In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
from sklearn import datasets, linear_model
```

In [2]:
```
diabetes = datasets.load_diabetes()    # dataset loaded from sklearn library.
diabetes
```

Out[2]:
```
{'data': array([[ 0.03807591,  0.05068012,  0.06169621, ..., -0.00259226,
          0.01990749, -0.01764613],
        [-0.00188202, -0.04464164, -0.05147406, ..., -0.03949338,
         -0.06833155, -0.09220405],
        [ 0.08529891,  0.05068012,  0.04445121, ..., -0.00259226,
          0.00286131, -0.02593034],
        ...,
        [ 0.04170844,  0.05068012, -0.01590626, ..., -0.01107952,
         -0.04688253,  0.01549073],
        [-0.04547248, -0.04464164,  0.03906215, ...,  0.02655962,
          0.04452873, -0.02593034],
        [-0.04547248, -0.04464164, -0.0730303 , ..., -0.03949338,
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 'target': array([151.,  75., 141., 206., 135.,  97., 138.,  63., 110., 310., 101.,
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       128.,  52.,  37., 170., 170.,  61., 144.,  52., 128.,  71., 163.,
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       200., 252., 113., 143.,  51.,  52., 210.,  65., 141.,  55., 134.,
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        71.,  47., 187., 125.,  78.,  51., 258., 215., 303., 243.,  91.,
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       145.,  74.,  45., 115., 264.,  87., 202., 127., 182., 241.,  66.,
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        60., 219.,  80.,  68., 332., 248.,  84., 200.,  55.,  85.,  89.,
```

```
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       191., 122., 230., 242., 248., 249., 192., 131., 237.,  78., 135.,
       244., 199., 270., 164.,  72.,  96., 306.,  91., 214.,  95., 216.,
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        77., 109., 272.,  60.,  54., 221.,  90., 311., 281., 182., 321.,
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       140., 217., 121., 235., 245.,  40.,  52., 104., 132.,  88.,  69.,
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        94., 183.,  66., 173.,  72.,  49.,  64.,  48., 178., 104., 132.,
       220.,  57.]),
 'frame': None,
 'DESCR': '.. _diabetes_dataset:\n\nDiabetes dataset\n----------------\n\nTen baseline variables, age, sex, body mass index, average blood\npressur
e, and six blood serum measurements were obtained for each of n =\n442 diabetes patients, as well as the response of interest, a\nquantitative measu
re of disease progression one year after baseline.\n\n**Data Set Characteristics:**\n\n  :Number of Instances: 442\n\n  :Number of Attributes: First
10 columns are numeric predictive values\n\n  :Target: Column 11 is a quantitative measure of disease progression one year after baseline\n\n  :Attr
ibute Information:\n      - age     age in years\n      - sex\n      - bmi     body mass index\n      - bp      average blood pressure\n      - s1
tc, total serum cholesterol\n      - s2      ldl, low-density lipoproteins\n      - s3      hdl, high-density lipoproteins\n      - s4      tch, tot
al cholesterol / HDL\n      - s5      ltg, possibly log of serum triglycerides level\n      - s6      glu, blood sugar level\n\nNote: Each of these
10 feature variables have been mean centered and scaled by the standard deviation times the square root of `n_samples` (i.e. the sum of squares of e
ach column totals 1).\n\nSource URL:\nhttps://www4.stat.ncsu.edu/~boos/var.select/diabetes.html\n\nFor more information see:\nBradley Efron, Trevor
Hastie, Iain Johnstone and Robert Tibshirani (2004) "Least Angle Regression," Annals of Statistics (with discussion), 407-499.\n(https://web.stanfor
d.edu/~hastie/Papers/LARS/LeastAngle_2002.pdf)\n',
 'feature_names': ['age',
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  'bmi',
  'bp',
  's1',
  's2',
  's3',
  's4',
  's5',
  's6'],
 'data_filename': 'diabetes_data_raw.csv.gz',
 'target_filename': 'diabetes_target.csv.gz',
 'data_module': 'sklearn.datasets.data'}
```

In [3]:
```
diabetes.target
```

Out[3]:
```
array([151.,  75., 141., 206., 135.,  97., 138.,  63., 110., 310., 101.,
        69., 179., 185., 118., 171., 166., 144.,  97., 168.,  68.,  49.,
        68., 245., 184., 202., 137.,  85., 131., 283., 129.,  59., 341.,
        87.,  65., 102., 265., 276., 252.,  90., 100.,  55.,  61.,  92.,
       259.,  53., 190., 142.,  75., 142., 155., 225.,  59., 104., 182.,
       128.,  52.,  37., 170., 170.,  61., 144.,  52., 128.,  71., 163.,
       150.,  97., 160., 178.,  48., 270., 202., 111.,  85.,  42., 170.,
       200., 252., 113., 143.,  51.,  52., 210.,  65., 141.,  55., 134.,
        42., 111.,  98., 164.,  48.,  96.,  90., 162., 150., 279.,  92.,
        83., 128., 102., 302., 198.,  95.,  53., 134., 144., 232.,  81.,
       104.,  59., 246., 297., 258., 229., 275., 281., 179., 200., 200.,
       173., 180.,  84., 121., 161.,  99., 109., 115., 268., 274., 158.,
       107.,  83., 103., 272.,  85., 280., 336., 281., 118., 317., 235.,
        60., 174., 259., 178., 128.,  96., 126., 288.,  88., 292.,  71.,
       197., 186.,  25.,  84.,  96., 195.,  53., 217., 172., 131., 214.,
        59.,  70., 220., 268., 152.,  47.,  74., 295., 101., 151., 127.,
       237., 225.,  81., 151., 107.,  64., 138., 185., 265., 101., 137.,
       143., 141.,  79., 292., 178.,  91., 116.,  86., 122.,  72., 129.,
       142.,  90., 158.,  39., 196., 222., 277.,  99., 196., 202., 155.,
        77., 191.,  70.,  73.,  49.,  65., 263., 248., 296., 214., 185.,
        78.,  93., 252., 150.,  77., 208.,  77., 108., 160.,  53., 220.,
       154., 259.,  90., 246., 124.,  67.,  72., 257., 262., 275., 177.,
        71.,  47., 187., 125.,  78.,  51., 258., 215., 303., 243.,  91.,
       150., 310., 153., 346.,  63.,  89.,  50.,  39., 103., 308., 116.,
       145.,  74.,  45., 115., 264.,  87., 202., 127., 182., 241.,  66.,
        94., 283.,  64., 102., 200., 265.,  94., 230., 181., 156., 233.,
        60., 219.,  80.,  68., 332., 248.,  84., 200.,  55.,  85.,  89.,
        31., 129.,  83., 275.,  65., 198., 236., 253., 124.,  44., 172.,
       114., 142., 109., 180., 144., 163., 147.,  97., 220., 190., 109.,
       191., 122., 230., 242., 248., 249., 192., 131., 237.,  78., 135.,
       244., 199., 270., 164.,  72.,  96., 306.,  91., 214.,  95., 216.,
       263., 178., 113., 200., 139., 139.,  88., 148.,  88., 243.,  71.,
        77., 109., 272.,  60.,  54., 221.,  90., 311., 281., 182., 321.,
        58., 262., 206., 233., 242., 123., 167.,  63., 197.,  71., 168.,
       140., 217., 121., 235., 245.,  40.,  52., 104., 132.,  88.,  69.,
       219.,  72., 201., 110.,  51., 277.,  63., 118.,  69., 273., 258.,
        43., 198., 242., 232., 175.,  93., 168., 275., 293., 281.,  72.,
       140., 189., 181., 209., 136., 261., 113., 131., 174., 257.,  55.,
        84.,  42., 146., 212., 233.,  91., 111., 152., 120.,  67., 310.,
        94., 183.,  66., 173.,  72.,  49.,  64.,  48., 178., 104., 132.,
       220.,  57.])
```

In [4]:
```
diabetes.DESCR
```

Out[4]:
```
'.. _diabetes_dataset:\n\nDiabetes dataset\n----------------\n\nTen baseline variables, age, sex, body mass index, average blood\npressure, and six
blood serum measurements were obtained for each of n =\n442 diabetes patients, as well as the response of interest, a\nquantitative measure of disea
se progression one year after baseline.\n\n**Data Set Characteristics:**\n\n  :Number of Instances: 442\n\n  :Number of Attributes: First 10 columns
are numeric predictive values\n\n  :Target: Column 11 is a quantitative measure of disease progression one year after baseline\n\n  :Attribute Infor
mation:\n      - age     age in years\n      - sex\n      - bmi     body mass index\n      - bp      average blood pressure\n      - s1      tc, tot
al serum cholesterol\n      - s2      ldl, low-density lipoproteins\n      - s3      hdl, high-density lipoproteins\n      - s4      tch, total chol
esterol / HDL\n      - s5      ltg, possibly log of serum triglycerides level\n      - s6      glu, blood sugar level\n\nNote: Each of these 10 feat
ure variables have been mean centered and scaled by the standard deviation times the square root of `n_samples` (i.e. the sum of squares of each col
umn totals 1).\n\nSource URL:\nhttps://www4.stat.ncsu.edu/~boos/var.select/diabetes.html\n\nFor more information see:\nBradley Efron, Trevor Hastie,
Iain Johnstone and Robert Tibshirani (2004) "Least Angle Regression," Annals of Statistics (with discussion), 407-499.\n(https://web.stanford.edu/~h
astie/Papers/LARS/LeastAngle_2002.pdf)\n'
```

In [5]:
```
diabetes.data
```

Out[5]:
```
array([[ 0.03807591,  0.05068012,  0.06169621, ..., -0.00259226,
         0.01990749, -0.01764613],
       [-0.00188202, -0.04464164, -0.05147406, ..., -0.03949338,
        -0.06833155, -0.09220405],
       [ 0.08529891,  0.05068012,  0.04445121, ..., -0.00259226,
         0.00286131, -0.02593034],
       ...,
       [ 0.04170844,  0.05068012, -0.01590626, ..., -0.01107952,
        -0.04688253,  0.01549073],
       [-0.04547248, -0.04464164,  0.03906215, ...,  0.02655962,
         0.04452873, -0.02593034],
       [-0.04547248, -0.04464164, -0.0730303 , ..., -0.03949338,
        -0.00422151,  0.00306441]])
```

In [6]:
```
diabetes_x = diabetes.data[:, np.newaxis, 2]   # if we remove the list from this expression then mean squared error changes.
print(diabetes_x)                              # and plots cannot be drawn.
```

```
 [-0.04285156]
 [ 0.00564998]
 [-0.03530688]
 [ 0.02397278]
 [-0.01806189]
 [ 0.04229559]
 [-0.0547075 ]
 [-0.00297252]
 [-0.06656343]
 [-0.01267283]
 [-0.04177375]
 [-0.03099563]
 [-0.00512814]
 [-0.05901875]
 [ 0.0250506 ]
 [-0.046085  ]
 [ 0.00349435]
 [ 0.05415152]
 [-0.04500719]
 [-0.05794093]
```

In [7]:
```
diabetes_x_train = diabetes_x[:-30]
diabetes_x_test = diabetes_x[-30:]
diabetes_y_train = diabetes.target[:-30]
diabetes_y_test = diabetes.target[-30:]
```

In [13]:
```
model = linear_model.LinearRegression()
model.fit(diabetes_x_train, diabetes_y_train)
diabetes_y_predicted = model.predict(diabetes_x_test)
```

In [14]:
```
from sklearn.metrics import mean_squared_error
```

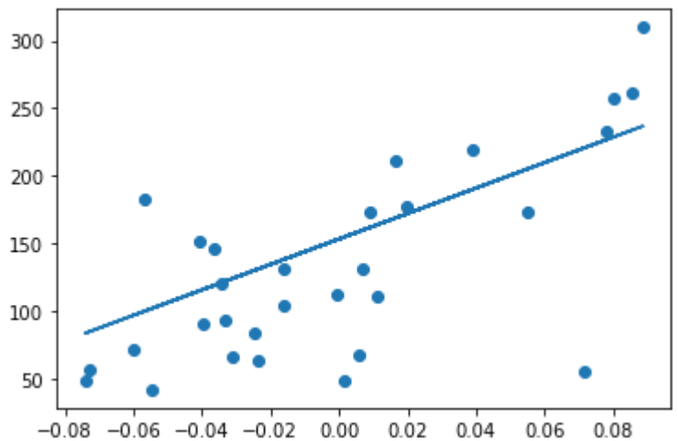
In [15]:
```
print("Mean Squared Error:", mean_squared_error(diabetes_y_test, diabetes_y_predicted))
```

```
Mean Squared Error: 3035.0601152912695
```

In [16]:
```
print("weights: ", model.coef_)
print('intercept: ', model.intercept_)
```

```
weights:  [941.43097333]
intercept:  153.39713623331644
```

In [19]:
```
plt.scatter(diabetes_x_test, diabetes_y_test)
plt.plot(diabetes_x_test, diabetes_y_predicted)
plt.show()
```



In [ ]:
```

```