19/03

LAB - 03

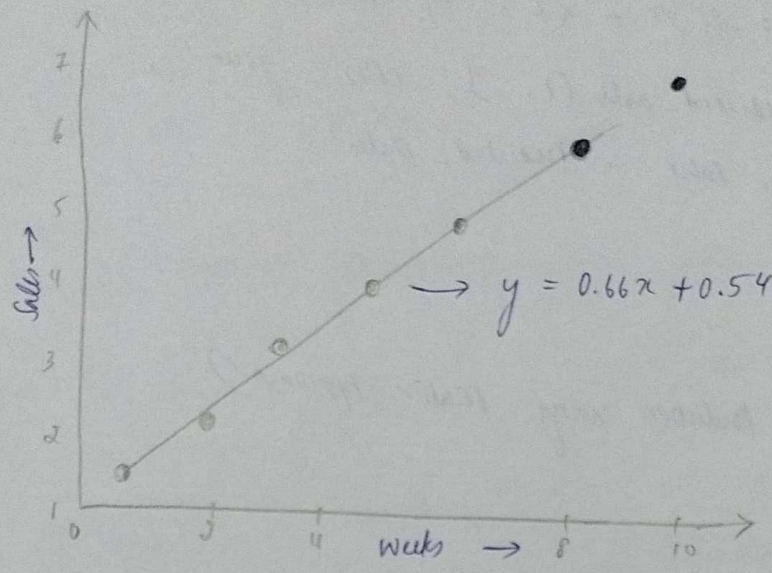
Build a linear regression model using 1) Simple Linear Regression
2) Linear regression in matrix

1) SIMPLE LINEAR REGRESSION

```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression

xi = np.array([1, 2, 3, 4, 5]).reshape(-1, 1)
yi = np.array([1.2, 1.8, 2.6, 3.2, 3.8])

model = LinearRegression()
model.fit(xi, yi)

m = model.coef_[0]
c = model.intercept_

future_weeks = np.array([7, 9]).reshape(-1, 1)
predicted_sales = model.predict(future_weeks)

x_range = np.arange(1, 10, 0.1).reshape(-1, 1)
y_range = model.predict(x_range)

plt.scatter(xi, yi, color = 'blue', label = 'Actual Sales')
plt.plot(x_range, y_range, color = 'red', label = f'Regression line: y = {m:.2f}x + {c:.2f}')
plt.scatter(future_weeks, predicted_sales, color = 'green', marker = 'o',
            label = 'Predicted Sales (Weeks 7 and 9)')

plt.xlabel('Weeks')
plt.ylabel('Sales')
plt.title('Weekly Sales Prediction using Linear Regression')
plt.legend()
plt.grid(True)
```

```
plt.show()
print(f"Equation of the regression line : y = {m:.2f}x + {c:.2f}")
print(f"Predicted sales for week 7 : {predicted_sales[0]:.2f}")
print(f"Predicted sales for week 9 : {predicted_sales[1]:.2f}")
```

O/P



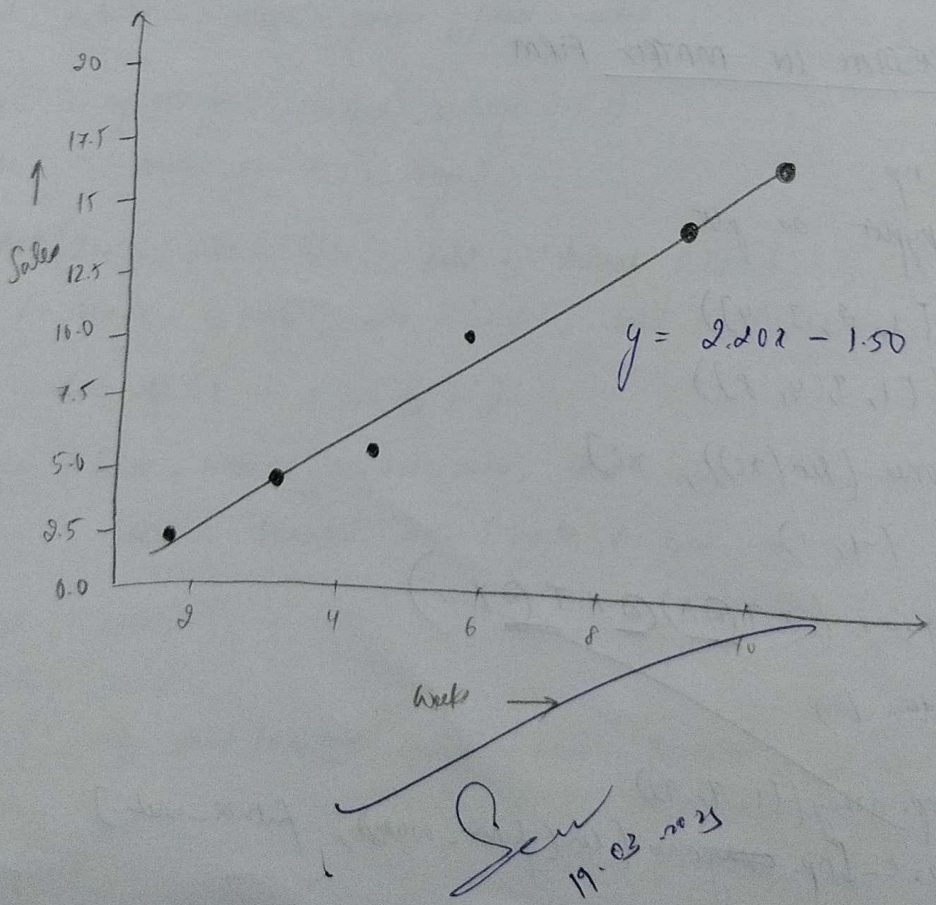
Equation of regression line : $y = 0.66x + 0.54$
Predicted sales for week 7 : 5.16
week 9 : 6.48

(2) LINEAR REGRESSION IN MATRIX FORM

```
import numpy as np
import matplotlib.pyplot as plt

xi = np.array([1, 2, 3, 4])
yi = np.array([1, 3, 4, 8])

X = np.c_[np.ones(len(xi)), xi]
Y = yi.reshape(-1, 1)

theta = np.linalg.inv(X.T @ X) @ X.T @ Y

c, m = theta.flatten()

future_week = np.array([1, 7, 9])
X_future = np.c_[np.ones(len(future_week)), future_week]
predicted_sale = X_future @ theta
```

```
x_range = np.linspace(1, 10, 100)
y_range = c + m * x_range

plt.scatter(xi, yi, color = 'blue', label = 'Actual Sales')
plt.plot(x_range, y_range, color = 'red', label = f'Regression Line:
                y = {m:.2f}x + {c:.2f}")
plt.scatter([7,9], predicted_sales[1:], color = 'green',
            marker = 'o', label = 'Predicted_Sales')

plt.xlabel('Weeks')
plt.ylabel('Sales')
plt.title('Weekly Sale Prediction using Matrix Approach')
plt.legend()
plt.grid(True)
plt.show()
```

6) Equation of the regression line $y = 2.20x - 1.50$.



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