

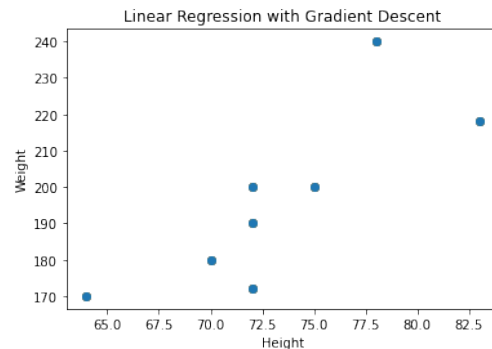
# Implementation of Gradient Descent

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1. Implement Gradient Descent optimization along for the linear regression problem using the data given below. Compare the results for learning rates:  $0.001, 0.003, 0.01, 0.03, 0.1, 0.3$

Height (inches)	Weight (pounds)
70	180
72	190
75	200
78	240
83	218
72	200
72	172
64	170



## Results:

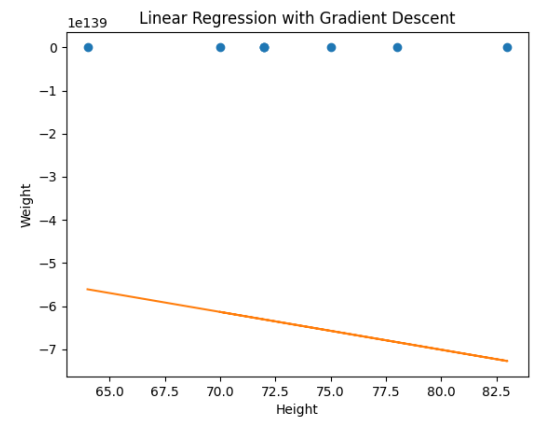
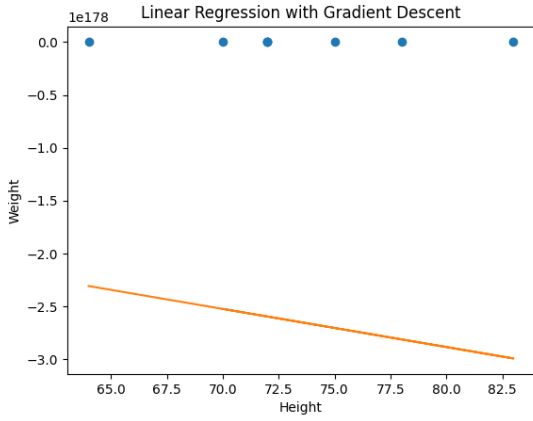
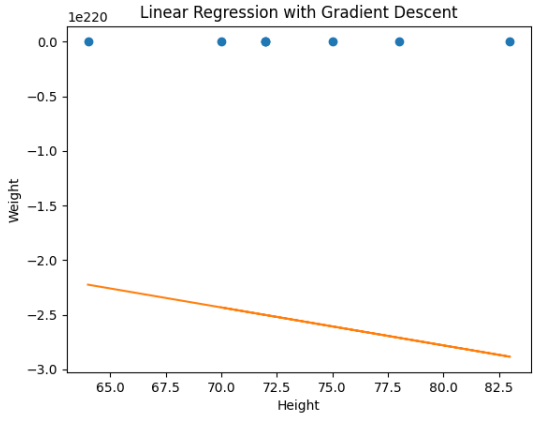
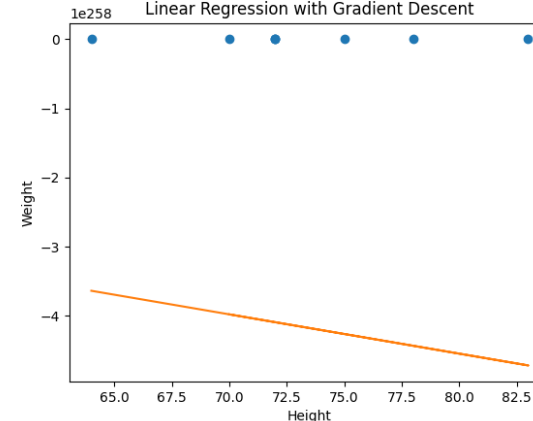
No. of iterations: 10

Initial  $m = 0$

Initial  $b = 0$

**Note:** We need to tune and find the optimal values of the above parameters to find a good fit for the given dataset.

LR	Predicted Value	Plot
0.001	-1.3791667819694832e+53, - 1.4185624176712554e+53, - 1.4776558712239138e+53, - 1.536749324776572e+53, - 1.6352384140310025e+53, - 1.4185624176712554e+53, - 1.4185624176712554e+53, - 1.2609798748641667e+53	
0.003	-2.2668193319796277e+96, - 2.3315710021468418e+96, - 2.4286985073976626e+96, - 2.5258260126484834e+96, - 2.6877051880665177e+96, - 2.3315710021468418e+96, - 2.3315710021468418e+96, - 2.0725643214779863e+96	

0.01	-6.135513636768548e+139, - 6.310774796797529e+139, - 6.573666536841001e+139, - 6.836558276884473e+139, - 7.274711176956926e+139, - 6.310774796797529e+139, - 6.310774796797529e+139, - 5.609730156681604e+139]	
0.03	-2.5221197423948042e+178, - 2.594164210450843e+178, - 2.702230912534901e+178, - 2.810297614618959e+178, - 2.9904087847590557e+178, - 2.594164210450843e+178, - 2.594164210450843e+178, - 2.3059863382266882e+178	
0.1	-2.4332142864811547e+220, - 2.5027191759640983e+220, - 2.606976510188514e+220, - 2.71123384441293e+220, - 2.88499606812029e+220, - 2.5027191759640983e+220, - 2.5027191759640983e+220, - 2.2246996180323226e+220	
0.3	-3.979108112291325e+258, - 4.09277154190289e+258, - 4.2632666863202375e+258, - 4.433761830737584e+258, - 4.717920404766496e+258, - 4.09277154190289e+258, - 4.09277154190289e+258, - 3.638117823456631e+258	

- Implement Gradient Descent optimization along for the linear regression problem using the data given below. Compare the results for learning rates: 0.001, 0.003, 0.01, 0.03, 0.1, 0.3.

Hour={2.3,5.0,3.2,8.5,3.5,1.5,9.2,5.5,8.3,2.7,7.7,5.9,4.5,3.4,1.1,8.9,2.5,1.9,6.1,7.4,2.7,4.8,3.7,6.8,7.4}

Scores={18,45,25,72,30,20,88,60,81,25,85,62,41,44,17,95,30,24,67,69,30,54,33,70,85}

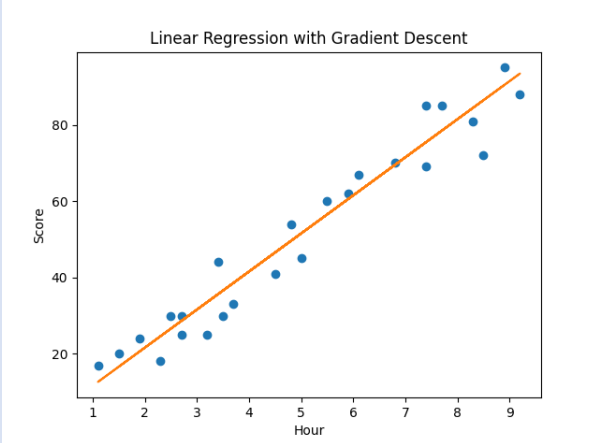
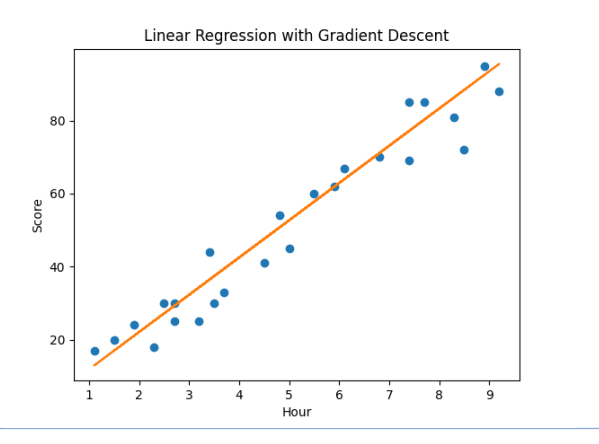
### Result:

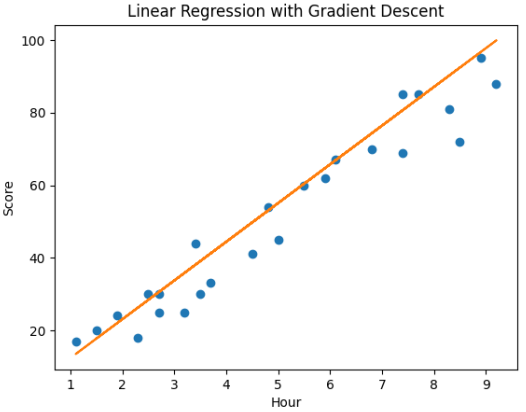
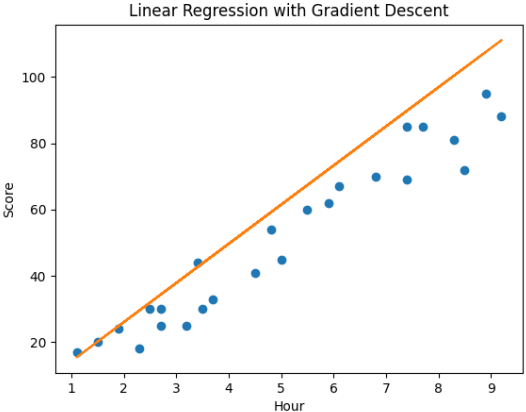
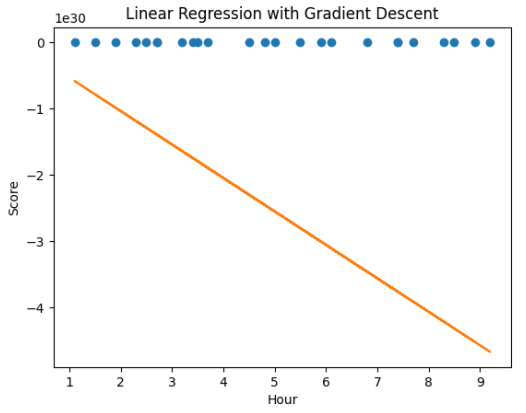
No. of iterations: 10

Initial m = 0

Initial b = 0

**Observation:** We can see that the obtained values are not good when we give higher learning rates (0.1 and 0.3). We miss the optimum values for higher learning rates. For obtaining better results, we can go for SGD (Stochastic Gradient Descent) or tune the above parameters.

LR	Predicted Value	Plot
0.001	24.59, 51.54, 33.57, 86.46, 36.57, 16.61, 93.45, 56.53, 84.47, 28.58, 78.48, 60.52, 46.55, 35.57, 12.62, 90.46, 26.59, 20.6, 62.51, 75.49, 28.58, 49.54, 38.56, 69.5, 75.49	
0.003	25.15, 52.7, 34.34, 88.42, 37.4, 16.99, 95.56, 57.81, 86.38, 29.24, 80.25, 61.89, 47.6, 36.38, 12.91, 92.5, 27.2, 21.07, 63.93, 77.19, 29.24, 50.66, 39.44, 71.07, 77.19	

0.01	26.27, 55.08, 35.88, 92.43, 39.08, 17.74, 99.9, 60.42, 90.3, 30.54, 83.89, 64.69, 49.75, 38.01, 13.47, 96.7, 28.41, 22.01, 66.82, 80.69, 30.54, 52.95, 41.21, 74.29, 80.69	
0.03	29.6, 61.47, 40.23, 102.79, 43.77, 20.16, 111.05, 67.38, 100.43, 34.32, 93.35, 72.1, 55.57, 42.59, 15.44, 107.51, 31.96, 24.88, 74.46, 89.8, 34.32, 59.11, 46.13, 82.72, 89.8	
0.1	-1.1850862373666779e+30, - 2.5469933349732056e+30, - 1.6390552699021874e+30, - 4.3124284615001865e+30, - 1.790378280747357e+30, - 7.815582084462253e+29, - 4.665515486805582e+30, - 2.799198353048489e+30, - 4.2115464542700734e+30, - 1.3868502518269045e+30, - 3.908900432579734e+30, - 3.000962367508715e+30, - 2.2947883168979228e+30, - 1.7399372771323005e+30, - 5.79794193985999e+29, - 4.514192475960413e+30, - 1.285968244596791e+30, - 9.833222229064516e+29, - 3.101844374738828e+30, - 3.757577421734564e+30, - 1.3868502518269045e+30, - 2.4461113277430925e+30, - 1.8912602879774702e+30, - 3.4549314000442245e+30, - 3.757577421734564e+30	
0.3	-5.0009184788770495e+159, - 1.054581071140131e+160, - 6.84921588971847e+159, -	

1.7733633975784606e+160, -  
7.465315026665611e+159, -  
3.3579874470180107e+159, -  
1.9171198628661264e+160, -  
1.157264260631321e+160, -  
1.7322901217819848e+160, -  
5.82238399480657e+159, -  
1.6090702943925566e+160, -  
1.239410812224273e+160, -  
9.51897881648941e+159, -  
7.25994864768323e+159, -  
2.536521931088491e+159, -  
1.8555099491714126e+160, -  
5.41165123684181e+159, -  
4.17945296294753e+159, -  
1.280484088020749e+160, -  
1.5474603806978428e+160, -  
5.82238399480657e+159, -  
1.013507795343655e+160, -  
7.876047784630371e+159, -  
1.4242405533084147e+160, -  
1.5474603806978428e+160

