

```
import mpmath
from mpmath import sqrt, fadd, fsub, fmul, fdiv, fmul, power
```

```
liste2 = [14.134725142,    21.022039639,    25.010857580,    30.424876126,
32.935061588,    37.586178159,    40.918719012,    43.327073281,
48.005150881,    49.773832478,    52.970321478,    56.446247697,
59.347044003,    60.831778525,    65.112544048,    67.079810529,
69.546401711,    72.067157674,    75.704690699,    77.144840069,
79.337375020,    82.910380854,    84.735492981,    87.425274613,
88.809111208,    92.491899271,    94.651344041,    95.870634228,
98.831194218,    101.317851006,    103.725538040,    105.446623052,
107.168611184,    111.029535543,    111.874659177,    114.320220915,
116.226680321,    118.790782866,    121.370125002,    122.946829294,
124.256818554,    127.516683880,    129.578704200,    131.087688531,
133.497737203,    134.756509753,    138.116042055,    139.736208952,
141.123707404,    143.111845808,    146.000982487,    147.422765343,
150.053520421,    150.925257612,    153.024693811,    156.112909294,
157.597591818,    158.849988171,    161.188964138,    163.030709687,
165.537069188,    167.184439978,    169.094515416,    169.911976479,
173.411536520,    174.754191523,    176.441434298,    178.377407776,
179.916484020,    182.207078484,    184.874467848,    185.598783678,
187.228922584,    189.416158656,    192.026656361,    193.079726604,
195.265396680,    196.876481841,    198.015309676,    201.264751944,
202.493594514,    204.189671803,    205.394697202,    207.906258888,
209.576509717,    211.690862595,    213.347919360,    214.547044783,
216.169538508,    219.067596349,    220.714918839,    221.430705555,
224.007000255,    224.983324670,    227.421444280,    229.337413306,
231.250188700,    231.987235253,    233.693404179,    236.524229666,
237.769820481,    239.555477573,    241.049157796,    242.823271934,
244.070898497,    247.136990075,    248.101990060,    249.573689645,
251.014947795,    253.069986748,    255.306256455,    256.380713694,
258.610439492,    259.874406990,    260.805084505,    263.573893905,
265.557851839,    266.614973782,    267.921915083,    269.970449024,
271.494055642,    273.459609188,    275.587492649,    276.452049503,
278.250743530,    279.229250928,    282.465114765,    283.211185733,
284.835963981,    286.667445363,    287.911920501,    289.579854929,
291.846291329,    293.558434139,    294.965369619,    295.573254879,
297.979277062,    299.840326054,    301.649325462,    302.696749590,
304.864371341,    305.728912602,    307.219496128,    310.109463147,
311.165141530,    312.427801181,    313.985285731,    315.475616089,
317.734805942,    318.853104256,    321.160134309,    322.144558672,
323.466969558,    324.862866052,    327.443901262,    329.033071680,
329.953239728,    331.474467583,    333.645378525,    334.211354833,
336.841850428,    338.339992851,    339.858216725,    341.042261111,
342.054877510,    344.661702940,    346.347870566,    347.272677584,
349.316260871,    350.408419349,    351.878649025,    353.488900489,
356.017574977,    357.151302252,    357.952685102,    359.743754953,
361.289361696,    363.331330579,    364.736024114,    366.212710288,
367.993575482,    368.968438096,    370.050919212,    373.061928372,
373.864873911,    375.825912767,    376.324092231,    378.436680250,
379.872975347,    381.484468617,    383.443529450,    384.956116815,
385.861300846,    387.222890222,    388.846128354,    391.456083564,
392.245083340,    393.427743844,    395.582870011,    396.381854223,
397.918736210,    399.985119876,    401.839228601,    402.861917764,
404.236441800,    405.134387460,    407.581460387,    408.947245502,
410.513869193,    411.972267804,    413.262736070,    415.018809755,
415.455214996,    418.387705790,    419.861364818,    420.643827625,
422.076710059,    423.716579627,    425.069882494,    427.208825084,
428.127914077,    430.328745431,    431.301306931,    432.138641735,
433.889218481,    436.161006433,    437.581698168,    438.621738656,
439.918442214,    441.683199201,    442.904546303,    444.319336278,
446.860622696,    447.441704194,    449.148545685,    450.126945780,
451.403308445,    453.986737807,    454.974683769,    456.328426689,
457.903893064,    459.513415281,    460.087944422,    462.065367275,
```

464.057286911,	465.671539211,	466.570286931,	467.439046210,
469.536004559,	470.773655478,	472.799174662,	473.835232345,
475.600339369,	476.769015237,	478.075263767,	478.942181535,
481.830339376,	482.834782791,	483.851427212,	485.539148129,
486.528718262,	488.380567090,	489.661761578,	491.398821594,
493.314441582,	493.957997805,	495.358828822,	496.429696216,
498.580782430,	500.309084942,	501.604446965,	502.276270327,
504.499773313,	505.415231742,	506.464152710,	508.800700336,
510.264227944,	511.562289700,	512.623144531,	513.668985555,
515.435057167,	517.589668572,	518.234223148,	520.106310412,
521.525193449,	522.456696178,	523.960530892,	525.077385687,
527.903641601,	528.406213852,	529.806226319,	530.866917884,
532.688183028,	533.779630754,	535.664314076,	537.069759083,
538.428526176,	540.213166376,	540.631390247,	541.847437121,
544.323890101,	545.636833249,	547.010912058,	547.931613364,
549.497567563,	550.970010039,	552.049572201,	553.764972119,
555.792020562,	556.899476407,	557.564659172,	559.316237029,
560.240807497,	562.559207616,	564.160879111,	564.506055938,
566.698787683,	567.731757901,	568.923955180,	570.051114782,
572.419984132,	573.614610527,	575.093886014,	575.807247141,
577.039003472,	579.098834672,	580.136959362,	581.946576266,
583.236088219,	584.561705903,	585.984563205,	586.742771891,
588.139663266,	590.660397517,	591.725858065,	592.571358300,
593.974714682,	595.728153697,	596.362768328,	598.493077346,
599.545640364,	601.602136736,	602.579167886,	603.625618904,
604.616218494,	606.383460422,	608.413217311,	609.389575155,
610.839162938,	611.774209621,	613.599778676,	614.646237872,
615.538563369,	618.112831366,	619.184482598,	620.272893672,
621.709294528,	622.375002740,	624.269900018,	626.019283428,
627.268396851,	628.325862359,	630.473887438,	630.805780927,
632.225141167,	633.546858252,	635.523800311,	637.397193160,
637.925513981,	638.927938267,	640.694794669,	641.945499666,
643.278883781,	644.990578230,	646.348191596,	647.761753004,
648.786400889,	650.197519345,	650.668683891,	653.649571605,
654.301920586,	655.709463022,	656.964084599,	658.175614419,
659.663845973,	660.716732595,	662.296586431,	664.244604652,
665.342763096,	666.515147704,	667.148494895,	668.975848820,
670.323585206,	672.458183584,	673.043578286,	674.355897810,
676.139674364,	677.230180669,	677.800444746,	679.742197883,
681.894991533,	682.602735020,	684.013549814,	684.972629862,
686.163223588,	687.961543185,	689.368941362,	690.474735032,
692.451684416,	693.176970061,	694.533908700,	695.726335921,
696.626069900,	699.132095476,	700.296739132,	701.301742955,
702.227343146,	704.033839296,	705.125813955,	706.184654800,
708.269070885,	709.229588570,	711.130274180,	711.900289914,
712.749383470,	714.082771821,	716.112396454,	717.482569703,
718.742786545,	719.697100988,	721.351162219,	722.277504976,
723.845821045,	724.562613890,	727.056403230,	728.405481589,
728.758749796,	730.416482123,	731.417354919,	732.818052714,
734.789643252,	735.765459209,	737.052928912,	738.580421171,
739.909523674,	740.573807447,	741.757335573,	743.895013142,
745.344989551,	746.499305899,	747.674563624,	748.242754465,
750.655950362,	750.966381067,	752.887621567,	754.322370472,
755.839308976,	756.768248440,	758.101729246,	758.900238225,
760.282366984,	762.700033250,	763.593066173,	764.307522724,
766.087540100,	767.218472156,	768.281461807,	769.693407253,
771.070839314,	772.961617566,	774.117744628,	775.047847097,
775.999711963,	777.299748530,	779.157076949,	780.348925004,
782.137664391,	782.597943946,	784.288822612,	785.739089701,
786.461147451,	787.468463816,	790.059092364,	790.831620468,
792.427707609,	792.888652563,	794.483791870,	795.606596156,
797.263470038,	798.707570166,	799.654336211,	801.604246463,
802.541984878,	803.243096204,	804.762239113,	805.861635667,
808.151814936,	809.197783363,	810.081804886,	811.184358847,

812.771108389, 814.045913608, 814.870539626, 816.727737714,
818.380668866, 819.204642171, 820.721898444, 821.713454133,
822.197757493, 824.526293872, 826.039287377, 826.905810954,
828.340174300, 829.437010968, 830.895884053, 831.799777659,
833.003640909, 834.651915148, 836.693576188, 837.347335060,
838.249021993, 839.465394810, 841.036389829, 842.041354207,
844.166196607, 844.805993976, 846.194769928, 847.971717640,
848.489281181, 849.862274349, 850.645448466, 853.163112583,
854.095511720, 855.286710244, 856.484117491, 857.310740603,
858.904026466, 860.410670896, 861.171098213, 863.189719772,
864.340823930, 865.594664327, 866.423739904, 867.693122612,
868.670494229, 870.846902326, 872.188750822, 873.098978971,
873.908389235, 875.985285109, 876.600825833, 877.654698341,
879.380951970, 880.834648848, 882.386696627, 883.430331839,
884.198743115, 885.272304480, 886.852801963, 888.475566674,
889.735294294, 890.813132113, 892.386433260, 893.119117567,
894.886292321, 895.397919675, 896.632251556, 899.221522668,
899.858884608, 900.849739861, 902.243207587, 903.099674443,
904.702902722, 905.829940758, 907.656729469, 908.333543645,
910.186334057, 911.234951486, 912.331045600, 912.823999247,
914.730096958, 916.355000809, 917.825377570, 918.836535244,
919.448344440, 921.156395507, 922.500629307, 923.285719802,
924.773483933, 926.551552785, 927.850858986, 928.663659329,
929.874092851, 931.009211337, 931.852740746, 934.385306837,
934.995424864, 936.228649379, 937.532925712, 939.024300899,
939.660940615, 941.156999642, 942.052341643, 944.188035810,
945.333562503, 946.765842205, 947.079183096, 948.346646255,
950.151612685, 951.033248734, 952.727988620, 954.129719270,
954.829308938, 956.675479343, 957.510052596, 958.414593390,
959.459168807, 961.669572474, 963.182086671, 963.567040192,
965.055579624, 966.110754818, 967.371153766, 968.636301906,
970.125610557, 971.071491486, 973.185361294, 973.873078993,
974.774635066, 976.178502421, 976.917202117, 978.766671535,
980.578000640, 981.288615302, 982.396485169, 983.575076006,
985.186928656, 986.130515110, 986.756008408, 988.992622371,
990.223917804, 991.374294148, 992.728696337, 993.214580957,
994.404590571, 996.205336164, 997.511934752, 998.827547137,
999.791571557, 1001.349482638, 1002.404305488, 1003.267808179,
1004.675044121, 1005.543420304, 1008.006704307, 1008.795709901,
1009.806590747, 1010.569757011, 1012.410042516, 1013.058638098,
1014.689632622, 1016.060178943, 1017.266402364, 1018.605572519,
1019.912439744, 1020.917475017, 1021.544344500, 1022.885270912,
1025.265724198, 1025.707944371, 1027.467693516, 1028.128964255,
1029.227297444, 1030.897368791, 1031.833180297, 1032.812883035,
1034.612915530, 1036.195917358, 1037.024707646, 1038.087752241,
1039.077401437, 1040.264037938, 1041.621528015, 1043.623954350,
1044.514975829, 1045.107042353, 1047.089817484, 1047.987147490,
1048.953785195, 1049.996284257, 1051.576571843, 1053.245785158,
1054.781039478, 1055.002146476, 1056.688847364, 1057.100043660,
1059.133769107, 1060.139518562, 1061.501304465, 1062.915381508,
1064.071551072, 1065.121855106, 1066.463223469, 1067.418860121,
1067.990000079, 1070.535041997, 1071.618623215, 1072.543998011,
1073.570353165, 1074.747771044, 1076.266625594, 1076.924056066,
1078.647198481, 1079.809965429, 1081.171002343, 1082.952749723,
1083.295466514, 1084.183264310, 1085.647831209, 1086.911998990,
1088.755724675, 1089.795337924, 1090.863191026, 1091.728472967,
1093.440873272, 1094.284457524, 1095.433084759, 1096.401917795,
1098.841015467, 1099.360667179, 1100.574460622, 1101.839111169,
1102.551779900, 1103.732297175, 1105.617188831, 1106.774371676,
1107.774531955, 1109.158918857, 1110.444142994, 1111.443504765,
1112.432995408, 1113.397595115, 1115.065359462, 1116.787253881,
1117.965919669, 1118.684134861, 1119.473247426, 1121.155937676,
1122.458621357, 1123.101117388, 1125.314729398, 1125.763442429,
1127.658023527, 1128.430224614, 1129.728996777, 1130.391597896,

1131.495085562,	1133.708625669,	1134.885654592,	1135.562213975,
1136.929293481,	1138.151589780,	1138.992341820,	1140.721848172,
1141.261022964,	1142.858659608,	1144.782299519,	1145.485327517,
1146.576814925,	1147.501776523,	1148.615277209,	1149.982601028,
1151.562814724,	1152.943128531,	1153.890303716,	1154.697519535,
1156.621567834,	1157.432314576,	1158.001609027,	1159.480657019,
1161.396644634,	1162.487528602,	1163.701031683,	1164.737586351,
1165.271227706,	1166.943613410,	1168.086271610,	1169.698356885,
1170.463638578,	1172.120681866,	1173.305687764,	1174.232766856,
1175.215452396,	1176.632875810,	1177.106304422,	1179.701223502,
1180.653543787,	1181.267318152,	1182.582270347,	1183.712775296,
1185.155842847,	1185.875358695,	1187.345161493,	1188.856444298,
1189.963636498,	1191.482605926,	1192.218611478,	1193.324021427,
1193.857427135,	1196.034671749,	1197.071786659,	1198.686569105,
1199.356513708,	1200.532692031,	1201.810334857,	1203.137350861,
1203.855247594,	1204.985492171,	1206.870499794,	1208.471459950,
1208.989484168,	1209.898030088,	1211.416115893,	1212.113153066,
1213.598372680,	1215.389975065,	1216.183722033,	1217.174482498,
1219.050028177,	1219.614471311,	1220.816347691,	1221.692242483,
1222.952484095,	1225.018330024,	1225.855020761,	1227.231827641,
1227.917141614,	1228.793154363,	1230.584603154,	1231.562273878,
1232.529587041,	1234.277816653,	1235.502548527,	1236.399017466,
1237.977298514,	1238.457232796,	1239.490807147,	1240.813471785,
1243.078076398,	1243.538146526,	1244.851433967,	1245.655866188,
1247.372561970,	1248.063061053,	1249.159887953,	1250.672397276,
1251.659832004,	1253.673577852,	1254.431328422,	1255.408230645,
1256.181214198,	1257.541219413,	1258.779233489,	1260.344548316,
1261.611717161,	1262.556614000,	1263.676732844,	1264.957223007,
1266.179037761,	1267.200345612,	1267.570571779,	1270.118921886,
1271.134299632,	1272.083959599,	1273.261144633,	1274.196220889,
1275.092030316,	1276.842171556,	1277.763091986,	1279.332843317,
1280.155794409,	1281.828726960,	1283.000491387,	1283.335032139,
1284.854795155,	1285.695023331,	1287.410026617,	1289.165351533,
1290.104771520,	1290.417708073,	1291.945870968,	1293.493981557,
1294.118474378,	1295.365363505,	1296.801110992,	1298.256527068,
1299.405171251,	1300.490018982,	1301.495516681,	1302.346742379,
1303.273200229,	1305.401672188,	1306.508393313,	1307.267242108,
1308.988196518,	1309.421532493,	1311.056570511,	1311.966940608,
1313.031599369,	1314.052565652,	1316.212112603,	1317.072986035,
1318.171279132,	1318.947880597,	1319.931082878,	1321.628138552,
1322.258067123,	1324.224978719,	1325.237624359,	1325.981969630,
1327.635281108,	1329.043517997,	1329.205018785,	1330.429937120,
1331.827591385,	1333.673522610,	1334.747329052,	1335.694974526,
1336.690184653,	1337.688791810,	1338.923164599,	1340.426400457,
1341.166272253,	1342.608507884,	1344.156044004,	1345.477106261,
1345.731413255,	1347.519471751,	1348.017238019,	1349.085194014,
1351.296206374,	1352.210465159,	1353.483338358,	1353.886781972,
1355.680595321,	1356.605655710,	1357.771742829,	1358.460160399,
1360.393144762,	1361.393074714,	1363.022328603,	1363.879190797,
1364.576584897,	1365.493733551,	1367.104090970,	1368.330193308,
1369.686949077,	1370.973522768,	1371.686553553,	1373.202914562,
1374.154798659,	1375.302392345,	1376.161779994,	1377.177633642,
1379.683283029,	1380.148578442,	1381.073977149,	1382.345662978,
1383.297591008,	1384.444415848,	1385.663777011,	1387.326647663,
1387.921454127,	1389.565831798,	1390.705490286,	1391.853200443,
1392.644027789,	1393.433401741,	1394.884184676,	1396.544163124,
1397.834623321,	1398.837675201,	1399.839472941,	1400.426946297,
1402.564347250,	1402.973747641,	1404.006292171,	1405.666975059,
1407.085142776,	1408.136307496,	1409.320681080,	1410.024810726,
1411.257056816,	1411.965653462,	1413.843148789,	1415.585784795,
1415.781581303,	1417.102822934,	1418.696963852,	1419.422480946]

```
nmax = 1000000  
for b in range(1, len(liste2)):
```

```
somme = 1
unzero = 0.5+liste2[b]*1j
for m in range(2,nmax+1):
    somme = fadd(somme,fdiv(1,m ** unzero))
print('\nsomme = ',somme)
moinsinv = -1/unzero
z = fsub((fdiv(moinsinv,fsub(moinsinv,1))*(nmax **
fdiv(fsub(moinsinv,1),moinsinv))),fdiv(moinsinv,fsub(moinsinv,1)))
print('z = ',z)
print('je le divise ',fdiv(z,nmax))
```