Lab - 3

19/03/2025

Linear regression :
Straight line method

① Using $y = mx + c$ (or) $y = ax + b$ formula to find slope & intercept and to find the 5th & 7th week sales based on the below table, by linear regression.

x (week)	y (Sales in thousands)
1	2
2	4
3	5
4	9

```
import pandas as pd
#read the data from the csv file.
data = pd.read_csv('/content/data.csv')
x = data['x(week)']
y = data['y(Sales in thousands)']

#Calculate the mean of x & y.
x_mean = x.mean()
y_mean = y.mean()

# Calculate the Slope (b1)
numerator = ((x - x_mean) * (y - y_mean)).sum()
denominator = ((x - x_mean)**2).sum()
b1 = numerator/denominator
# Calculate the intercept (b0)
b0 = y_mean - (b1 * x_mean)

print("intercept:", round(b0, 2))
print("Slope:", round(b1, 2))
```

predict Sales for the 5th and 7th week.

week_5_Sales = b0 + (b1 * 5)
week_7_Sales = b0 + (b1 * 7)

print("predicted Sales for week 5:", round(week_5_Sales, 2))
print("predicted Sales for week 7:", round(week_7_Sales, 2))

Output:

Intercept: -0.5
Slope: 2.2

predicted Sales for week 5: 10.5
predicted Sales for week 7: 14.9

(2) Matrix method:

Linear regression of data of week and product sales in thousands, the matrix approach for finding Slope(b1), Intercept(b0) and the predicting Sales for 5th and 7th weeks.

X (week)	Y (Sales in thousands)
1	2
2	4
3	5
4	9

```
import pandas as pd
import numpy as np
# Importing csv file
data = pd.read_csv('/content/data.csv')
# prepare the data for linear regression
X = data['X(week)'].values
y = data['Y(Sales in thousands)'].values
```

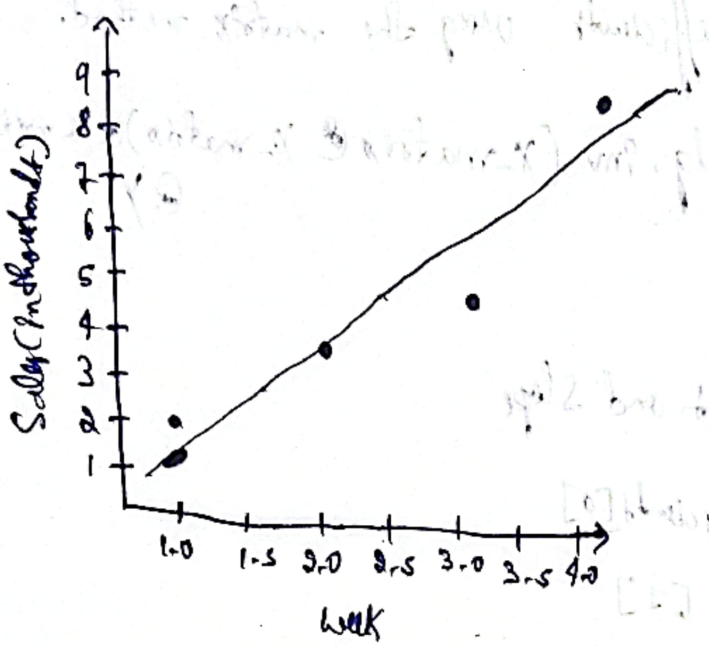
```
# Create the design matrix.
X_matrix = np.vstack([np.ones(len(X)), X]).T

#Calculate the coefficients using the matrix method.
coefficients = np.linalg.inv(X_matrix @ X_matrix)@ X_matrix.
                                                    @ Y

#Extract the intercept and slope
intercept = coefficients[0]
slope = coefficients[1]

print("Intercept:", round(intercept,2))
print("Slope:", round(slope,2))

# predict sales for the 5th and 7th week
week_5_sales = intercept + slope * 5
week_7_sales = intercept + slope * 7

print("predicted sales for week 5:", round(week_5_sales,2))
print("predicted sales for week 7:", round(week_7_sales,2))
```

Output

```
Intercept: -0.5
Slope: 2.2
predicted sales for week 5: 10.5
predicted sales for week 7: 14.9
```

① Straight line method graph

Salt VS week regression



② Matrix method graph.