

Implement Gradient Descent Algorithm to find the local minima of a function. For example, find the local minima of the function  $y=(x+3)^2$  starting from the point  $x=2$ .

```
cur_x = 2           # The algorithm starts at x=2
rate = 0.01         # Learning rate
8#This tells us when to stop the algorithm
previous_step_size = 1
max_iters = 10000    # maximum number of iterations
iters = 0            #iteration counter
df = lambda x: (x+3)*2 #Gradient of our function

while previous_step_size > precision and iters < max_iters:
    prev_x = cur_x #Store current x value in prev_x
    cur_x = cur_x - rate * df(prev_x) #Grad descent
    previous_step_size = abs(cur_x - prev_x) #Change in x
    iters = iters+1 #iteration count
    print("Iteration ",iters,": X value is",cur_x) #Print iterations
#print("Total iterarions:",iters)

print("The local minimum occurs at", cur_x)
```

```
Iteration 1 : X value is 1.9
Iteration 2 : X value is 1.8019999999999998
Iteration 3 : X value is 1.70596
Iteration 4 : X value is 1.6118408
Iteration 5 : X value is 1.519603984
Iteration 6 : X value is 1.42921190432
Iteration 7 : X value is 1.3406276662336
Iteration 8 : X value is 1.253815112908928
Iteration 9 : X value is 1.1687388106507495
Iteration 10 : X value is 1.0853640344377344
Iteration 11 : X value is 1.0036567537489798
Iteration 12 : X value is 0.9235836186740002
Iteration 13 : X value is 0.8451119463005202
Iteration 14 : X value is 0.7682097073745098
Iteration 15 : X value is 0.6928455132270196
Iteration 16 : X value is 0.6189886029624792
Iteration 17 : X value is 0.5466088309032295
Iteration 18 : X value is 0.4756766542851649
Iteration 19 : X value is 0.40616312119946163
Iteration 20 : X value is 0.3380398587754724
Iteration 21 : X value is 0.27127906159996296
Iteration 22 : X value is 0.2058534803679637
Iteration 23 : X value is 0.14173641076060442
Iteration 24 : X value is 0.07890168254539233
Iteration 25 : X value is 0.017323648894484484
Iteration 26 : X value is -0.04302282408340521
Iteration 27 : X value is -0.10216236760173711
Iteration 28 : X value is -0.16011912024970237
Iteration 29 : X value is -0.21691673784470833
```

```
Iteration 30 : X value is -0.27257840308781417
Iteration 31 : X value is -0.3271268350260579
Iteration 32 : X value is -0.38058429832553675
Iteration 33 : X value is -0.432972612359026
Iteration 34 : X value is -0.4843131601118455
Iteration 35 : X value is -0.5346268969096086
Iteration 36 : X value is -0.5839343589714164
Iteration 37 : X value is -0.632255671791988
Iteration 38 : X value is -0.6796105583561483
Iteration 39 : X value is -0.7260183471890252
Iteration 40 : X value is -0.7714979802452447
Iteration 41 : X value is -0.8160680206403399
Iteration 42 : X value is -0.8597466602275331
Iteration 43 : X value is -0.9025517270229825
Iteration 44 : X value is -0.9445006924825228
Iteration 45 : X value is -0.9856106786328723
Iteration 46 : X value is -1.025898465060215
Iteration 47 : X value is -1.0653804957590107
Iteration 48 : X value is -1.1040728858438305
Iteration 49 : X value is -1.1419914281269539
Iteration 50 : X value is -1.1791515995644148
Iteration 51 : X value is -1.2155685675731265
Iteration 52 : X value is -1.2512571962216639
Iteration 53 : X value is -1.2862320522972306
Iteration 54 : X value is -1.320507411251286
Iteration 55 : X value is -1.3540972630262602
Iteration 56 : X value is -1.387015317765735
Iteration 57 : X value is -1.4192750114104202
Iteration 58 : X value is -1.4508895111822118
Iteration 59 : X value is -1.4818717209585675
Iteration 60 : X value is -1.512234286539396
Iteration 61 : X value is -1.5419896008086083
Iteration 62 : X value is -1.571149808792436
Iteration 63 : X value is -1.5997268126165873
Iteration 64 : X value is -1.6277322763642557
Iteration 65 : X value is -1.6551776308369706
Iteration 66 : X value is -1.6820740782202313
Iteration 67 : X value is -1.7084325966558267
Iteration 68 : X value is -1.7342639447227102
Iteration 69 : X value is -1.759578665828256
Iteration 70 : X value is -1.784387092511691
Iteration 71 : X value is -1.808699350661457
Iteration 72 : X value is -1.832525363648228
Iteration 73 : X value is -1.8558748563752634
Iteration 74 : X value is -1.8787573592477582
Iteration 75 : X value is -1.901182212062803
Iteration 76 : X value is -1.923158567821547
Iteration 77 : X value is -1.9446953964651161
Iteration 78 : X value is -1.9658014885358137
```

```
Iteration 79 : X value is -1.9864854587650975
Iteration 80 : X value is -2.0067557495897956
Iteration 81 : X value is -2.026620634598
Iteration 82 : X value is -2.04608822190604
Iteration 83 : X value is -2.065166457467919
Iteration 84 : X value is -2.0838631283185607
Iteration 85 : X value is -2.1021858657521895
Iteration 86 : X value is -2.1201421484371457
Iteration 87 : X value is -2.137739305468403
Iteration 88 : X value is -2.1549845193590347
Iteration 89 : X value is -2.171884828971854
Iteration 90 : X value is -2.188447132392417
Iteration 91 : X value is -2.204678189744569
Iteration 92 : X value is -2.2205846259496775
Iteration 93 : X value is -2.236172933430684
Iteration 94 : X value is -2.2514494747620706
Iteration 95 : X value is -2.266420485266829
Iteration 96 : X value is -2.2810920755614923
Iteration 97 : X value is -2.2954702340502626
Iteration 98 : X value is -2.3095608293692576
Iteration 99 : X value is -2.3233696127818724
Iteration 100 : X value is -2.336902220526235
Iteration 101 : X value is -2.3501641761157104
Iteration 102 : X value is -2.3631608925933962
Iteration 103 : X value is -2.375897674741528
Iteration 104 : X value is -2.3883797212466975
Iteration 105 : X value is -2.4006121268217635
Iteration 106 : X value is -2.4125998842853282
Iteration 107 : X value is -2.4243478865996217
Iteration 108 : X value is -2.4358609288676294
Iteration 109 : X value is -2.447143710290277
Iteration 110 : X value is -2.458200836084471
Iteration 111 : X value is -2.4690368193627816
Iteration 112 : X value is -2.479656082975526
Iteration 113 : X value is -2.4900629613160152
Iteration 114 : X value is -2.500261702089695
Iteration 115 : X value is -2.510256468047901
Iteration 116 : X value is -2.520051338686943
Iteration 117 : X value is -2.5296503119132043
Iteration 118 : X value is -2.53905730567494
Iteration 119 : X value is -2.5482761595614414
Iteration 120 : X value is -2.5573106363702127
Iteration 121 : X value is -2.5661644236428085
Iteration 122 : X value is -2.5748411351699523
Iteration 123 : X value is -2.5833443124665534
Iteration 124 : X value is -2.591677426217222
Iteration 125 : X value is -2.599843877692878
Iteration 126 : X value is -2.6078470001390204
Iteration 127 : X value is -2.61569006013624
```

```
Iteration 128 : X value is -2.623376258933515
Iteration 129 : X value is -2.6309087337548447
Iteration 130 : X value is -2.638290559079748
Iteration 131 : X value is -2.6455247478981527
Iteration 132 : X value is -2.6526142529401895
Iteration 133 : X value is -2.6595619678813858
Iteration 134 : X value is -2.666370728523758
Iteration 135 : X value is -2.6730433139532828
Iteration 136 : X value is -2.679582447674217
Iteration 137 : X value is -2.685990798720733
Iteration 138 : X value is -2.6922709827463183
Iteration 139 : X value is -2.698425563091392
Iteration 140 : X value is -2.7044570518295643
Iteration 141 : X value is -2.7103679107929732
Iteration 142 : X value is -2.7161605525771138
Iteration 143 : X value is -2.7218373415255717
Iteration 144 : X value is -2.72740059469506
Iteration 145 : X value is -2.7328525828011587
Iteration 146 : X value is -2.7381955311451356
Iteration 147 : X value is -2.743431620522233
Iteration 148 : X value is -2.748562988111788
Iteration 149 : X value is -2.7535917283495523
Iteration 150 : X value is -2.7585198937825615
Iteration 151 : X value is -2.76334949590691
Iteration 152 : X value is -2.768082505988772
Iteration 153 : X value is -2.7727208558689966
Iteration 154 : X value is -2.777266438751617
Iteration 155 : X value is -2.7817211099765844
Iteration 156 : X value is -2.7860866877770527
Iteration 157 : X value is -2.790364954021512
Iteration 158 : X value is -2.7945576549410815
Iteration 159 : X value is -2.79866650184226
Iteration 160 : X value is -2.802693171805415
Iteration 161 : X value is -2.8066393083693066
Iteration 162 : X value is -2.8105065222019205
Iteration 163 : X value is -2.8142963917578823
Iteration 164 : X value is -2.818010463922725
Iteration 165 : X value is -2.82165025464427
Iteration 166 : X value is -2.8252172495513848
Iteration 167 : X value is -2.828712904560357
Iteration 168 : X value is -2.83213864646915
Iteration 169 : X value is -2.8354958735397666
Iteration 170 : X value is -2.838785956068971
Iteration 171 : X value is -2.842010236947592
Iteration 172 : X value is -2.84517003220864
Iteration 173 : X value is -2.8482666315644676
Iteration 174 : X value is -2.851301298933178
Iteration 175 : X value is -2.8542752729545144
Iteration 176 : X value is -2.857189767495424
```

```
Iteration 177 : X value is -2.8600459721455156
Iteration 178 : X value is -2.8628450527026055
Iteration 179 : X value is -2.8655881516485535
Iteration 180 : X value is -2.8682763886155827
Iteration 181 : X value is -2.870910860843271
Iteration 182 : X value is -2.8734926436264057
Iteration 183 : X value is -2.8760227907538773
Iteration 184 : X value is -2.8785023349388
Iteration 185 : X value is -2.880932288240024
Iteration 186 : X value is -2.8833136424752235
Iteration 187 : X value is -2.885647369625719
Iteration 188 : X value is -2.8879344222332044
Iteration 189 : X value is -2.8901757337885403
Iteration 190 : X value is -2.8923722191127696
Iteration 191 : X value is -2.894524774730514
Iteration 192 : X value is -2.896634279235904
Iteration 193 : X value is -2.898701593651186
Iteration 194 : X value is -2.900727561778162
Iteration 195 : X value is -2.9027130105425987
Iteration 196 : X value is -2.9046587503317465
Iteration 197 : X value is -2.9065655753251116
Iteration 198 : X value is -2.9084342638186094
Iteration 199 : X value is -2.910265578542237
Iteration 200 : X value is -2.9120602669713924
Iteration 201 : X value is -2.9138190616319646
Iteration 202 : X value is -2.915542680399325
Iteration 203 : X value is -2.9172318267913386
Iteration 204 : X value is -2.918887190255512
Iteration 205 : X value is -2.920509446450402
Iteration 206 : X value is -2.9220992575213938
Iteration 207 : X value is -2.9236572723709657
Iteration 208 : X value is -2.9251841269235466
Iteration 209 : X value is -2.9266804443850756
Iteration 210 : X value is -2.928146835497374
Iteration 211 : X value is -2.9295838987874263
Iteration 212 : X value is -2.9309922208116777
Iteration 213 : X value is -2.932372376395444
Iteration 214 : X value is -2.933724928867535
Iteration 215 : X value is -2.9350504302901843
Iteration 216 : X value is -2.9363494216843806
Iteration 217 : X value is -2.937622433250693
Iteration 218 : X value is -2.938869984585679
Iteration 219 : X value is -2.9400925848939656
Iteration 220 : X value is -2.9412907331960865
Iteration 221 : X value is -2.9424649185321647
Iteration 222 : X value is -2.9436156201615216
Iteration 223 : X value is -2.944743307758291
Iteration 224 : X value is -2.9458484416031254
Iteration 225 : X value is -2.946931472771063
```

```
Iteration 226 : X value is -2.9479928433156415
Iteration 227 : X value is -2.9490329864493288
Iteration 228 : X value is -2.9500523267203422
Iteration 229 : X value is -2.9510512801859354
Iteration 230 : X value is -2.952030254582217
Iteration 231 : X value is -2.9529896494905725
Iteration 232 : X value is -2.953929856500761
Iteration 233 : X value is -2.954851259370746
Iteration 234 : X value is -2.955754234183331
Iteration 235 : X value is -2.9566391494996647
Iteration 236 : X value is -2.9575063665096715
Iteration 237 : X value is -2.958356239179478
Iteration 238 : X value is -2.9591891143958886
Iteration 239 : X value is -2.9600053321079707
Iteration 240 : X value is -2.960805225465811
Iteration 241 : X value is -2.9615891209564946
Iteration 242 : X value is -2.9623573385373647
Iteration 243 : X value is -2.9631101917666176
Iteration 244 : X value is -2.963847987931285
Iteration 245 : X value is -2.9645710281726596
Iteration 246 : X value is -2.9652796076092063
Iteration 247 : X value is -2.965974015457022
Iteration 248 : X value is -2.9666545351478817
Iteration 249 : X value is -2.967321444444924
Iteration 250 : X value is -2.9679750155560254
Iteration 251 : X value is -2.9686155152449047
Iteration 252 : X value is -2.969243204940007
Iteration 253 : X value is -2.9698583408412067
Iteration 254 : X value is -2.9704611740243827
Iteration 255 : X value is -2.9710519505438953
Iteration 256 : X value is -2.9716309115330173
Iteration 257 : X value is -2.9721982933023567
Iteration 258 : X value is -2.9727543274363097
Iteration 259 : X value is -2.9732992408875836
Iteration 260 : X value is -2.973833256069832
Iteration 261 : X value is -2.9743565909484353
Iteration 262 : X value is -2.9748694591294664
Iteration 263 : X value is -2.9753720699468773
Iteration 264 : X value is -2.9758646285479395
Iteration 265 : X value is -2.9763473359769805
Iteration 266 : X value is -2.976820389257441
Iteration 267 : X value is -2.9772839814722922
Iteration 268 : X value is -2.9777383018428463
Iteration 269 : X value is -2.9781835358059894
Iteration 270 : X value is -2.9786198650898696
Iteration 271 : X value is -2.9790474677880723
Iteration 272 : X value is -2.979466518432311
Iteration 273 : X value is -2.9798771880636648
Iteration 274 : X value is -2.9802796443023913
```

```
Iteration 275 : X value is -2.9806740514163437
Iteration 276 : X value is -2.9810605703880166
Iteration 277 : X value is -2.981439358980256
Iteration 278 : X value is -2.981810571800651
Iteration 279 : X value is -2.9821743603646382
Iteration 280 : X value is -2.9825308731573457
Iteration 281 : X value is -2.982880255694199
Iteration 282 : X value is -2.983222650580315
Iteration 283 : X value is -2.983558197568709
Iteration 284 : X value is -2.983887033617335
Iteration 285 : X value is -2.984209292944988
Iteration 286 : X value is -2.9845251070860885
Iteration 287 : X value is -2.984834604944367
Iteration 288 : X value is -2.9851379128454796
Iteration 289 : X value is -2.98543515458857
Iteration 290 : X value is -2.9857264514967983
Iteration 291 : X value is -2.9860119224668624
Iteration 292 : X value is -2.9862916840175253
Iteration 293 : X value is -2.9865658503371746
Iteration 294 : X value is -2.986834533330431
Iteration 295 : X value is -2.987097842663822
Iteration 296 : X value is -2.987355885810546
Iteration 297 : X value is -2.987608768094335
Iteration 298 : X value is -2.9878565927324483
Iteration 299 : X value is -2.9880994608777995
Iteration 300 : X value is -2.9883374716602438
Iteration 301 : X value is -2.988570722227039
Iteration 302 : X value is -2.988799307782498
Iteration 303 : X value is -2.989023321626848
Iteration 304 : X value is -2.989242855194311
Iteration 305 : X value is -2.989457998090425
Iteration 306 : X value is -2.9896688381286163
Iteration 307 : X value is -2.989875461366044
Iteration 308 : X value is -2.9900779521387233
Iteration 309 : X value is -2.990276393095949
Iteration 310 : X value is -2.99047086523403
Iteration 311 : X value is -2.9906614479293494
Iteration 312 : X value is -2.9908482189707626
Iteration 313 : X value is -2.9910312545913476
Iteration 314 : X value is -2.9912106294995207
Iteration 315 : X value is -2.9913864169095303
Iteration 316 : X value is -2.99155868857134
Iteration 317 : X value is -2.991727514799913
Iteration 318 : X value is -2.9918929645039145
Iteration 319 : X value is -2.9920551052138364
Iteration 320 : X value is -2.99221400310956
Iteration 321 : X value is -2.9923697230473687
Iteration 322 : X value is -2.9925223285864213
Iteration 323 : X value is -2.992671882014693
```

```
Iteration 324 : X value is -2.9928184443743993
Iteration 325 : X value is -2.9929620754869113
Iteration 326 : X value is -2.993102833977173
Iteration 327 : X value is -2.9932407772976295
Iteration 328 : X value is -2.993375961751677
Iteration 329 : X value is -2.993508442516643
Iteration 330 : X value is -2.9936382736663103
Iteration 331 : X value is -2.993765508192984
Iteration 332 : X value is -2.993890198029124
Iteration 333 : X value is -2.9940123940685415
Iteration 334 : X value is -2.994132146187171
Iteration 335 : X value is -2.9942495032634273
Iteration 336 : X value is -2.9943645131981587
Iteration 337 : X value is -2.9944772229341954
Iteration 338 : X value is -2.9945876784755114
Iteration 339 : X value is -2.9946959249060012
Iteration 340 : X value is -2.9948020064078813
Iteration 341 : X value is -2.9949059662797235
Iteration 342 : X value is -2.9950078469541292
Iteration 343 : X value is -2.995107690015047
Iteration 344 : X value is -2.995205536214746
Iteration 345 : X value is -2.995301425490451
Iteration 346 : X value is -2.995395396980642
Iteration 347 : X value is -2.9954874890410292
Iteration 348 : X value is -2.9955777392602085
Iteration 349 : X value is -2.9956661844750045
Iteration 350 : X value is -2.9957528607855046
Iteration 351 : X value is -2.9958378035697946
Iteration 352 : X value is -2.9959210474983986
Iteration 353 : X value is -2.9960026265484307
Iteration 354 : X value is -2.996082574017462
Iteration 355 : X value is -2.9961609225371126
Iteration 356 : X value is -2.9962377040863704
Iteration 357 : X value is -2.996312950004643
Iteration 358 : X value is -2.9963866910045502
Iteration 359 : X value is -2.9964589571844593
Iteration 360 : X value is -2.9965297780407703
Iteration 361 : X value is -2.996599182479955
Iteration 362 : X value is -2.9966671988303557
Iteration 363 : X value is -2.9967338548537485
Iteration 364 : X value is -2.9967991777566736
Iteration 365 : X value is -2.99686319420154
Iteration 366 : X value is -2.9969259303175093
Iteration 367 : X value is -2.9969874117111592
Iteration 368 : X value is -2.997047663476936
Iteration 369 : X value is -2.997106710207397
Iteration 370 : X value is -2.997164576003249
Iteration 371 : X value is -2.997221284483184
Iteration 372 : X value is -2.99727685879352
```



```
Iteration 373 : X value is -2.99733132161765
Iteration 374 : X value is -2.9973846951852967
Iteration 375 : X value is -2.997437001281591
Iteration 376 : X value is -2.9974882612559592
Iteration 377 : X value is -2.99753849603084
Iteration 378 : X value is -2.9975877261102233
Iteration 379 : X value is -2.9976359715880188
Iteration 380 : X value is -2.9976832521562584
Iteration 381 : X value is -2.9977295871131333
Iteration 382 : X value is -2.9977749953708708
Iteration 383 : X value is -2.997819495463453
Iteration 384 : X value is -2.9978631055541842
Iteration 385 : X value is -2.9979058434431005
Iteration 386 : X value is -2.9979477265742385
Iteration 387 : X value is -2.9979887720427536
Iteration 388 : X value is -2.9980289966018985
Iteration 389 : X value is -2.9980684166698603
Iteration 390 : X value is -2.9981070483364634
Iteration 391 : X value is -2.998144907369734
Iteration 392 : X value is -2.9981820092223392
Iteration 393 : X value is -2.9982183690378923
Iteration 394 : X value is -2.9982540016571346
Iteration 395 : X value is -2.998288921623992
Iteration 396 : X value is -2.998323143191512
Iteration 397 : X value is -2.998356680327682
Iteration 398 : X value is -2.9983895467211283
Iteration 399 : X value is -2.9984217557867057
Iteration 400 : X value is -2.9984533206709716
Iteration 401 : X value is -2.9984842542575523
Iteration 402 : X value is -2.9985145691724013
Iteration 403 : X value is -2.9985442777889535
Iteration 404 : X value is -2.9985733922331743
Iteration 405 : X value is -2.998601924388511
Iteration 406 : X value is -2.9986298859007405
Iteration 407 : X value is -2.998657288182726
Iteration 408 : X value is -2.998684142419071
Iteration 409 : X value is -2.9987104595706895
Iteration 410 : X value is -2.9987362503792756
Iteration 411 : X value is -2.99876152537169
Iteration 412 : X value is -2.9987862948642565
Iteration 413 : X value is -2.9988105689669715
Iteration 414 : X value is -2.998834357587632
Iteration 415 : X value is -2.9988576704358794
Iteration 416 : X value is -2.9988805170271617
Iteration 417 : X value is -2.9989029066866184
Iteration 418 : X value is -2.998924848552886
Iteration 419 : X value is -2.998946351581828
Iteration 420 : X value is -2.998967424550192
Iteration 421 : X value is -2.998988076059188
```

```
Iteration 422 : X value is -2.9990083145380044
Iteration 423 : X value is -2.9990281482472443
Iteration 424 : X value is -2.9990475852822995
Iteration 425 : X value is -2.9990666335766534
Iteration 426 : X value is -2.9990853009051204
Iteration 427 : X value is -2.999103594887018
Iteration 428 : X value is -2.999121522989278
Iteration 429 : X value is -2.999139092529492
Iteration 430 : X value is -2.9991563106789023
Iteration 431 : X value is -2.999173184465324
Iteration 432 : X value is -2.999189720776018
Iteration 433 : X value is -2.9992059263604975
Iteration 434 : X value is -2.9992218078332877
Iteration 435 : X value is -2.999237371676622
Iteration 436 : X value is -2.9992526242430895
Iteration 437 : X value is -2.9992675717582276
Iteration 438 : X value is -2.999282220323063
Iteration 439 : X value is -2.9992965759166017
Iteration 440 : X value is -2.9993106443982698
Iteration 441 : X value is -2.9993244315103045
Iteration 442 : X value is -2.9993379428800986
Iteration 443 : X value is -2.9993511840224967
Iteration 444 : X value is -2.9993641603420467
Iteration 445 : X value is -2.9993768771352056
Iteration 446 : X value is -2.9993893395925015
Iteration 447 : X value is -2.9994015528006517
Iteration 448 : X value is -2.9994135217446387
Iteration 449 : X value is -2.999425251309746
Iteration 450 : X value is -2.999436746283551
Iteration 451 : X value is -2.99944801135788
Iteration 452 : X value is -2.9994590511307226
Iteration 453 : X value is -2.999469870108108
Iteration 454 : X value is -2.999480472705946
Iteration 455 : X value is -2.999490863251827
Iteration 456 : X value is -2.999501045986791
Iteration 457 : X value is -2.999511025067055
Iteration 458 : X value is -2.999520804565714
Iteration 459 : X value is -2.9995303884744
Iteration 460 : X value is -2.999539780704912
Iteration 461 : X value is -2.9995489850908137
Iteration 462 : X value is -2.999558005388997
Iteration 463 : X value is -2.999566845281217
Iteration 464 : X value is -2.999575508375593
Iteration 465 : X value is -2.999583998208081
Iteration 466 : X value is -2.9995923182439195
Iteration 467 : X value is -2.999600471879041
Iteration 468 : X value is -2.9996084624414605
Iteration 469 : X value is -2.999616293192631
Iteration 470 : X value is -2.9996239673287786
```

```
Iteration 471 : X value is -2.999631487982203
Iteration 472 : X value is -2.999638858222559
Iteration 473 : X value is -2.9996460810581076
Iteration 474 : X value is -2.9996531594369453
Iteration 475 : X value is -2.9996600962482063
Iteration 476 : X value is -2.999666894323242
Iteration 477 : X value is -2.999673556436777
Iteration 478 : X value is -2.9996800853080416
Iteration 479 : X value is -2.999686483601881
Iteration 480 : X value is -2.999692753929843
Iteration 481 : X value is -2.9996988988512463
Iteration 482 : X value is -2.9997049208742212
Iteration 483 : X value is -2.999710822456737
Iteration 484 : X value is -2.999716606007602
Iteration 485 : X value is -2.9997222738874503
Iteration 486 : X value is -2.9997278284097013
Iteration 487 : X value is -2.9997332718415075
Iteration 488 : X value is -2.9997386064046774
Iteration 489 : X value is -2.999743834276584
Iteration 490 : X value is -2.999748957591052
Iteration 491 : X value is -2.999753978439231
Iteration 492 : X value is -2.9997588988704464
Iteration 493 : X value is -2.9997637208930374
Iteration 494 : X value is -2.999768446475177
Iteration 495 : X value is -2.9997730775456732
Iteration 496 : X value is -2.9997776159947596
Iteration 497 : X value is -2.999782063674864
Iteration 498 : X value is -2.999786422401367
Iteration 499 : X value is -2.9997906939533396
Iteration 500 : X value is -2.9997948800742726
Iteration 501 : X value is -2.9997989824727873
Iteration 502 : X value is -2.999803002823332
Iteration 503 : X value is -2.999806942766865
Iteration 504 : X value is -2.9998108039115277
Iteration 505 : X value is -2.999814587833297
Iteration 506 : X value is -2.999818296076631
Iteration 507 : X value is -2.9998219301550986
Iteration 508 : X value is -2.9998254915519964
Iteration 509 : X value is -2.9998289817209565
Iteration 510 : X value is -2.9998324020865375
Iteration 511 : X value is -2.9998357540448066
Iteration 512 : X value is -2.9998390389639105
Iteration 513 : X value is -2.9998422581846325
Iteration 514 : X value is -2.9998454130209398
Iteration 515 : X value is -2.999848504760521
Iteration 516 : X value is -2.9998515346653107
Iteration 517 : X value is -2.9998545039720046
Iteration 518 : X value is -2.9998574138925647
Iteration 519 : X value is -2.9998602656147133
Iteration 520 : X value is -2.999863060302419
```

```
Iteration 521 : X value is -2.9998657990963706
Iteration 522 : X value is -2.9998684831144433
Iteration 523 : X value is -2.9998711134521545
Iteration 524 : X value is -2.9998736911831116
Iteration 525 : X value is -2.9998762173594495
Iteration 526 : X value is -2.9998786930122607
Iteration 527 : X value is -2.9998811191520156
Iteration 528 : X value is -2.9998834967689754
Iteration 529 : X value is -2.9998858268335957
Iteration 530 : X value is -2.999888110296924
Iteration 531 : X value is -2.9998903480909855
Iteration 532 : X value is -2.999892541129166
Iteration 533 : X value is -2.9998946903065824
Iteration 534 : X value is -2.9998967965004506
Iteration 535 : X value is -2.9998988605704415
Iteration 536 : X value is -2.999900883359033
Iteration 537 : X value is -2.999902865691852
Iteration 538 : X value is -2.999904808378015
Iteration 539 : X value is -2.999906712210455
Iteration 540 : X value is -2.9999085779662455
Iteration 541 : X value is -2.9999104064069204
Iteration 542 : X value is -2.999912198278782
Iteration 543 : X value is -2.9999139543132065
Iteration 544 : X value is -2.9999156752269425
Iteration 545 : X value is -2.9999173617224035
Iteration 546 : X value is -2.9999190144879555
Iteration 547 : X value is -2.9999206341981965
Iteration 548 : X value is -2.9999222215142325
Iteration 549 : X value is -2.9999237770839478
Iteration 550 : X value is -2.9999253015422687
Iteration 551 : X value is -2.9999267955114233
Iteration 552 : X value is -2.999928259601195
Iteration 553 : X value is -2.999929694409171
Iteration 554 : X value is -2.9999311005209877
Iteration 555 : X value is -2.999932478510568
Iteration 556 : X value is -2.9999338289403563
Iteration 557 : X value is -2.9999351523615494
Iteration 558 : X value is -2.9999364493143186
Iteration 559 : X value is -2.9999377203280324
Iteration 560 : X value is -2.999938965921472
Iteration 561 : X value is -2.9999401866030424
Iteration 562 : X value is -2.9999413828709818
Iteration 563 : X value is -2.999942555213562
Iteration 564 : X value is -2.999943704109291
Iteration 565 : X value is -2.999944830027105
Iteration 566 : X value is -2.999945933426563
Iteration 567 : X value is -2.999947014758032
Iteration 568 : X value is -2.9999480744628713
Iteration 569 : X value is -2.999949112973614
```

```
Iteration 570 : X value is -2.999950130714142  
Iteration 571 : X value is -2.999951128099859  
The local minimum occurs at -2.999951128099859
```