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#!/usr/bin/env python
# coding: utf-8
#implement gradient descent algorithm to find local minima of a function.find
local minima of a function  $y = (x+3)**2$  starting from point  $x = 2$ 
# In[1]:

current_x = 2 # the algo starts at x=3
rate=0.01 # learning rate
precision = 0.000001 # this tells us when to stop the algo
previous_step_size = 1
max_iters = 10000 # maximum number of iterations
iters = 0 # iteration counter
df= lambda x:2*(x+3) #gradient of our function

# In[3]:

while previous_step_size > precision and iters < max_iters: # when previous step
size will be less than precision then we will reach at global maxima
    previous_x = current_x #store current x value in prev_x
    current_x = current_x - rate * df(previous_x) # grad descent
    previous_step_size = abs(current_x - previous_x) # change in x
    iters= iters+1 # iteration count
    print("iteration", iters, "\nX value is", current_x) #print iterations

print("the local minimum occurs at", current_x)

# In[ ]:
''' OUTPUT
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
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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  
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X value is 0.3380398587754724  
iteration 21  
X value is 0.27127906159996296  
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X value is 0.2058534803679637  
iteration 23  
X value is 0.14173641076060442  
iteration 24  
X value is 0.07890168254539233  
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