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SEC:01

CourseCode:20cs3026RA

In [2]:
```python
pip install PrettyTable
```

```
Collecting PrettyTableNote: you may need to restart the kernel to use updated packages.

  Downloading prettytable-3.4.1-py3-none-any.whl (26 kB)
Requirement already satisfied: wcwidth in c:\users\sri harshitha\anaconda3\anaconda\lib
\site-packages (from PrettyTable) (0.2.5)
Installing collected packages: PrettyTable
Successfully installed PrettyTable-3.4.1
```

In [3]:
```python
import warnings
warnings.filterwarnings("ignore")
from sklearn.datasets import load_boston
from random import seed
from random import randrange
from csv import reader
from math import sqrt
from sklearn import preprocessing
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from prettytable import PrettyTable
from sklearn.linear_model import SGDRegressor
from sklearn import preprocessing
from sklearn.metrics import mean_squared_error
from sklearn.model_selection import train_test_split
```

In [4]:
```python
X = load_boston().data
Y = load_boston().target
```

In [5]:
```python
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.3, random_state=0)
```

In [6]:
```python
scaler = preprocessing.StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

In [7]:
```python
X_train = pd.DataFrame(data = X_train, columns=load_boston().feature_names)
X_train['Price'] = list(y_train)
X_test = pd.DataFrame(data = X_test, columns=load_boston().feature_names)
X_test['Price'] = list(y_test)
```

In [8]:
```python
X_train.head()
```

Out[8]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTI
0	-0.207356	-0.499979	1.548016	-0.263603	0.588213	-1.839367	1.107402	-1.125110	-0.618160	0.206735	1.2

1	-0.388865	0.346774	-0.589747	-0.263603	-0.797821	0.327487	-0.367661	0.075090	-0.733637	-1.049493	0.0
2	-0.335735	-0.499979	1.548016	-0.263603	0.588213	0.037907	1.043114	-0.799984	-0.618160	0.206735	1.2
3	-0.394852	2.463658	-1.265584	-0.263603	-1.352235	0.052172	-1.746292	1.968937	-0.502683	-0.257013	-1.6
4	-0.391456	-0.499979	2.086394	-0.263603	0.215716	-0.495604	0.853820	-0.811511	-0.849114	-1.254951	0.2

In [9]:
```python
def sgd_regressor(X, y, learning_rate=0.2, n_epochs=1000, k=40):

    w = np.random.randn(1,13)  # Randomly initializing weights
    b = np.random.randn(1,1)   # Random intercept value

    epoch=1

    while epoch <= n_epochs:

        temp = X.sample(k)

        X_tr = temp.iloc[:,0:13].values
        y_tr = temp.iloc[:,-1].values

        Lw = w
        Lb = b

        loss = 0
        y_pred = []
        sq_loss = []

        for i in range(k):

            Lw = (-2/k * X_tr[i]) * (y_tr[i] - np.dot(X_tr[i],w.T) - b)
            Lb = (-2/k) * (y_tr[i] - np.dot(X_tr[i],w.T) - b)

            w = w - learning_rate * Lw
            b = b - learning_rate * Lb

            y_predicted = np.dot(X_tr[i],w.T)
            y_pred.append(y_predicted)

        loss = mean_squared_error(y_pred, y_tr)

        print("Epoch: %d, Loss: %.3f" %(epoch, loss))
        epoch+=1
        learning_rate = learning_rate/1.02

    return w,b

def predict(x,w,b):
    y_pred=[]
    for i in range(len(x)):
        temp_ = x
        X_test = temp_.iloc[:,0:13].values
        y = np.asscalar(np.dot(w,X_test[i])+b)
        y_pred.append(y)
    return np.array(y_pred)
```

In [10]:
```python
w,b = sgd_regressor(X_train,y_train)
y_pred_customsgd = predict(X_test,w,b)

from matplotlib.pyplot import figure
plt.figure(figsize=(25,6))
plt.plot(y_test, label='Actual')
plt.plot(y_pred_customsgd, label='Predicted')
```

```
plt.legend(prop={'size': 16})
plt.show()
print('Mean Squared Error :',mean_squared_error(y_test, y_pred_customsgd))
```

```
Epoch: 1, Loss: 474.440
Epoch: 2, Loss: 451.063
Epoch: 3, Loss: 506.109
Epoch: 4, Loss: 499.425
Epoch: 5, Loss: 491.238
Epoch: 6, Loss: 506.065
Epoch: 7, Loss: 509.829
Epoch: 8, Loss: 514.697
Epoch: 9, Loss: 536.834
Epoch: 10, Loss: 512.084
Epoch: 11, Loss: 525.200
Epoch: 12, Loss: 471.322
Epoch: 13, Loss: 524.702
Epoch: 14, Loss: 636.459
Epoch: 15, Loss: 555.918
Epoch: 16, Loss: 506.803
Epoch: 17, Loss: 542.832
Epoch: 18, Loss: 514.156
Epoch: 19, Loss: 517.490
Epoch: 20, Loss: 508.944
Epoch: 21, Loss: 639.487
Epoch: 22, Loss: 556.030
Epoch: 23, Loss: 582.569
Epoch: 24, Loss: 513.462
Epoch: 25, Loss: 532.852
Epoch: 26, Loss: 531.470
Epoch: 27, Loss: 529.835
Epoch: 28, Loss: 510.357
Epoch: 29, Loss: 526.875
Epoch: 30, Loss: 531.881
Epoch: 31, Loss: 536.123
Epoch: 32, Loss: 489.595
Epoch: 33, Loss: 489.506
Epoch: 34, Loss: 527.837
Epoch: 35, Loss: 534.149
Epoch: 36, Loss: 557.124
Epoch: 37, Loss: 524.012
Epoch: 38, Loss: 572.193
Epoch: 39, Loss: 574.419
Epoch: 40, Loss: 612.051
Epoch: 41, Loss: 557.290
Epoch: 42, Loss: 493.615
Epoch: 43, Loss: 608.258
Epoch: 44, Loss: 528.514
Epoch: 45, Loss: 532.984
Epoch: 46, Loss: 537.001
Epoch: 47, Loss: 513.204
Epoch: 48, Loss: 563.563
Epoch: 49, Loss: 557.049
Epoch: 50, Loss: 558.269
Epoch: 51, Loss: 504.232
Epoch: 52, Loss: 522.910
Epoch: 53, Loss: 550.304
Epoch: 54, Loss: 493.133
Epoch: 55, Loss: 495.975
Epoch: 56, Loss: 512.423
Epoch: 57, Loss: 488.092
Epoch: 58, Loss: 496.452
Epoch: 59, Loss: 543.232
Epoch: 60, Loss: 529.606
Epoch: 61, Loss: 576.479
Epoch: 62, Loss: 505.828
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Epoch: 63, Loss: 574.796
Epoch: 64, Loss: 550.814
Epoch: 65, Loss: 532.069
Epoch: 66, Loss: 555.851
Epoch: 67, Loss: 472.757
Epoch: 68, Loss: 630.511
Epoch: 69, Loss: 546.694
Epoch: 70, Loss: 517.293
Epoch: 71, Loss: 527.764
Epoch: 72, Loss: 565.550
Epoch: 73, Loss: 530.735
Epoch: 74, Loss: 488.021
Epoch: 75, Loss: 501.005
Epoch: 76, Loss: 510.170
Epoch: 77, Loss: 590.740
Epoch: 78, Loss: 525.262
Epoch: 79, Loss: 450.558
Epoch: 80, Loss: 504.732
Epoch: 81, Loss: 568.475
Epoch: 82, Loss: 523.676
Epoch: 83, Loss: 539.503
Epoch: 84, Loss: 619.414
Epoch: 85, Loss: 537.491
Epoch: 86, Loss: 556.856
Epoch: 87, Loss: 542.663
Epoch: 88, Loss: 607.316
Epoch: 89, Loss: 551.423
Epoch: 90, Loss: 515.644
Epoch: 91, Loss: 587.034
Epoch: 92, Loss: 557.351
Epoch: 93, Loss: 558.889
Epoch: 94, Loss: 530.631
Epoch: 95, Loss: 510.791
Epoch: 96, Loss: 495.625
Epoch: 97, Loss: 513.435
Epoch: 98, Loss: 507.795
Epoch: 99, Loss: 533.411
Epoch: 100, Loss: 551.159
Epoch: 101, Loss: 545.625
Epoch: 102, Loss: 497.746
Epoch: 103, Loss: 507.177
Epoch: 104, Loss: 517.514
Epoch: 105, Loss: 557.692
Epoch: 106, Loss: 611.594
Epoch: 107, Loss: 641.685
Epoch: 108, Loss: 498.358
Epoch: 109, Loss: 554.912
Epoch: 110, Loss: 524.285
Epoch: 111, Loss: 498.208
Epoch: 112, Loss: 509.798
Epoch: 113, Loss: 627.546
Epoch: 114, Loss: 594.152
Epoch: 115, Loss: 479.519
Epoch: 116, Loss: 518.814
Epoch: 117, Loss: 453.058
Epoch: 118, Loss: 530.208
Epoch: 119, Loss: 546.935
Epoch: 120, Loss: 488.309
Epoch: 121, Loss: 531.833
Epoch: 122, Loss: 500.472
Epoch: 123, Loss: 546.734
Epoch: 124, Loss: 477.824
Epoch: 125, Loss: 637.382
Epoch: 126, Loss: 571.279
Epoch: 127, Loss: 570.627
Epoch: 128, Loss: 515.086
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Epoch: 129, Loss: 552.307
Epoch: 130, Loss: 522.123
Epoch: 131, Loss: 581.826
Epoch: 132, Loss: 518.997
Epoch: 133, Loss: 478.677
Epoch: 134, Loss: 513.446
Epoch: 135, Loss: 521.718
Epoch: 136, Loss: 546.476
Epoch: 137, Loss: 524.199
Epoch: 138, Loss: 543.405
Epoch: 139, Loss: 535.532
Epoch: 140, Loss: 525.021
Epoch: 141, Loss: 551.577
Epoch: 142, Loss: 604.158
Epoch: 143, Loss: 513.652
Epoch: 144, Loss: 468.765
Epoch: 145, Loss: 496.695
Epoch: 146, Loss: 605.492
Epoch: 147, Loss: 569.307
Epoch: 148, Loss: 535.637
Epoch: 149, Loss: 540.260
Epoch: 150, Loss: 522.079
Epoch: 151, Loss: 547.305
Epoch: 152, Loss: 608.151
Epoch: 153, Loss: 548.622
Epoch: 154, Loss: 557.881
Epoch: 155, Loss: 531.199
Epoch: 156, Loss: 483.686
Epoch: 157, Loss: 530.112
Epoch: 158, Loss: 536.620
Epoch: 159, Loss: 540.970
Epoch: 160, Loss: 580.681
Epoch: 161, Loss: 656.888
Epoch: 162, Loss: 502.918
Epoch: 163, Loss: 582.522
Epoch: 164, Loss: 507.607
Epoch: 165, Loss: 547.538
Epoch: 166, Loss: 526.071
Epoch: 167, Loss: 521.315
Epoch: 168, Loss: 529.694
Epoch: 169, Loss: 566.824
Epoch: 170, Loss: 559.778
Epoch: 171, Loss: 525.515
Epoch: 172, Loss: 520.210
Epoch: 173, Loss: 507.240
Epoch: 174, Loss: 509.031
Epoch: 175, Loss: 560.854
Epoch: 176, Loss: 434.281
Epoch: 177, Loss: 587.084
Epoch: 178, Loss: 529.147
Epoch: 179, Loss: 537.381
Epoch: 180, Loss: 525.408
Epoch: 181, Loss: 506.654
Epoch: 182, Loss: 497.325
Epoch: 183, Loss: 539.903
Epoch: 184, Loss: 538.858
Epoch: 185, Loss: 526.028
Epoch: 186, Loss: 550.069
Epoch: 187, Loss: 502.453
Epoch: 188, Loss: 462.709
Epoch: 189, Loss: 517.452
Epoch: 190, Loss: 539.413
Epoch: 191, Loss: 573.431
Epoch: 192, Loss: 533.762
Epoch: 193, Loss: 580.984
Epoch: 194, Loss: 553.564
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Epoch: 195, Loss: 516.290
Epoch: 196, Loss: 575.018
Epoch: 197, Loss: 607.825
Epoch: 198, Loss: 532.122
Epoch: 199, Loss: 509.899
Epoch: 200, Loss: 572.996
Epoch: 201, Loss: 580.494
Epoch: 202, Loss: 496.580
Epoch: 203, Loss: 504.130
Epoch: 204, Loss: 552.446
Epoch: 205, Loss: 496.761
Epoch: 206, Loss: 582.991
Epoch: 207, Loss: 546.382
Epoch: 208, Loss: 482.501
Epoch: 209, Loss: 519.703
Epoch: 210, Loss: 549.843
Epoch: 211, Loss: 533.746
Epoch: 212, Loss: 581.784
Epoch: 213, Loss: 540.817
Epoch: 214, Loss: 556.090
Epoch: 215, Loss: 571.068
Epoch: 216, Loss: 551.452
Epoch: 217, Loss: 541.354
Epoch: 218, Loss: 595.370
Epoch: 219, Loss: 518.013
Epoch: 220, Loss: 587.057
Epoch: 221, Loss: 515.090
Epoch: 222, Loss: 501.446
Epoch: 223, Loss: 472.755
Epoch: 224, Loss: 562.948
Epoch: 225, Loss: 542.505
Epoch: 226, Loss: 520.522
Epoch: 227, Loss: 474.351
Epoch: 228, Loss: 543.692
Epoch: 229, Loss: 565.670
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Epoch: 231, Loss: 529.472
Epoch: 232, Loss: 507.395
Epoch: 233, Loss: 581.286
Epoch: 234, Loss: 534.491
Epoch: 235, Loss: 541.302
Epoch: 236, Loss: 492.125
Epoch: 237, Loss: 538.061
Epoch: 238, Loss: 529.591
Epoch: 239, Loss: 494.791
Epoch: 240, Loss: 522.782
Epoch: 241, Loss: 496.322
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Epoch: 254, Loss: 544.033
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Epoch: 256, Loss: 512.743
Epoch: 257, Loss: 576.682
Epoch: 258, Loss: 514.950
Epoch: 259, Loss: 609.197
Epoch: 260, Loss: 572.142
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Epoch: 261, Loss: 542.012
Epoch: 262, Loss: 536.677
Epoch: 263, Loss: 586.801
Epoch: 264, Loss: 551.124
Epoch: 265, Loss: 537.669
Epoch: 266, Loss: 563.982
Epoch: 267, Loss: 564.035
Epoch: 268, Loss: 498.575
Epoch: 269, Loss: 521.228
Epoch: 270, Loss: 612.321
Epoch: 271, Loss: 545.455
Epoch: 272, Loss: 569.244
Epoch: 273, Loss: 559.682
Epoch: 274, Loss: 564.871
Epoch: 275, Loss: 532.199
Epoch: 276, Loss: 555.002
Epoch: 277, Loss: 612.330
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Epoch: 279, Loss: 494.905
Epoch: 280, Loss: 572.211
Epoch: 281, Loss: 607.362
Epoch: 282, Loss: 536.646
Epoch: 283, Loss: 529.511
Epoch: 284, Loss: 556.524
Epoch: 285, Loss: 566.152
Epoch: 286, Loss: 520.342
Epoch: 287, Loss: 549.530
Epoch: 288, Loss: 478.154
Epoch: 289, Loss: 528.544
Epoch: 290, Loss: 575.543
Epoch: 291, Loss: 488.298
Epoch: 292, Loss: 484.169
Epoch: 293, Loss: 488.873
Epoch: 294, Loss: 467.886
Epoch: 295, Loss: 546.963
Epoch: 296, Loss: 549.664
Epoch: 297, Loss: 491.657
Epoch: 298, Loss: 510.075
Epoch: 299, Loss: 580.702
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Epoch: 301, Loss: 509.170
Epoch: 302, Loss: 578.554
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Epoch: 304, Loss: 548.293
Epoch: 305, Loss: 513.281
Epoch: 306, Loss: 489.460
Epoch: 307, Loss: 608.710
Epoch: 308, Loss: 458.167
Epoch: 309, Loss: 523.052
Epoch: 310, Loss: 508.377
Epoch: 311, Loss: 504.056
Epoch: 312, Loss: 484.929
Epoch: 313, Loss: 484.698
Epoch: 314, Loss: 520.902
Epoch: 315, Loss: 578.745
Epoch: 316, Loss: 530.171
Epoch: 317, Loss: 538.928
Epoch: 318, Loss: 567.248
Epoch: 319, Loss: 533.291
Epoch: 320, Loss: 602.803
Epoch: 321, Loss: 520.738
Epoch: 322, Loss: 564.819
Epoch: 323, Loss: 561.300
Epoch: 324, Loss: 536.505
Epoch: 325, Loss: 609.965
Epoch: 326, Loss: 521.888
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Epoch: 327, Loss: 531.201
Epoch: 328, Loss: 546.440
Epoch: 329, Loss: 542.533
Epoch: 330, Loss: 503.260
Epoch: 331, Loss: 536.614
Epoch: 332, Loss: 472.461
Epoch: 333, Loss: 576.641
Epoch: 334, Loss: 515.516
Epoch: 335, Loss: 568.781
Epoch: 336, Loss: 563.615
Epoch: 337, Loss: 509.995
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Epoch: 339, Loss: 541.166
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Epoch: 342, Loss: 528.320
Epoch: 343, Loss: 577.173
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Epoch: 351, Loss: 552.520
Epoch: 352, Loss: 557.263
Epoch: 353, Loss: 553.396
Epoch: 354, Loss: 549.328
Epoch: 355, Loss: 524.678
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Epoch: 357, Loss: 479.247
Epoch: 358, Loss: 527.105
Epoch: 359, Loss: 552.390
Epoch: 360, Loss: 571.875
Epoch: 361, Loss: 500.120
Epoch: 362, Loss: 503.649
Epoch: 363, Loss: 511.835
Epoch: 364, Loss: 509.943
Epoch: 365, Loss: 560.962
Epoch: 366, Loss: 611.066
Epoch: 367, Loss: 535.478
Epoch: 368, Loss: 484.229
Epoch: 369, Loss: 564.967
Epoch: 370, Loss: 546.011
Epoch: 371, Loss: 524.113
Epoch: 372, Loss: 532.699
Epoch: 373, Loss: 546.484
Epoch: 374, Loss: 490.228
Epoch: 375, Loss: 564.746
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Epoch: 377, Loss: 536.959
Epoch: 378, Loss: 499.919
Epoch: 379, Loss: 604.126
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Epoch: 381, Loss: 544.172
Epoch: 382, Loss: 554.993
Epoch: 383, Loss: 546.319
Epoch: 384, Loss: 493.653
Epoch: 385, Loss: 557.099
Epoch: 386, Loss: 482.330
Epoch: 387, Loss: 591.923
Epoch: 388, Loss: 559.163
Epoch: 389, Loss: 576.370
Epoch: 390, Loss: 529.421
Epoch: 391, Loss: 548.990
Epoch: 392, Loss: 563.260
```

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Epoch: 393, Loss: 543.546
Epoch: 394, Loss: 502.287
Epoch: 395, Loss: 523.408
Epoch: 396, Loss: 532.677
Epoch: 397, Loss: 527.990
Epoch: 398, Loss: 574.625
Epoch: 399, Loss: 532.988
Epoch: 400, Loss: 544.550
Epoch: 401, Loss: 583.408
Epoch: 402, Loss: 561.656
Epoch: 403, Loss: 563.881
Epoch: 404, Loss: 560.621
Epoch: 405, Loss: 500.918
Epoch: 406, Loss: 507.564
Epoch: 407, Loss: 483.035
Epoch: 408, Loss: 572.826
Epoch: 409, Loss: 581.721
Epoch: 410, Loss: 561.876
Epoch: 411, Loss: 499.013
Epoch: 412, Loss: 475.895
Epoch: 413, Loss: 534.383
Epoch: 414, Loss: 546.216
Epoch: 415, Loss: 524.309
Epoch: 416, Loss: 530.612
Epoch: 417, Loss: 539.544
Epoch: 418, Loss: 527.137
Epoch: 419, Loss: 550.636
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Epoch: 421, Loss: 501.193
Epoch: 422, Loss: 476.652
Epoch: 423, Loss: 518.595
Epoch: 424, Loss: 581.545
Epoch: 425, Loss: 514.556
Epoch: 426, Loss: 536.261
Epoch: 427, Loss: 568.983
Epoch: 428, Loss: 559.583
Epoch: 429, Loss: 512.205
Epoch: 430, Loss: 595.181
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Epoch: 439, Loss: 530.953
Epoch: 440, Loss: 526.106
Epoch: 441, Loss: 537.134
Epoch: 442, Loss: 566.461
Epoch: 443, Loss: 564.011
Epoch: 444, Loss: 552.058
Epoch: 445, Loss: 520.628
Epoch: 446, Loss: 565.530
Epoch: 447, Loss: 610.877
Epoch: 448, Loss: 518.400
Epoch: 449, Loss: 611.070
Epoch: 450, Loss: 551.611
Epoch: 451, Loss: 621.709
Epoch: 452, Loss: 512.526
Epoch: 453, Loss: 540.220
Epoch: 454, Loss: 483.338
Epoch: 455, Loss: 477.919
Epoch: 456, Loss: 536.915
Epoch: 457, Loss: 554.928
Epoch: 458, Loss: 576.276
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Epoch: 459, Loss: 506.947
Epoch: 460, Loss: 582.005
Epoch: 461, Loss: 511.594
Epoch: 462, Loss: 516.745
Epoch: 463, Loss: 570.583
Epoch: 464, Loss: 549.807
Epoch: 465, Loss: 533.750
Epoch: 466, Loss: 536.076
Epoch: 467, Loss: 617.123
Epoch: 468, Loss: 602.243
Epoch: 469, Loss: 648.849
Epoch: 470, Loss: 589.040
Epoch: 471, Loss: 531.180
Epoch: 472, Loss: 509.074
Epoch: 473, Loss: 537.419
Epoch: 474, Loss: 528.144
Epoch: 475, Loss: 538.701
Epoch: 476, Loss: 529.176
Epoch: 477, Loss: 520.073
Epoch: 478, Loss: 525.636
Epoch: 479, Loss: 526.814
Epoch: 480, Loss: 552.799
Epoch: 481, Loss: 514.210
Epoch: 482, Loss: 521.902
Epoch: 483, Loss: 592.846
Epoch: 484, Loss: 605.195
Epoch: 485, Loss: 573.149
Epoch: 486, Loss: 573.016
Epoch: 487, Loss: 624.466
Epoch: 488, Loss: 538.809
Epoch: 489, Loss: 532.757
Epoch: 490, Loss: 554.556
Epoch: 491, Loss: 469.690
Epoch: 492, Loss: 481.970
Epoch: 493, Loss: 516.754
Epoch: 494, Loss: 482.957
Epoch: 495, Loss: 486.535
Epoch: 496, Loss: 495.250
Epoch: 497, Loss: 501.020
Epoch: 498, Loss: 487.930
Epoch: 499, Loss: 579.515
Epoch: 500, Loss: 560.634
Epoch: 501, Loss: 523.142
Epoch: 502, Loss: 518.164
Epoch: 503, Loss: 514.225
Epoch: 504, Loss: 535.966
Epoch: 505, Loss: 493.192
Epoch: 506, Loss: 514.706
Epoch: 507, Loss: 581.377
Epoch: 508, Loss: 557.674
Epoch: 509, Loss: 460.479
Epoch: 510, Loss: 564.038
Epoch: 511, Loss: 528.191
Epoch: 512, Loss: 581.877
Epoch: 513, Loss: 493.078
Epoch: 514, Loss: 557.028
Epoch: 515, Loss: 548.015
Epoch: 516, Loss: 511.797
Epoch: 517, Loss: 539.254
Epoch: 518, Loss: 510.358
Epoch: 519, Loss: 514.082
Epoch: 520, Loss: 529.552
Epoch: 521, Loss: 538.474
Epoch: 522, Loss: 574.793
Epoch: 523, Loss: 532.424
Epoch: 524, Loss: 526.251
```

```
Epoch: 525, Loss: 500.745
Epoch: 526, Loss: 506.253
Epoch: 527, Loss: 553.612
Epoch: 528, Loss: 516.719
Epoch: 529, Loss: 574.695
Epoch: 530, Loss: 610.322
Epoch: 531, Loss: 560.188
Epoch: 532, Loss: 663.159
Epoch: 533, Loss: 531.206
Epoch: 534, Loss: 569.622
Epoch: 535, Loss: 566.202
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Epoch: 539, Loss: 507.548
Epoch: 540, Loss: 512.793
Epoch: 541, Loss: 502.214
Epoch: 542, Loss: 514.006
Epoch: 543, Loss: 531.726
Epoch: 544, Loss: 493.044
Epoch: 545, Loss: 572.812
Epoch: 546, Loss: 573.292
Epoch: 547, Loss: 502.613
Epoch: 548, Loss: 502.465
Epoch: 549, Loss: 590.746
Epoch: 550, Loss: 518.688
Epoch: 551, Loss: 541.600
Epoch: 552, Loss: 507.076
Epoch: 553, Loss: 502.906
Epoch: 554, Loss: 509.713
Epoch: 555, Loss: 534.586
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Epoch: 559, Loss: 538.242
Epoch: 560, Loss: 535.470
Epoch: 561, Loss: 522.380
Epoch: 562, Loss: 502.258
Epoch: 563, Loss: 640.502
Epoch: 564, Loss: 559.559
Epoch: 565, Loss: 508.140
Epoch: 566, Loss: 570.726
Epoch: 567, Loss: 507.984
Epoch: 568, Loss: 600.737
Epoch: 569, Loss: 558.974
Epoch: 570, Loss: 537.596
Epoch: 571, Loss: 542.361
Epoch: 572, Loss: 524.867
Epoch: 573, Loss: 521.974
Epoch: 574, Loss: 555.175
Epoch: 575, Loss: 526.503
Epoch: 576, Loss: 525.353
Epoch: 577, Loss: 578.728
Epoch: 578, Loss: 588.008
Epoch: 579, Loss: 553.028
Epoch: 580, Loss: 517.995
Epoch: 581, Loss: 519.474
Epoch: 582, Loss: 542.579
Epoch: 583, Loss: 544.018
Epoch: 584, Loss: 511.030
Epoch: 585, Loss: 549.732
Epoch: 586, Loss: 585.315
Epoch: 587, Loss: 572.774
Epoch: 588, Loss: 584.360
Epoch: 589, Loss: 557.087
Epoch: 590, Loss: 586.042
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Epoch: 591, Loss: 589.714
Epoch: 592, Loss: 563.991
Epoch: 593, Loss: 525.858
Epoch: 594, Loss: 556.245
Epoch: 595, Loss: 546.999
Epoch: 596, Loss: 489.190
Epoch: 597, Loss: 521.103
Epoch: 598, Loss: 535.474
Epoch: 599, Loss: 583.420
Epoch: 600, Loss: 502.676
Epoch: 601, Loss: 539.445
Epoch: 602, Loss: 502.282
Epoch: 603, Loss: 568.937
Epoch: 604, Loss: 499.981
Epoch: 605, Loss: 537.140
Epoch: 606, Loss: 580.090
Epoch: 607, Loss: 537.163
Epoch: 608, Loss: 610.804
Epoch: 609, Loss: 569.672
Epoch: 610, Loss: 570.980
Epoch: 611, Loss: 450.614
Epoch: 612, Loss: 583.056
Epoch: 613, Loss: 529.369
Epoch: 614, Loss: 484.313
Epoch: 615, Loss: 570.191
Epoch: 616, Loss: 570.121
Epoch: 617, Loss: 487.611
Epoch: 618, Loss: 510.052
Epoch: 619, Loss: 498.920
Epoch: 620, Loss: 465.338
Epoch: 621, Loss: 499.008
Epoch: 622, Loss: 454.220
Epoch: 623, Loss: 586.458
Epoch: 624, Loss: 483.659
Epoch: 625, Loss: 557.823
Epoch: 626, Loss: 507.439
Epoch: 627, Loss: 553.898
Epoch: 628, Loss: 501.794
Epoch: 629, Loss: 519.837
Epoch: 630, Loss: 498.811
Epoch: 631, Loss: 505.605
Epoch: 632, Loss: 561.535
Epoch: 633, Loss: 552.304
Epoch: 634, Loss: 493.911
Epoch: 635, Loss: 556.755
Epoch: 636, Loss: 521.876
Epoch: 637, Loss: 513.167
Epoch: 638, Loss: 533.752
Epoch: 639, Loss: 516.336
Epoch: 640, Loss: 540.288
Epoch: 641, Loss: 534.937
Epoch: 642, Loss: 510.680
Epoch: 643, Loss: 533.210
Epoch: 644, Loss: 600.060
Epoch: 645, Loss: 524.453
Epoch: 646, Loss: 543.968
Epoch: 647, Loss: 569.760
Epoch: 648, Loss: 514.245
Epoch: 649, Loss: 491.962
Epoch: 650, Loss: 581.757
Epoch: 651, Loss: 483.076
Epoch: 652, Loss: 506.800
Epoch: 653, Loss: 524.299
Epoch: 654, Loss: 513.387
Epoch: 655, Loss: 527.970
Epoch: 656, Loss: 568.227
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Epoch: 657, Loss: 489.493
Epoch: 658, Loss: 503.382
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Epoch: 663, Loss: 596.865
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Epoch: 666, Loss: 562.505
Epoch: 667, Loss: 503.385
Epoch: 668, Loss: 553.624
Epoch: 669, Loss: 557.456
Epoch: 670, Loss: 527.995
Epoch: 671, Loss: 540.920
Epoch: 672, Loss: 515.405
Epoch: 673, Loss: 521.985
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Epoch: 675, Loss: 574.668
Epoch: 676, Loss: 510.551
Epoch: 677, Loss: 549.298
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Epoch: 679, Loss: 553.441
Epoch: 680, Loss: 559.021
Epoch: 681, Loss: 595.519
Epoch: 682, Loss: 568.047
Epoch: 683, Loss: 554.873
Epoch: 684, Loss: 528.252
Epoch: 685, Loss: 579.322
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Epoch: 687, Loss: 525.872
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Epoch: 697, Loss: 533.010
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Epoch: 714, Loss: 546.502
Epoch: 715, Loss: 547.836
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Epoch: 718, Loss: 593.047
Epoch: 719, Loss: 475.689
Epoch: 720, Loss: 602.206
Epoch: 721, Loss: 586.054
Epoch: 722, Loss: 539.514
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Epoch: 730, Loss: 546.356
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Epoch: 753, Loss: 515.571
Epoch: 754, Loss: 616.564
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Epoch: 757, Loss: 503.703
Epoch: 758, Loss: 523.633
Epoch: 759, Loss: 522.918
Epoch: 760, Loss: 535.631
Epoch: 761, Loss: 606.310
Epoch: 762, Loss: 552.472
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Epoch: 764, Loss: 589.546
Epoch: 765, Loss: 579.509
Epoch: 766, Loss: 537.661
Epoch: 767, Loss: 547.072
Epoch: 768, Loss: 547.532
Epoch: 769, Loss: 548.315
Epoch: 770, Loss: 536.541
Epoch: 771, Loss: 526.062
Epoch: 772, Loss: 479.871
Epoch: 773, Loss: 545.853
Epoch: 774, Loss: 543.642
Epoch: 775, Loss: 536.910
Epoch: 776, Loss: 601.440
Epoch: 777, Loss: 544.637
Epoch: 778, Loss: 476.484
Epoch: 779, Loss: 560.059
Epoch: 780, Loss: 546.937
Epoch: 781, Loss: 568.661
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Epoch: 784, Loss: 461.770
Epoch: 785, Loss: 599.430
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Epoch: 787, Loss: 502.555
Epoch: 788, Loss: 581.600
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Epoch: 802, Loss: 520.871
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Epoch: 804, Loss: 529.925
Epoch: 805, Loss: 515.796
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Epoch: 807, Loss: 556.790
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Epoch: 810, Loss: 563.879
Epoch: 811, Loss: 469.794
Epoch: 812, Loss: 559.023
Epoch: 813, Loss: 491.730
Epoch: 814, Loss: 519.631
Epoch: 815, Loss: 565.690
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Epoch: 823, Loss: 541.189
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Epoch: 839, Loss: 528.878
Epoch: 840, Loss: 516.970
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Epoch: 843, Loss: 507.130
Epoch: 844, Loss: 482.266
Epoch: 845, Loss: 566.483
Epoch: 846, Loss: 600.214
Epoch: 847, Loss: 475.059
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Epoch: 849, Loss: 549.816
Epoch: 850, Loss: 477.463
Epoch: 851, Loss: 532.871
Epoch: 852, Loss: 578.436
Epoch: 853, Loss: 609.339
Epoch: 854, Loss: 516.102
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Epoch: 855, Loss: 479.783
Epoch: 856, Loss: 536.259
Epoch: 857, Loss: 536.738
Epoch: 858, Loss: 562.191
Epoch: 859, Loss: 556.617
Epoch: 860, Loss: 547.488
Epoch: 861, Loss: 515.298
Epoch: 862, Loss: 525.802
Epoch: 863, Loss: 517.462
Epoch: 864, Loss: 577.657
Epoch: 865, Loss: 513.968
Epoch: 866, Loss: 552.328
Epoch: 867, Loss: 564.500
Epoch: 868, Loss: 529.692
Epoch: 869, Loss: 562.075
Epoch: 870, Loss: 560.000
Epoch: 871, Loss: 599.801
Epoch: 872, Loss: 560.001
Epoch: 873, Loss: 602.552
Epoch: 874, Loss: 511.205
Epoch: 875, Loss: 554.407
Epoch: 876, Loss: 546.908
Epoch: 877, Loss: 463.986
Epoch: 878, Loss: 552.379
Epoch: 879, Loss: 585.522
Epoch: 880, Loss: 527.890
Epoch: 881, Loss: 546.026
Epoch: 882, Loss: 511.434
Epoch: 883, Loss: 541.171
Epoch: 884, Loss: 472.372
Epoch: 885, Loss: 513.501
Epoch: 886, Loss: 491.799
Epoch: 887, Loss: 563.688
Epoch: 888, Loss: 555.447
Epoch: 889, Loss: 565.335
Epoch: 890, Loss: 605.346
Epoch: 891, Loss: 512.073
Epoch: 892, Loss: 538.324
Epoch: 893, Loss: 550.686
Epoch: 894, Loss: 490.938
Epoch: 895, Loss: 533.782
Epoch: 896, Loss: 515.029
Epoch: 897, Loss: 539.674
Epoch: 898, Loss: 524.430
Epoch: 899, Loss: 526.677
Epoch: 900, Loss: 553.533
Epoch: 901, Loss: 545.498
Epoch: 902, Loss: 536.977
Epoch: 903, Loss: 575.707
Epoch: 904, Loss: 505.578
Epoch: 905, Loss: 539.549
Epoch: 906, Loss: 595.330
Epoch: 907, Loss: 579.439
Epoch: 908, Loss: 527.335
Epoch: 909, Loss: 527.935
Epoch: 910, Loss: 600.600
Epoch: 911, Loss: 535.520
Epoch: 912, Loss: 568.409
Epoch: 913, Loss: 542.647
Epoch: 914, Loss: 491.776
Epoch: 915, Loss: 505.685
Epoch: 916, Loss: 572.505
Epoch: 917, Loss: 463.529
Epoch: 918, Loss: 532.248
Epoch: 919, Loss: 555.652
Epoch: 920, Loss: 610.773
```
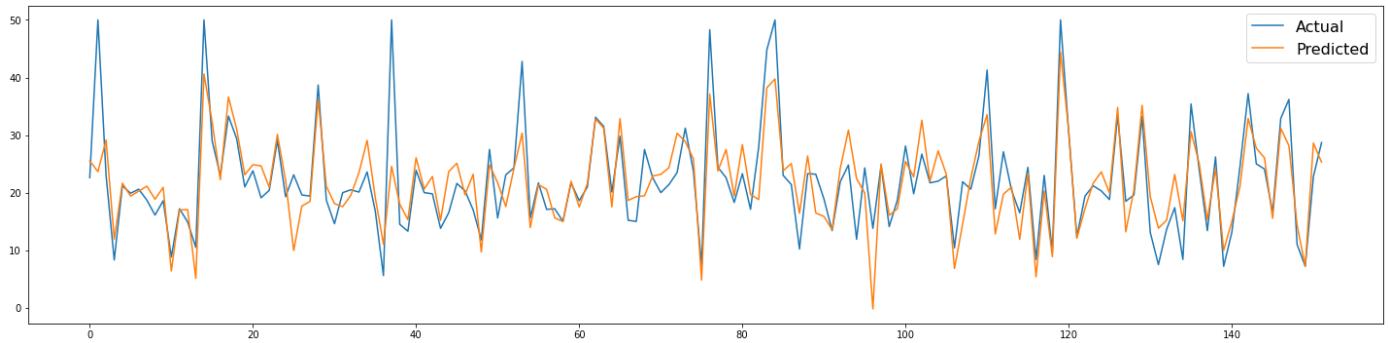
```
Epoch: 921, Loss: 549.346
Epoch: 922, Loss: 548.319
Epoch: 923, Loss: 510.619
Epoch: 924, Loss: 556.325
Epoch: 925, Loss: 574.427
Epoch: 926, Loss: 520.311
Epoch: 927, Loss: 525.277
Epoch: 928, Loss: 511.106
Epoch: 929, Loss: 592.587
Epoch: 930, Loss: 549.925
Epoch: 931, Loss: 555.964
Epoch: 932, Loss: 590.408
Epoch: 933, Loss: 580.467
Epoch: 934, Loss: 475.988
Epoch: 935, Loss: 507.855
Epoch: 936, Loss: 495.714
Epoch: 937, Loss: 502.440
Epoch: 938, Loss: 533.854
Epoch: 939, Loss: 519.158
Epoch: 940, Loss: 575.370
Epoch: 941, Loss: 508.283
Epoch: 942, Loss: 506.388
Epoch: 943, Loss: 498.928
Epoch: 944, Loss: 542.942
Epoch: 945, Loss: 478.499
Epoch: 946, Loss: 557.130
Epoch: 947, Loss: 540.129
Epoch: 948, Loss: 542.018
Epoch: 949, Loss: 498.081
Epoch: 950, Loss: 554.126
Epoch: 951, Loss: 506.256
Epoch: 952, Loss: 510.815
Epoch: 953, Loss: 530.074
Epoch: 954, Loss: 592.229
Epoch: 955, Loss: 567.124
Epoch: 956, Loss: 534.364
Epoch: 957, Loss: 497.475
Epoch: 958, Loss: 594.065
Epoch: 959, Loss: 519.108
Epoch: 960, Loss: 611.108
Epoch: 961, Loss: 541.816
Epoch: 962, Loss: 558.735
Epoch: 963, Loss: 555.701
Epoch: 964, Loss: 552.887
Epoch: 965, Loss: 562.884
Epoch: 966, Loss: 534.443
Epoch: 967, Loss: 564.349
Epoch: 968, Loss: 539.659
Epoch: 969, Loss: 599.629
Epoch: 970, Loss: 548.243
Epoch: 971, Loss: 535.500
Epoch: 972, Loss: 583.738
Epoch: 973, Loss: 572.186
Epoch: 974, Loss: 492.813
Epoch: 975, Loss: 564.383
Epoch: 976, Loss: 559.400
Epoch: 977, Loss: 531.761
Epoch: 978, Loss: 608.849
Epoch: 979, Loss: 582.777
Epoch: 980, Loss: 535.642
Epoch: 981, Loss: 487.135
Epoch: 982, Loss: 515.530
Epoch: 983, Loss: 477.301
Epoch: 984, Loss: 523.746
Epoch: 985, Loss: 576.484
Epoch: 986, Loss: 571.455
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Epoch: 987, Loss: 531.761
Epoch: 988, Loss: 532.187
Epoch: 989, Loss: 482.892
Epoch: 990, Loss: 508.864
Epoch: 991, Loss: 579.175
Epoch: 992, Loss: 550.930
Epoch: 993, Loss: 536.944
Epoch: 994, Loss: 535.672
Epoch: 995, Loss: 521.926
Epoch: 996, Loss: 619.343
Epoch: 997, Loss: 494.986
Epoch: 998, Loss: 502.171
Epoch: 999, Loss: 564.420
Epoch: 1000, Loss: 531.909
```
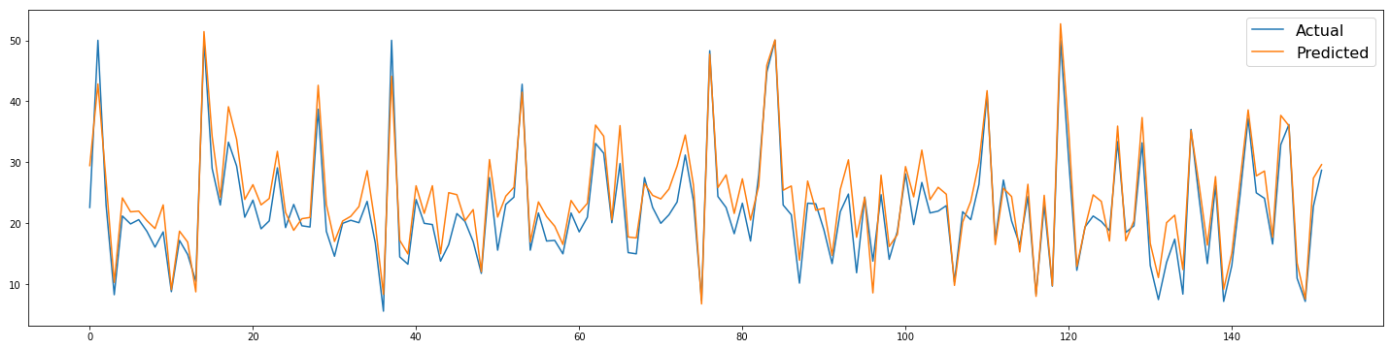


```
Mean Squared Error : 27.45652114632603
```

In [12]:
```python
from sklearn.linear_model import SGDRegressor
clf = SGDRegressor(max_iter=1000, tol=1e-3)
clf.fit(X_train, y_train)
y_pred = clf.predict(X_test)
import matplotlib.pyplot as plt
from matplotlib.pyplot import figure
plt.figure(figsize=(25,6))
plt.plot(y_test, label='Actual')
plt.plot(y_pred, label='Predicted')
plt.legend(prop={'size': 16})
plt.show()
print('Mean Squared Error :',mean_squared_error(y_test, y_pred))
```
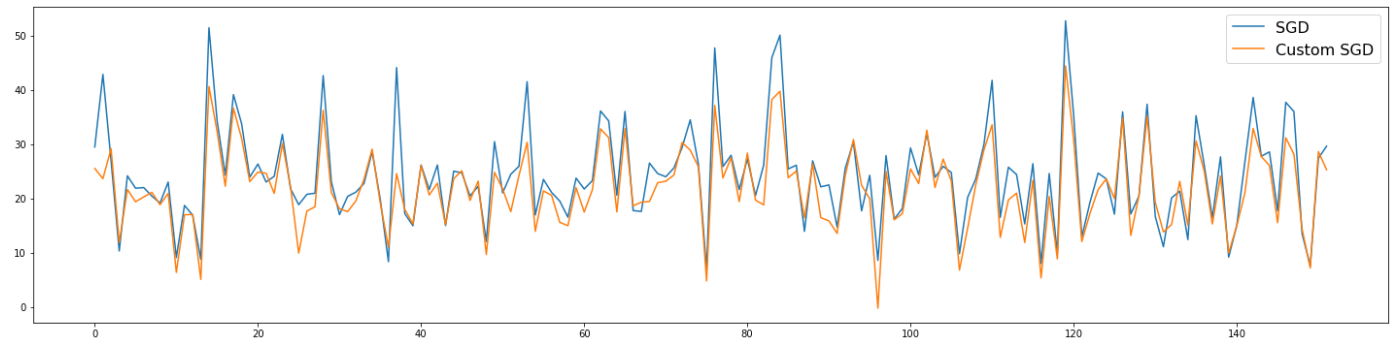


```
Mean Squared Error : 10.334494583525728
```

In [13]:
```python
import matplotlib.pyplot as plt
from matplotlib.pyplot import figure
plt.figure(figsize=(25,6))
plt.plot(y_pred, label='SGD')
plt.plot(y_pred_customsgd, label='Custom SGD')
plt.legend(prop={'size': 16})
plt.show()
print('Mean Squared Error of Custom SGD :',mean_squared_error(y_test, y_pred_customsgd))
print("Mean Squared Error of SKlearn's SGD :",mean_squared_error(y_test, y_pred))
```

Mean Squared Error of Custom SGD : 27.45652114632603
Mean Squared Error of SKlearn's SGD : 10.334494583525728

In [ ]: