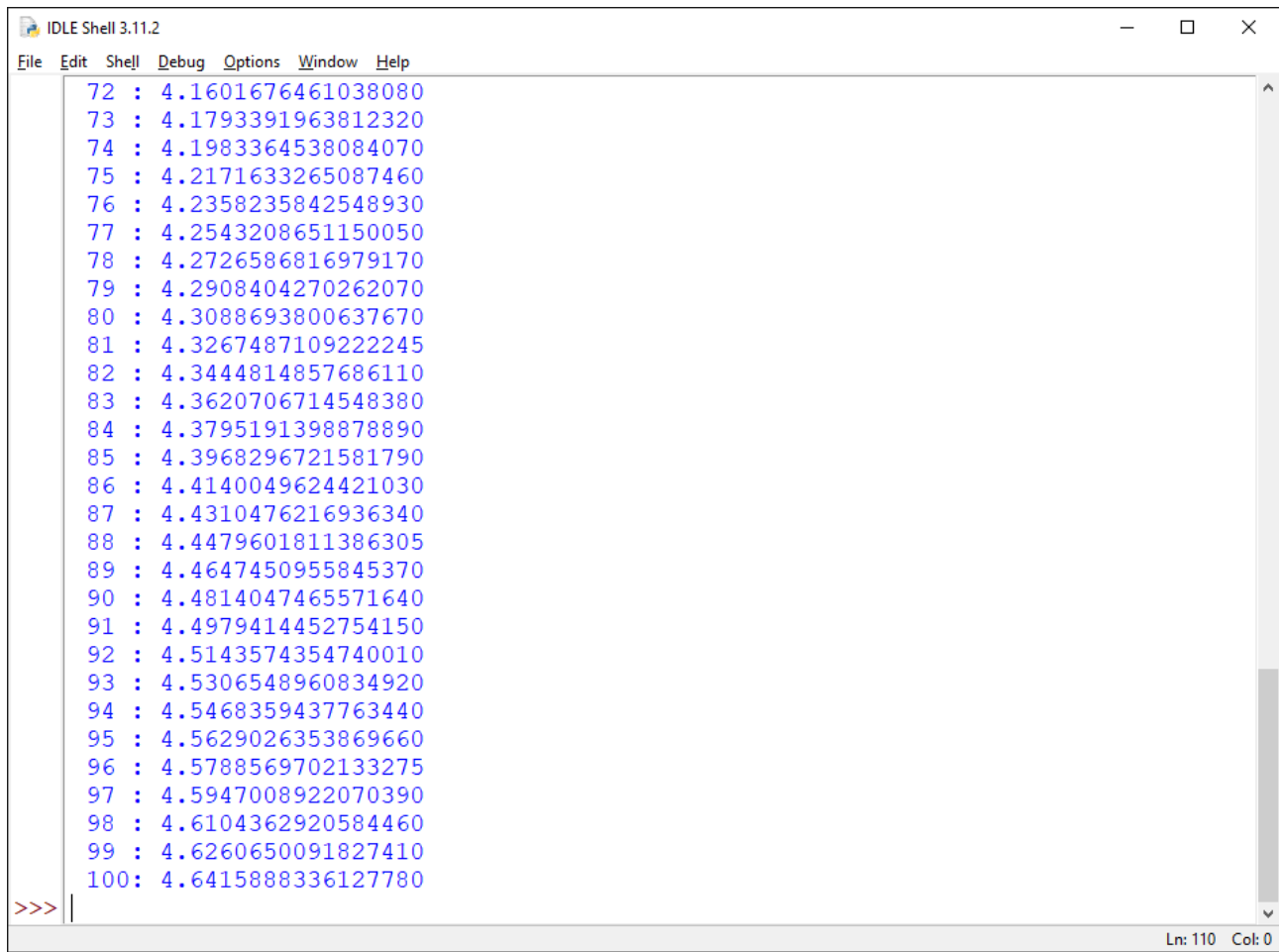
```
IDLE Shell 3.11.2
File Edit Shell Debug Options Window Help
Python 3.11.2 (tags/v3.11.2:878ead1, Feb 7 2023, 16:38:35) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: G:\BackupHD\HD-D\Cantinho da Programação\Códigos\Python\CalculaRaizes.py
Entre com o limite inferior da faixa: 1
Entre com o limite superior da faixa: 100
Digite o índice da raiz [2,3,4,5,..9]: 3

Raiz cúbica dos números naturais na faixa "1-100"
1 : 1.0000000000000000
2 : 1.2599210498948732
3 : 1.4422495703074083
4 : 1.5874010519681994
5 : 1.7099759466766968
6 : 1.8171205928321397
7 : 1.9129311827723890
8 : 2.0000000000000000
9 : 2.0800838230519040
10 : 2.1544346900318840
11 : 2.2239800905693152
12 : 2.2894284851066637
13 : 2.3513346877207573
14 : 2.4101422641752297
15 : 2.4662120743304700
16 : 2.5198420997897464
17 : 2.5712815906582350
18 : 2.6207413942088964
19 : 2.6684016487219450
20 : 2.7144176165949063
21 : 2.7589241763811203
22 : 2.8020393306553870
23 : 2.8438669798515654
24 : 2.8844991406148166
25 : 2.9240177382128660
26 : 2.9624960684073702
27 : 3.0000000000000000
28 : 3.0365889718756622
29 : 3.0723168256858470
30 : 3.1072325059538586
Ln: 110 Col: 0
```

Continua...

```
IDLE Shell 3.11.2
File Edit Shell Debug Options Window Help
31 : 3.1413806523913927
32 : 3.1748021039363987
33 : 3.2075343299958260
34 : 3.2396118012774830
35 : 3.2710663101885897
36 : 3.3019272488946263
37 : 3.3322218516459530
38 : 3.3619754067989630
39 : 3.3912114430141664
40 : 3.4199518933533937
41 : 3.4482172403827303
42 : 3.4760266448864496
43 : 3.5033980603867240
44 : 3.5303483353260630
45 : 3.5568933044900626
46 : 3.5830478710159460
47 : 3.6088260801386944
48 : 3.6342411856642790
49 : 3.6593057100229713
50 : 3.6840314986403864
51 : 3.7084297692661890
52 : 3.7325111568172478
53 : 3.7562857542210720
54 : 3.7797631496846193
55 : 3.8029524607613910
56 : 3.8258623655447780
57 : 3.8485011312768047
58 : 3.8708766406277966
59 : 3.8929964158732604
60 : 3.9148676411688634
61 : 3.9364971831021727
62 : 3.9578916096804053
63 : 3.9790572078963917
64 : 3.9999999999999996
65 : 4.0207257585890580
66 : 4.0412400206221900
67 : 4.0615481004456795
68 : 4.0816551019173480
69 : 4.1015659297023470
70 : 4.1212852998085560
71 : 4.1408177494228530
Ln: 110 Col: 0
```

Continua...



```
72 : 4.1601676461038080
73 : 4.1793391963812320
74 : 4.1983364538084070
75 : 4.2171633265087460
76 : 4.2358235842548930
77 : 4.2543208651150050
78 : 4.2726586816979170
79 : 4.2908404270262070
80 : 4.3088693800637670
81 : 4.3267487109222245
82 : 4.3444814857686110
83 : 4.3620706714548380
84 : 4.3795191398878890
85 : 4.3968296721581790
86 : 4.4140049624421030
87 : 4.4310476216936340
88 : 4.4479601811386305
89 : 4.4647450955845370
90 : 4.4814047465571640
91 : 4.4979414452754150
92 : 4.5143574354740010
93 : 4.5306548960834920
94 : 4.5468359437763440
95 : 4.5629026353869660
96 : 4.5788569702133275
97 : 4.5947008922070390
98 : 4.6104362920584460
99 : 4.6260650091827410
100: 4.6415888336127780
```

>>> |

Ln: 110 Col: 0

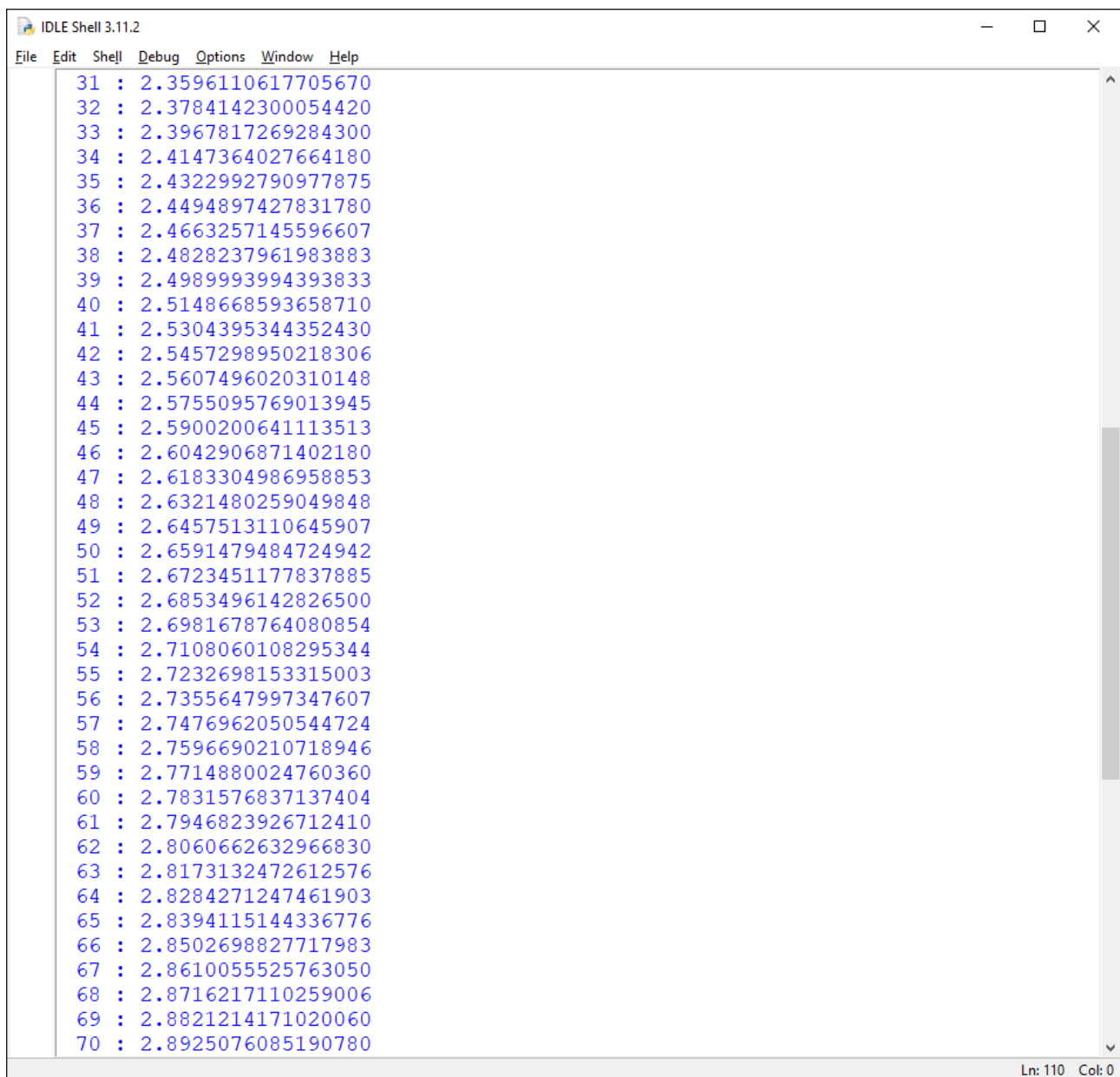
Figura 2 - Rapizes cúbicas

```
IDLE Shell 3.11.2
File Edit Shell Debug Options Window Help
Python 3.11.2 (tags/v3.11.2:878ead1, Feb 7 2023, 16:38:35) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: G:\BackupHD\HD-D\Cantinho da Programação\Códigos\Python\CalculaRaizes.py
Entre com o limite inferior da faixa: 1
Entre com o limite superior da faixa: 100
Digite o índice da raiz [2,3,4,5,..9]: 4

Raiz quarta dos números naturais na faixa "1-100"
1 : 1.0000000000000000
2 : 1.1892071150027210
3 : 1.3160740129524924
4 : 1.4142135623730951
5 : 1.4953487812212205
6 : 1.5650845800732873
7 : 1.6265765616977856
8 : 1.6817928305074290
9 : 1.7320508075688772
10 : 1.7782794100389228
11 : 1.8211602868378718
12 : 1.8612097182041991
13 : 1.8988289221159418
14 : 1.9343364202676694
15 : 1.9679896712654303
16 : 2.0000000000000000
17 : 2.0305431848689306
18 : 2.0597671439071177
19 : 2.0877976299298440
20 : 2.1147425268811280
21 : 2.1406951429280725
22 : 2.1657367706679937
23 : 2.1899387030948420
24 : 2.2133638394006430
25 : 2.2360679774997900
26 : 2.2581008643532257
27 : 2.2795070569547775
28 : 2.3003266337912060
29 : 2.3205957871060840
30 : 2.3403473193207160

Ln: 110 Col: 0
```

Continua...

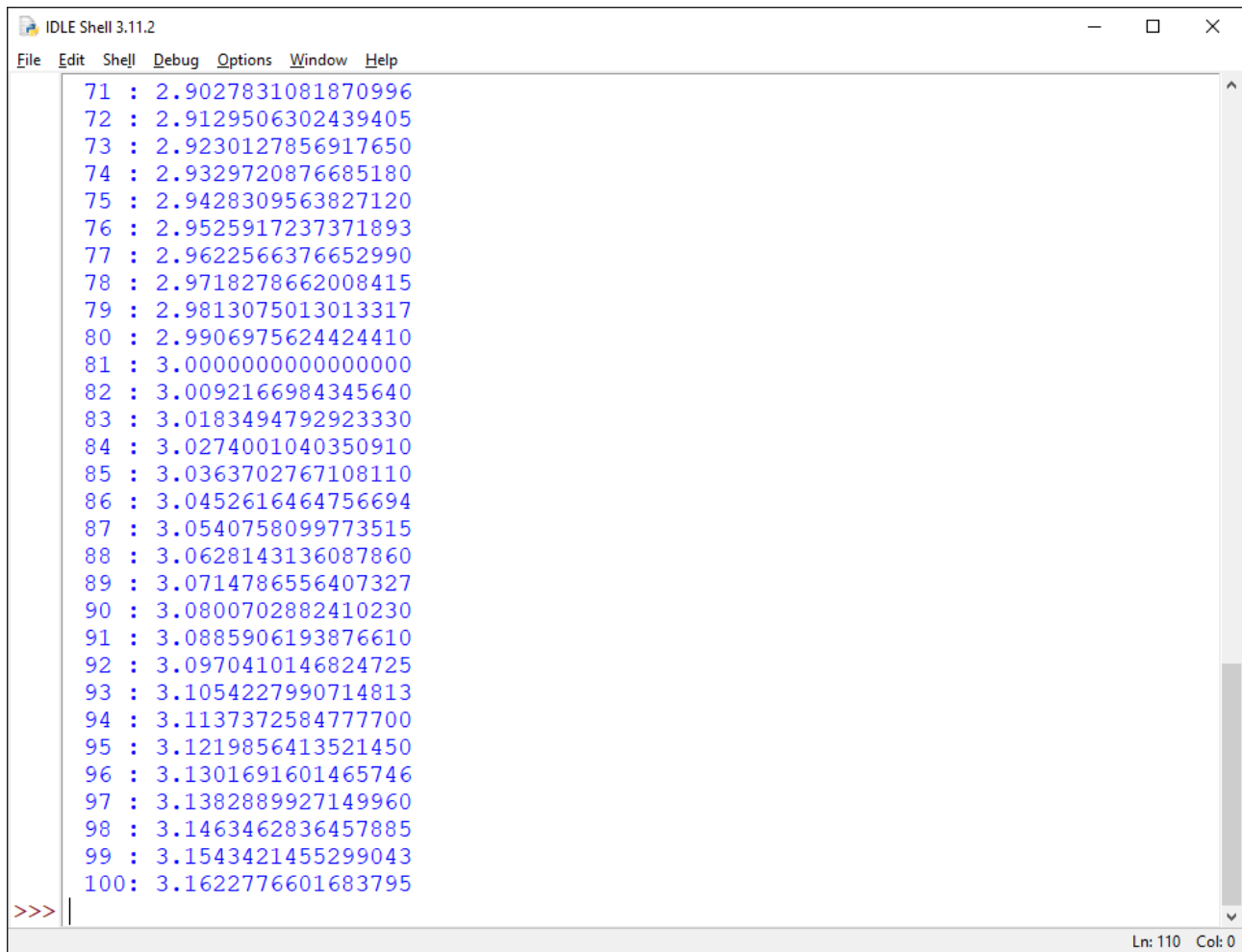


The image shows a screenshot of the IDLE Shell 3.11.2 application window. The window has a standard menu bar with 'File', 'Edit', 'Shell', 'Debug', 'Options', 'Window', and 'Help'. The main text area contains a list of 40 lines of numerical data, each starting with a line number followed by a colon and a space, then a long decimal number. The numbers range from 2.3596110617705670 to 2.8925076085190780. The status bar at the bottom right indicates 'Ln: 110 Col: 0'.

```
31 : 2.3596110617705670
32 : 2.3784142300054420
33 : 2.3967817269284300
34 : 2.4147364027664180
35 : 2.4322992790977875
36 : 2.4494897427831780
37 : 2.4663257145596607
38 : 2.4828237961983883
39 : 2.4989993994393833
40 : 2.5148668593658710
41 : 2.5304395344352430
42 : 2.5457298950218306
43 : 2.5607496020310148
44 : 2.5755095769013945
45 : 2.5900200641113513
46 : 2.6042906871402180
47 : 2.6183304986958853
48 : 2.6321480259049848
49 : 2.6457513110645907
50 : 2.6591479484724942
51 : 2.6723451177837885
52 : 2.6853496142826500
53 : 2.6981678764080854
54 : 2.7108060108295344
55 : 2.7232698153315003
56 : 2.7355647997347607
57 : 2.7476962050544724
58 : 2.7596690210718946
59 : 2.7714880024760360
60 : 2.7831576837137404
61 : 2.7946823926712410
62 : 2.8060662632966830
63 : 2.8173132472612576
64 : 2.8284271247461903
65 : 2.8394115144336776
66 : 2.8502698827717983
67 : 2.8610055525763050
68 : 2.8716217110259006
69 : 2.8821214171020060
70 : 2.8925076085190780
```

Ln: 110 Col: 0

Continua...



```
71 : 2.9027831081870996
72 : 2.9129506302439405
73 : 2.9230127856917650
74 : 2.9329720876685180
75 : 2.9428309563827120
76 : 2.9525917237371893
77 : 2.9622566376652990
78 : 2.9718278662008415
79 : 2.9813075013013317
80 : 2.9906975624424410
81 : 3.0000000000000000
82 : 3.0092166984345640
83 : 3.0183494792923330
84 : 3.0274001040350910
85 : 3.0363702767108110
86 : 3.0452616464756694
87 : 3.0540758099773515
88 : 3.0628143136087860
89 : 3.0714786556407327
90 : 3.0800702882410230
91 : 3.0885906193876610
92 : 3.0970410146824725
93 : 3.1054227990714813
94 : 3.1137372584777700
95 : 3.1219856413521450
96 : 3.1301691601465746
97 : 3.1382889927149960
98 : 3.1463462836457885
99 : 3.1543421455299043
100: 3.1622776601683795
```

>>> |

Ln: 110 Col: 0

Figura 3 - Rapizes quádruplas