

Name: Vedant Atul Sule

Roll: D4_61

Pract-9 (SP)

The screenshot shows a Google Colab notebook interface. The browser tabs at the top include 'Priority - Google Drive', 'A09_linear_regression.ipynb', 'A09_linear_regression2.ipynb', and 'New Tab'. The address bar shows the URL 'colab.research.google.com/drive/1dSAY6NOllk9FvxSH9xiJmaP2cuejeFhy'. The notebook title is 'A09_linear_regression.ipynb' with a star icon and a last edited timestamp of 'January 9'. The menu bar includes 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help'. On the right, there are buttons for 'Comment', 'Share', and a settings gear. The notebook content area has a left sidebar with icons for file explorer, search, and code execution. The main area shows a code cell with the following Python code:

```
1 |  
  
m = [ sum(yi)sum(xi) - n sum(xi yi) ] / [ sum(xi) ^2 - n sum(xi ^ 2) ]  
  
[ ] 1  
  
b = sum(yi)/n - m sum(xi) / n  
  
1 |
```

The bottom of the image shows a Windows taskbar with the date '12-02-2023' and time '18:48'.

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Pract-9 (SP)

The screenshot shows a Google Colab notebook interface. The browser tabs at the top include 'Priority - Google Drive', 'A09_linear_regression.ipynb', 'A09_linear_regression2.ipynb', and 'New Tab'. The address bar shows the URL 'colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR'. The notebook title is 'A09_linear_regression2.ipynb' with a star icon. The menu bar includes 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help', with a note 'Last edited on February 6'. On the right, there are buttons for 'Comment', 'Share', and a settings gear. The left sidebar shows icons for file explorer, search, and code execution. The main area contains three code cells:

```
1 internal = [15,23,18,23,24,22,22]
2 external = [49,63,58,60,58,61,60]
```

```
[ ] 1 # slope = m
    2 # b = constant
    3 # linear regression => y = mx + b
    4 m = 0
    5 b = 0
```

```
[ ] 1
```

```
[ ] 1
```

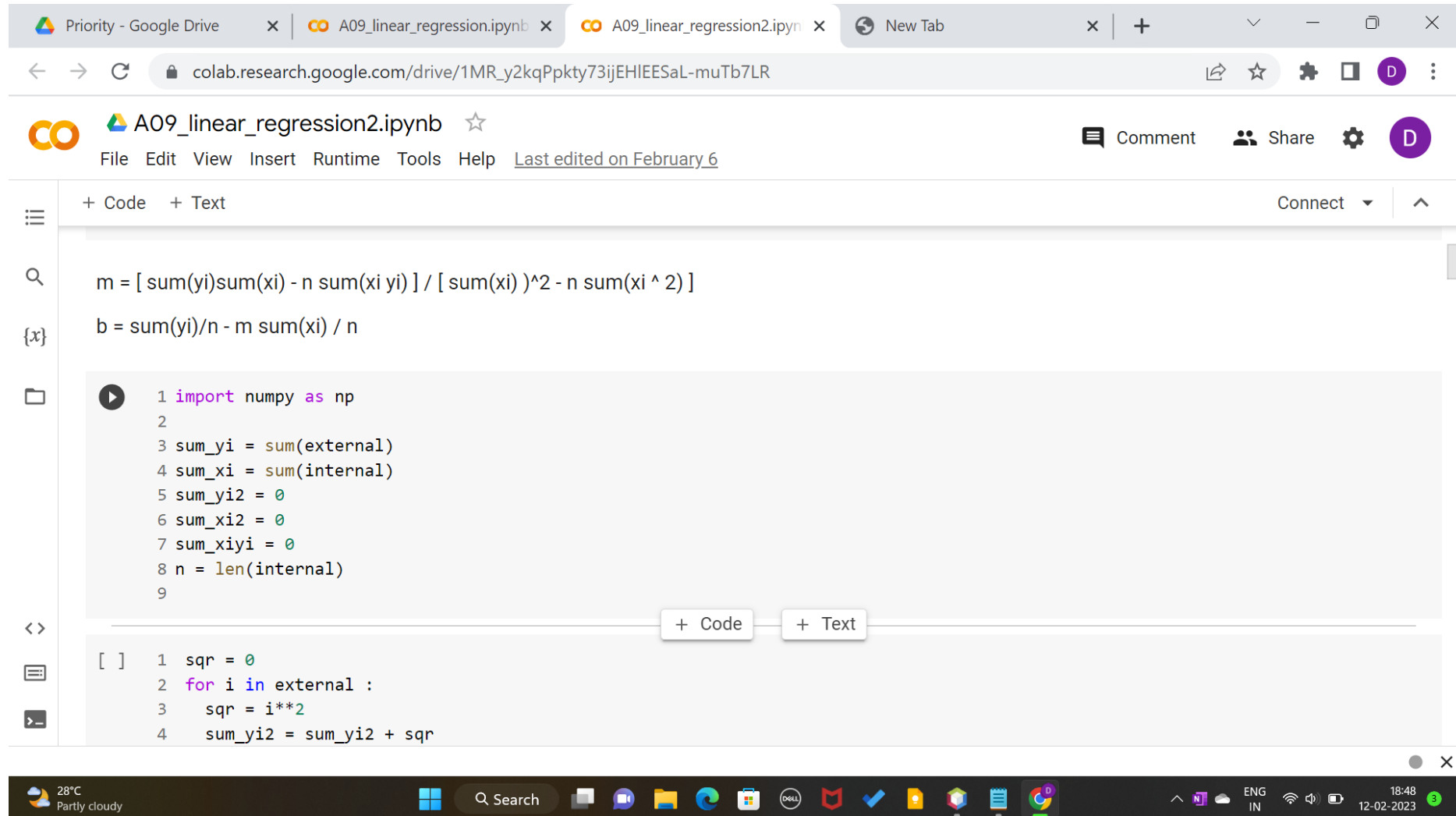
```
m = [ sum(yi)sum(xi) - n sum(xi yi) ] / [ sum(xi) ^2 - n sum(xi ^ 2) ]
b = sum(yi)/n - m sum(xi) / n
```

The Windows taskbar at the bottom shows the date and time as 12-02-2023 18:48, along with various system icons and a search bar.

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Pract-9 (SP)



The screenshot shows a Google Colab notebook titled "A09_linear_regression2.ipynb". The browser tabs include "Priority - Google Drive", "A09_linear_regression.ipynb", "A09_linear_regression2.ipynb", and "New Tab". The address bar shows the URL "colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR". The notebook interface includes a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", along with a "Last edited on February 6" timestamp. On the right, there are buttons for "Comment", "Share", and a settings icon. The left sidebar contains icons for a file explorer, search, and a code editor. The main code area is divided into two sections. The top section contains mathematical formulas for calculating the slope (m) and intercept (b) of a linear regression line. The bottom section contains two code blocks. The first code block imports numpy and calculates various sums. The second code block calculates the sum of squares (sqr) for the external variable.

Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x

colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^

m = [sum(yi)sum(xi) - n sum(xi yi)] / [sum(xi) ^2 - n sum(xi ^ 2)]

b = sum(yi)/n - m sum(xi) / n

```
1 import numpy as np
2
3 sum_yi = sum(external)
4 sum_xi = sum(internal)
5 sum_yi2 = 0
6 sum_xi2 = 0
7 sum_xiyi = 0
8 n = len(internal)
9
```

+ Code + Text

```
[ ] 1 sqr = 0
    2 for i in external :
    3     sqr = i**2
    4     sum_yi2 = sum_yi2 + sqr
```

28°C Partly cloudy Q Search ENG IN 18:48 12-02-2023

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Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x

colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^

```
[ ] 1  sqr = 0
      2  for i in external :
      3      sqr = i**2
      4      sum_yi2 = sum_yi2 + sqr
      5
      6  sqr = 0
      7  for i in internal :
      8      sqr = i**2
      9      sum_xi2 = sum_xi2 + sqr
```

```
1 if( len(external) == len(internal)):
2   prod = 0
3   for i in range(len(external)) :
4       prod = internal[i] * external[i]
5       sum_xiyi = sum_xiyi + prod
```

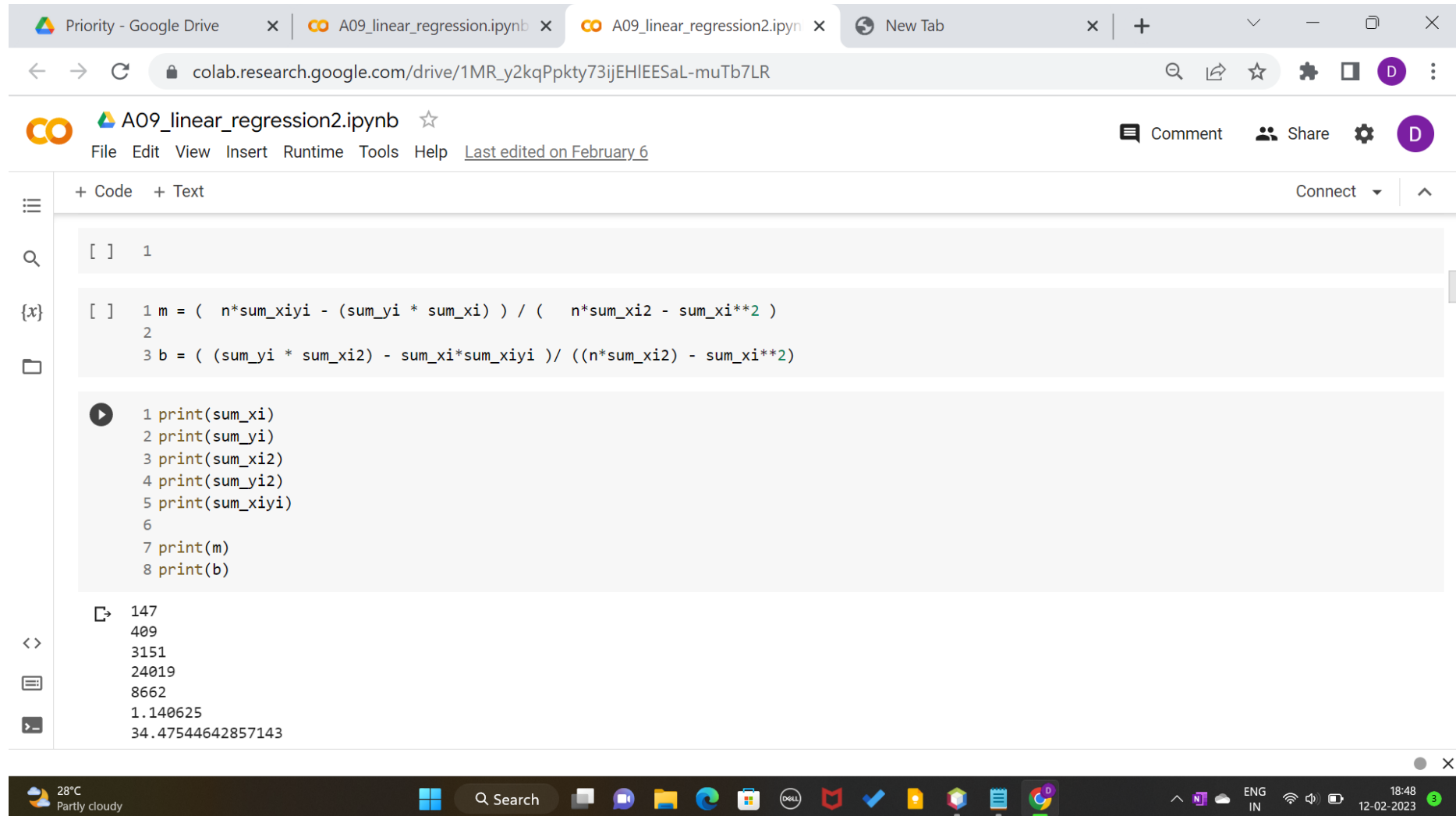
```
[ ] 1
```

28°C Partly cloudy Search 12-02-2023 18:48

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Pract-9 (SP)



The screenshot shows a Google Colab notebook titled "A09_linear_regression2.ipynb". The notebook is open in a browser window with the URL `colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR`. The notebook interface includes a menu bar with options like File, Edit, View, Insert, Runtime, Tools, and Help. The main area displays two code cells. The first cell contains a single line of code: `[] 1`. The second cell contains three lines of code: `[] 1 m = (n*sum_xiyi - (sum_yi * sum_xi)) / (n*sum_xi2 - sum_xi**2)`, `2`, and `3 b = ((sum_yi * sum_xi2) - sum_xi*sum_xiyi) / ((n*sum_xi2) - sum_xi**2)`. Below the code cells, the output of the second cell is displayed, showing the values of `sum_xi`, `sum_yi`, `sum_xi2`, `sum_yi2`, `sum_xiyi`, `m`, and `b`. The output values are: `147`, `409`, `3151`, `24019`, `8662`, `1.140625`, and `34.47544642857143`. The notebook is running on a Google Cloud Platform instance, as indicated by the "Connect" button in the top right corner.

Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x | + | - | x

colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^

```
[ ] 1
```

```
[ ] 1 m = ( n*sum_xiyi - (sum_yi * sum_xi) ) / ( n*sum_xi2 - sum_xi**2 )
2
3 b = ( (sum_yi * sum_xi2) - sum_xi*sum_xiyi ) / ((n*sum_xi2) - sum_xi**2)
```

```
1 print(sum_xi)
2 print(sum_yi)
3 print(sum_xi2)
4 print(sum_yi2)
5 print(sum_xiyi)
6
7 print(m)
8 print(b)
```

```
147
409
3151
24019
8662
1.140625
34.47544642857143
```

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Pract-9 (SP)

Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x

colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

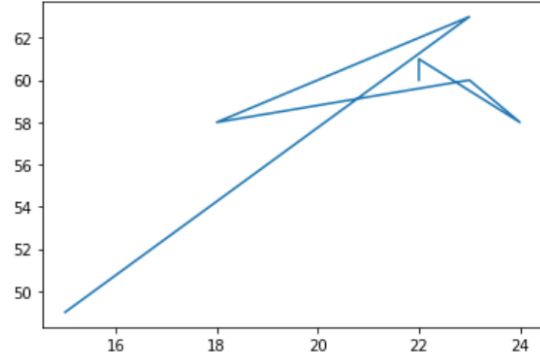
Comment Share Settings D

+ Code + Text Connect ^

```
34.47544042057145
```

```
1 import matplotlib.pyplot as plt
2 plt.plot(internal,external)
```

[<matplotlib.lines.Line2D at 0x7f17eb79a8b0>]



```
[ ] 1 plt.scatter(internal,external)
```

<matplotlib.collections.PathCollection at 0x7f17ec098760>

28°C Partly cloudy Search 0643 ENG IN 18:49 12-02-2023

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Pract-9 (SP)

Priority - Google Drive | A09_linear_regression.ipynb | A09_linear_regression2.ipynb | New Tab

colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

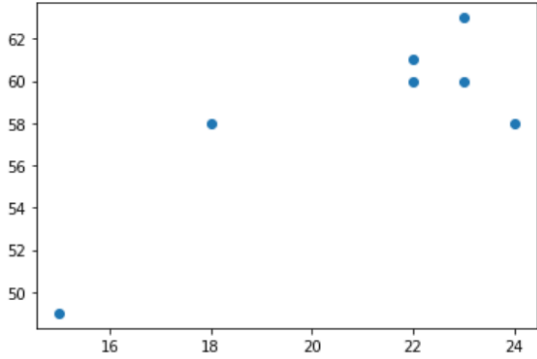
File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^

```
1 plt.scatter(internal,external)
```

<matplotlib.collections.PathCollection at 0x7f17ec098760>



| internal | external |
|----------|----------|
| 15.5 | 49.5 |
| 18.0 | 58.0 |
| 22.0 | 60.0 |
| 22.0 | 61.0 |
| 23.0 | 60.0 |
| 23.0 | 62.5 |
| 24.0 | 58.0 |
| 24.0 | 60.0 |

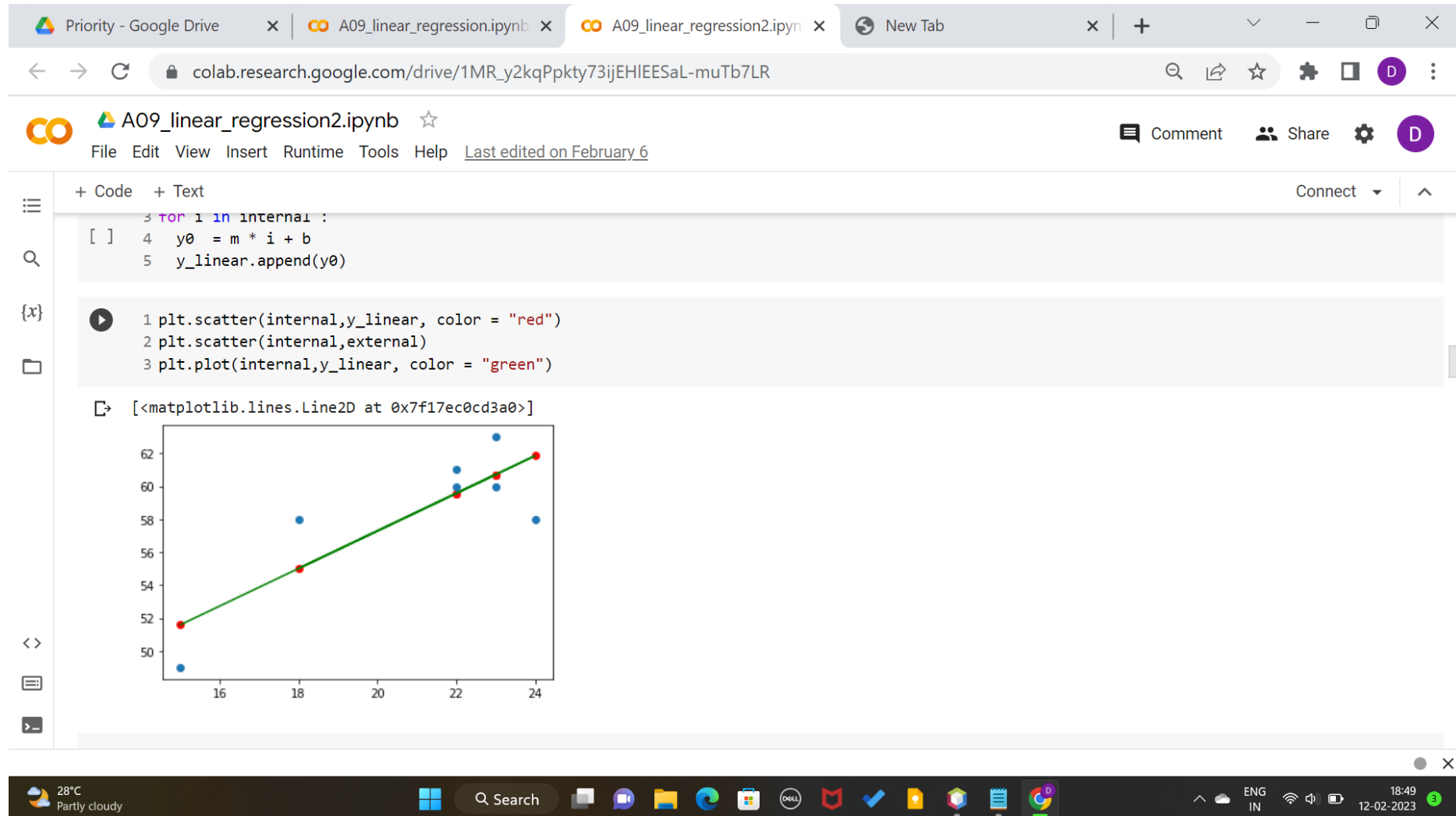
```
[ ] 1 y_linear = []  
    2 y0 = 0  
    3 for i in internal :
```

28°C Partly cloudy | Search | ENG IN | 18:49 12-02-2023

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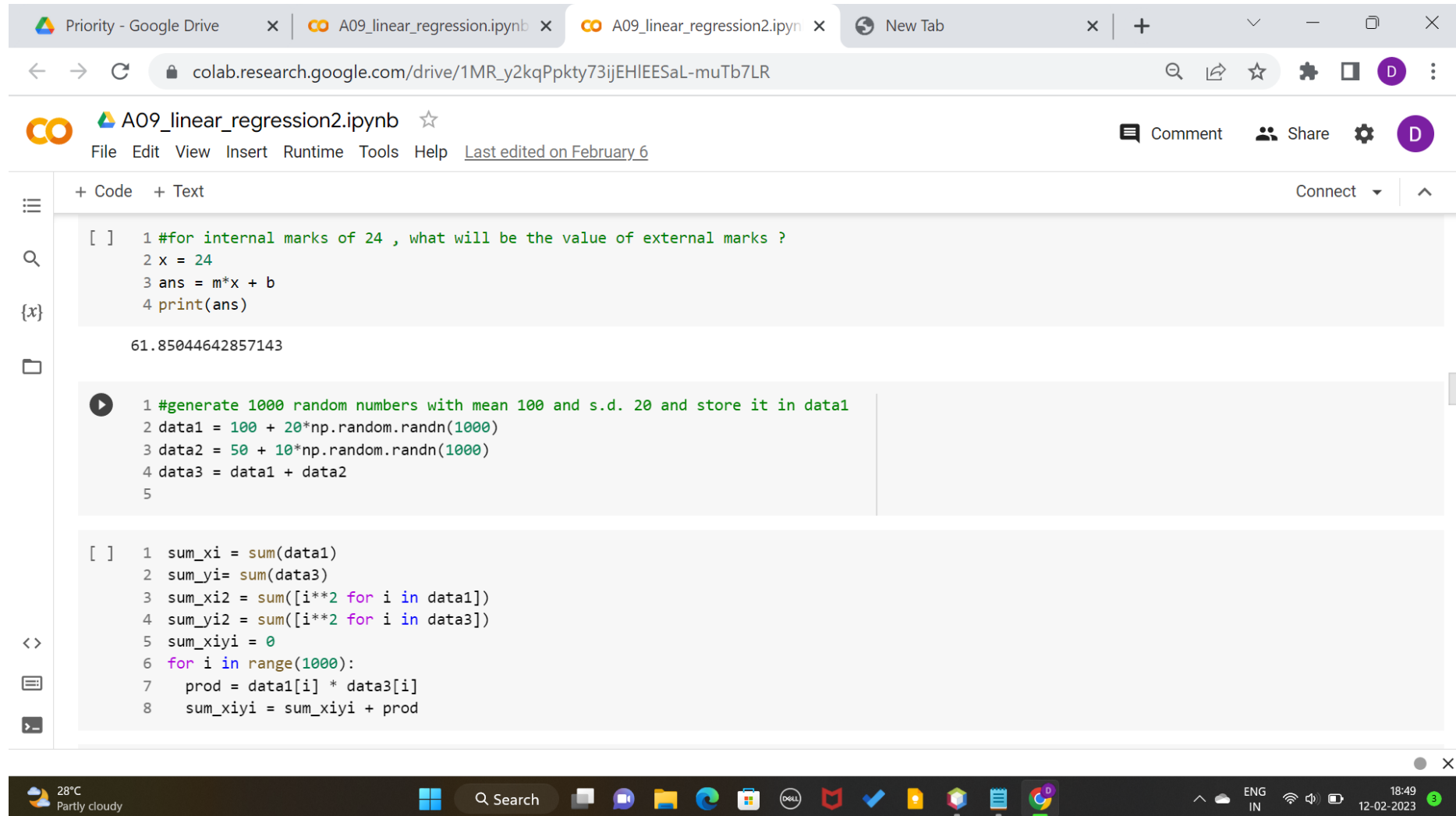
Pract-9 (SP)



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Pract-9 (SP)



Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x | + | - | x

colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

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+ Code + Text Connect ^

```
[ ] 1 #for internal marks of 24 , what will be the value of external marks ?
    2 x = 24
    3 ans = m*x + b
    4 print(ans)
```

61.85044642857143

```
1 #generate 1000 random numbers with mean 100 and s.d. 20 and store it in data1
2 data1 = 100 + 20*np.random.randn(1000)
3 data2 = 50 + 10*np.random.randn(1000)
4 data3 = data1 + data2
5
```

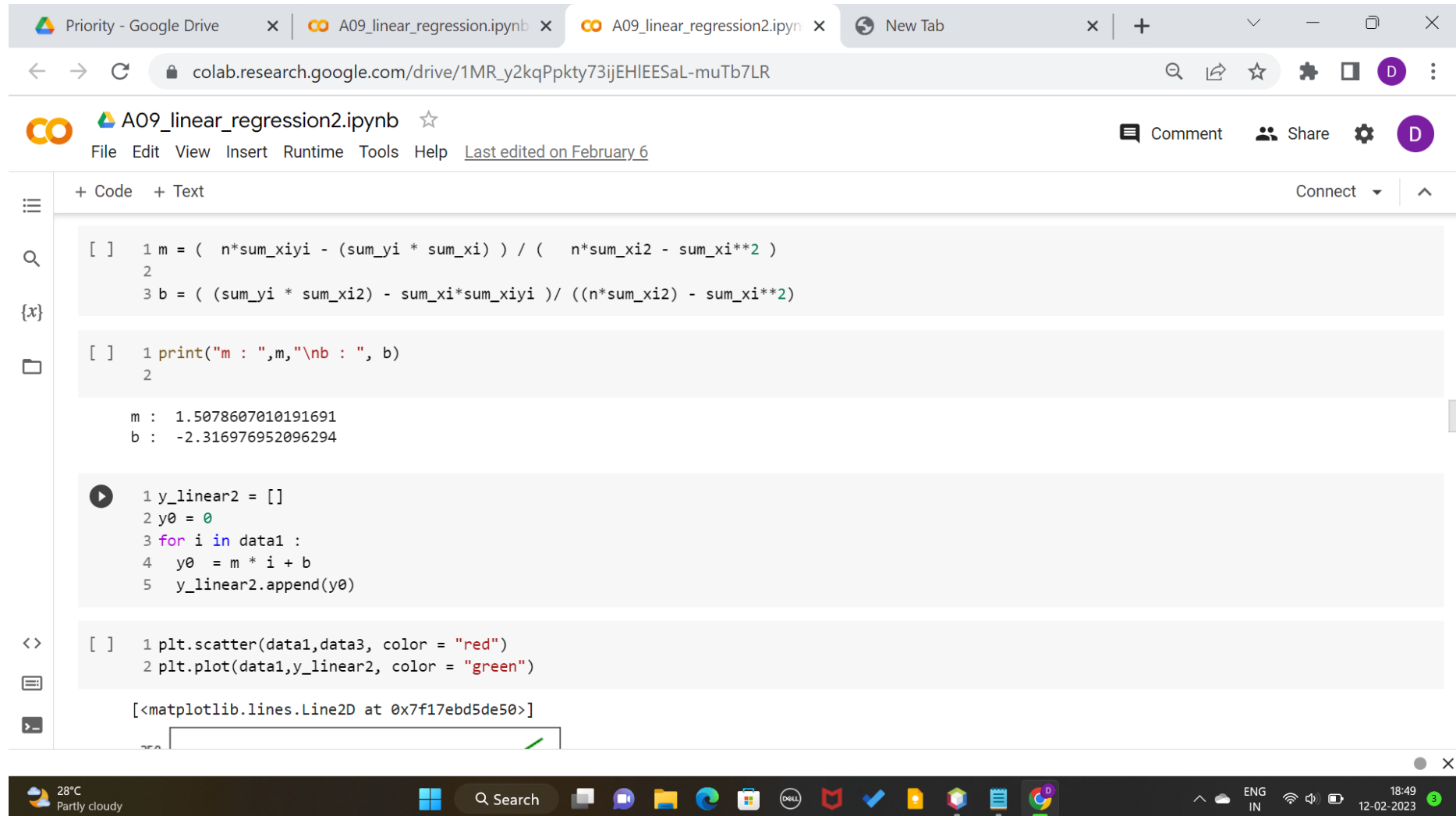
```
[ ] 1 sum_xi = sum(data1)
    2 sum_yi= sum(data3)
    3 sum_xi2 = sum([i**2 for i in data1])
    4 sum_yi2 = sum([i**2 for i in data3])
    5 sum_xiyi = 0
    6 for i in range(1000):
    7     prod = data1[i] * data3[i]
    8     sum_xiyi = sum_xiyi + prod
```

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Pract-9 (SP)



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$$m = \frac{n \sum x_i y_i - (\sum y_i \cdot \sum x_i)}{n \sum x_i^2 - \sum x_i^2}$$
$$b = \frac{(\sum y_i \cdot \sum x_i^2) - \sum x_i \sum x_i y_i}{(n \sum x_i^2) - \sum x_i^2}$$

The second cell prints the calculated values of m and b :

```
1 print("m : ",m,"nb : ", b)
2
```

The output shows $m = 1.5078607010191691$ and $b = -2.316976952096294$.

The third cell defines a function to calculate the predicted values y_0 for a given set of data points $data1$:

```
1 y_linear2 = []
2 y0 = 0
3 for i in data1 :
4     y0 = m * i + b
5     y_linear2.append(y0)
```

The fourth cell plots the data points and the fitted line:

```
1 plt.scatter(data1,data3, color = "red")
2 plt.plot(data1,y_linear2, color = "green")
```

The output of the plot is a `<matplotlib.lines.Line2D at 0x7f17ebd5de50>`.

The bottom of the screenshot shows the Windows taskbar with the date and time 18:49 on 12-02-2023, and the system status bar showing 28°C and Partly cloudy.

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Pract-9 (SP)

Priority - Google Drive x A09_linear_regression.ipynb x A09_linear_regression2.ipynb x New Tab x

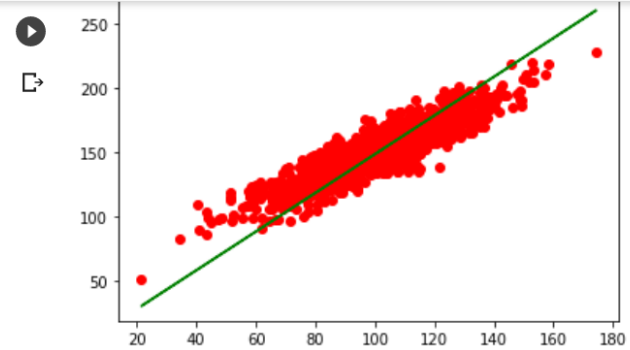
colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR

A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^



```
[ ] 1
2 def mse1 (a3, a1):
3     summation = 0
4     for i in range(len(data1)):
5         sqr_err = ( a3[i] - m*a1 +b) ** 2
6         summation = summation + sqr_err
7     mse = summation/len(data1)
8     return mse
```

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```
[ ] 1 def mse(data3, data1):
2     summation = 0
3     for i in range(1000):
4         sqr_err = ( data3[i] - (m*data1[i] + b) ) ** 2
5         summation = summation + sqr_err
6
7     mse = summation / 1000
8     return mse

1 mse_list = []
2 m_list = []
3
4 i = -1
5 while( i <= 1) :
6     m_list.append(m + i)
7     m = m + i
8     i = i + 0.1
9     mse_val = mse(y_linear2,data3)
10    mse_list.append(mse_val)

[ ] 1
```

The Windows taskbar at the bottom shows the date and time as 12-02-2023 18:49, along with various system icons and a search bar.

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Roll: D4_61

Pract-9 (SP)

Priority - Google Drive x | A09_linear_regression.ipynb x | A09_linear_regression2.ipynb x | New Tab x | +

colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR

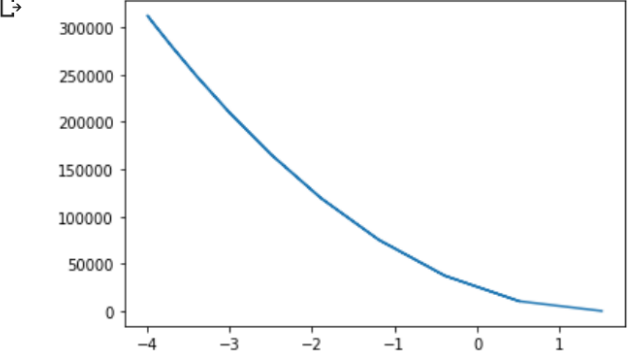
A09_linear_regression2.ipynb ☆

File Edit View Insert Runtime Tools Help Last edited on February 6

Comment Share Settings D

+ Code + Text Connect ^

```
1 plt.plot(m_list,mse_list)
2 plt.show()
```



```
[ ] 1 #the above graph must be a parabolla
```

```
[ ] 1 mse_list
```

```
[10550.182422253967.]
```

28°C Partly cloudy Search 18:49 12-02-2023

Name: Vedant Atul Sule

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Pract-9 (SP)

The screenshot displays a Google Colab notebook titled "A09_linear_regression2.ipynb". The browser's address bar shows the URL `colab.research.google.com/drive/1MR_y2kqPpky73ijEHIEESaL-muTb7LR`. The notebook interface includes a menu bar with options like File, Edit, View, Insert, Runtime, Tools, and Help. On the left, a sidebar shows icons for file management and search. The main workspace contains a code cell with the following content:

```
[ ] 1 #the above graph must be a parabolla
```

Below the code cell, a variable `mse_list` is displayed, containing a list of 20 numerical values:

```
1 mse_list
```

```
[10550.182422253967,  
 37495.03008096952,  
 75486.23291011645,  
 119568.41662763208,  
 165405.62873671154,  
 209281.3385258076,  
 248098.4370686319,  
 279379.23722415196,  
 301265.4736365956,  
 312518.3027354458,  
 312518.3027354458,  
 301265.47363659565,  
 279379.2372241521,  
 248098.43706863202,  
 209281.33852580786,  
 165405.6287367117,  
 119568.41662763225,  
 75486.23291011658,  
 37495.030080969635,  
 10550.182422254018,
```

The bottom of the image shows a Windows taskbar with the date and time set to 18:49 on 12-02-2023, and the weather as 28°C Partly cloudy.

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Pract-9 (SP)

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```
10550.182422254018,  
226.48600129016617]
```

Below the code cell, there is a variable "m_list" with a list of 20 data points, each consisting of a pair of numbers separated by a comma. The data points are:

- 0.5078607010191691,
- 0.3921392989808309,
- 1.1921392989808308,
- 1.892139298980831,
- 2.492139298980831,
- 2.992139298980831,
- 3.3921392989808314,
- 3.6921392989808317,
- 3.892139298980832,
- 3.992139298980832,
- 3.992139298980832,
- 3.8921392989808323,
- 3.6921392989808326,
- 3.3921392989808328,
- 2.992139298980833,
- 2.492139298980833,
- 1.892139298980833,
- 1.192139298980833,
- 0.3921392989808332,
- 0.5078607010191666,
- 1.5078607010191667

The bottom of the image shows a Windows taskbar with the date "12-02-2023" and time "18:49".

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```
1.5078607010191662]

[ ] 1

[ ] 1 # let m = (say) 1.5 and b = (say) -2.0

[ ] 1 # here "E" is only one error (i.e Y(predict)i - Y(actual)i)

1 m = 1.5
2 b = -2.0
3 eta = 0.001 # eta is learning rate .

[ ] 1 X = [15,23,18,23,24,22,22]
2 Y_actual = [49,63,58,60,58,61,60]
3 Y_predict = []
4
5 m_vals = [1.5]
6 b_vals = [-2.0]

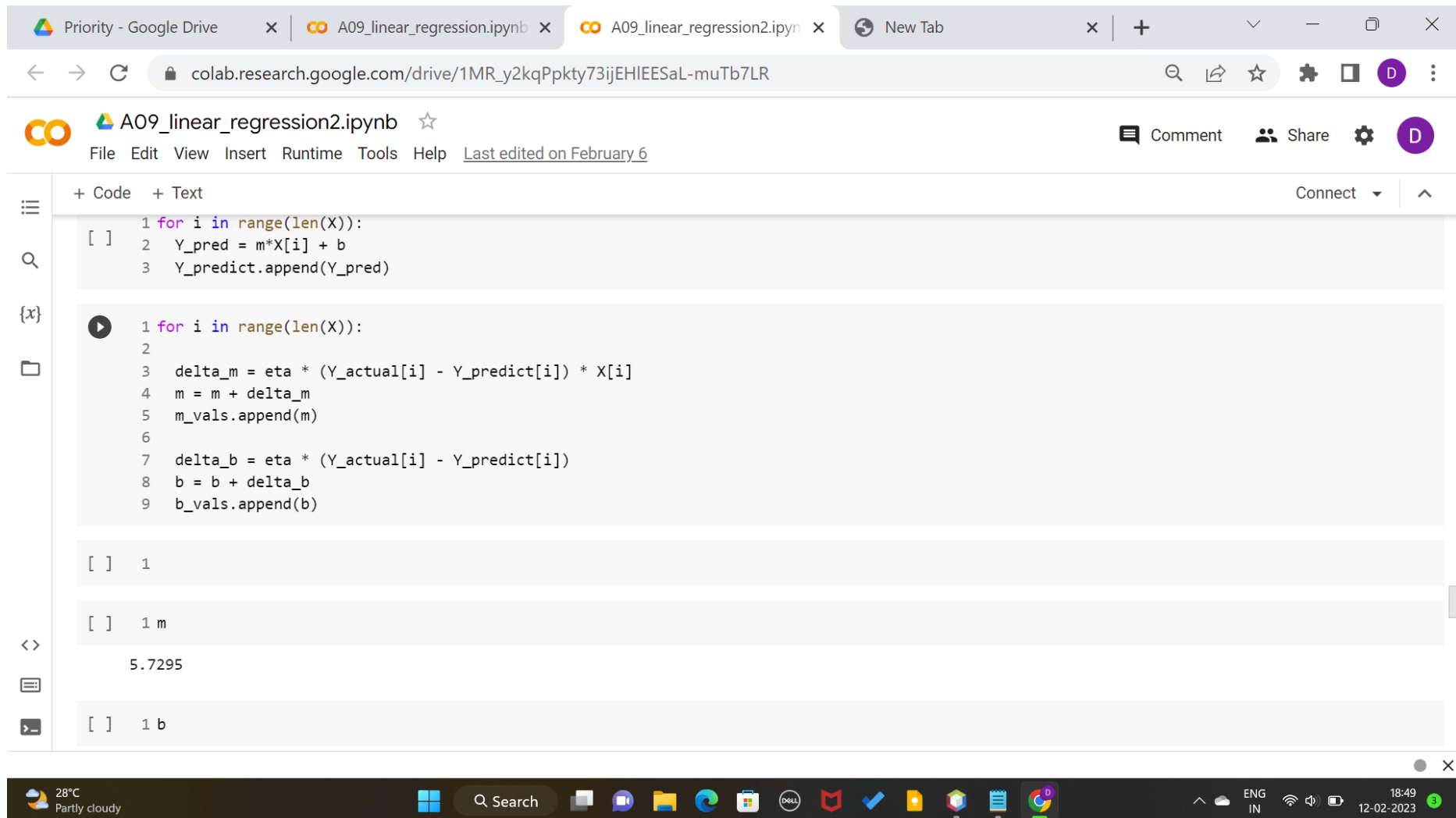
[ ] 1 for i in range(len(X)):
```

The Windows taskbar at the bottom shows the date and time as 12-02-2023 18:49, along with various system icons and a search bar.

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```
+ Code + Text
[ ] 1 for i in range(len(X)):
    2     Y_pred = m*X[i] + b
    3     Y_predict.append(Y_pred)

1 for i in range(len(X)):
2
3     delta_m = eta * (Y_actual[i] - Y_predict[i]) * X[i]
4     m = m + delta_m
5     m_vals.append(m)
6
7     delta_b = eta * (Y_actual[i] - Y_predict[i])
8     b = b + delta_b
9     b_vals.append(b)

[ ] 1

[ ] 1 m

5.7295

[ ] 1 b
```

The output of the code execution is displayed in the output area, showing the value 5.7295. The bottom status bar shows the system clock (18:49, 12-02-2023) and network status (ENG IN).

Name: Vedant Atul Sule

Roll: D4_61

Pract-9 (SP)

The screenshot shows a Google Colab notebook titled "A09_linear_regression2.ipynb". The browser tabs include "Priority - Google Drive", "A09_linear_regression.ipynb", "A09_linear_regression2.ipynb", and "New Tab". The address bar shows the URL "colab.research.google.com/drive/1MR_y2kqPpkty73ijEHIEESaL-muTb7LR". The notebook interface includes a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", and a status bar indicating "Last edited on February 6".

The notebook contains the following code cells:

```
[ ] 3 Y_predict.append(Y_pred)
```

```
[ ] 1 for i in range(len(X)):
2
3     delta_m = eta * (Y_actual[i] - Y_predict[i]) * X[i]
4     m = m + delta_m
5     m_vals.append(m)
6
7     delta_b = eta * (Y_actual[i] - Y_predict[i])
8     b = b + delta_b
9     b_vals.append(b)
```

```
[ ] 1
```

```
[ ] 1 m
5.7295
```

```
[ ] 1 b
-1.7975
```

The bottom of the image shows a Windows taskbar with the date "12-02-2023" and time "18:49".