Import The Libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
np.random.seed(42)
from sklearn.preprocessing import StandardScaler
```

Create the Linear Regression Model Class

In [2]:
```
class LinearRegression:

    def __init__(self, iterations, alpha):
        self.iterations = iterations
        self.alpha = alpha
        self.theta = None

    def fit(self, X, y):
        X = np.insert(X.reshape(-1, 1), 0, 1, axis=1)
        self.theta = np.zeros(X.shape[1])
        m = len(y)

        for i in range(self.iterations):
            h = np.dot(X, self.theta)
            gradient = (1/m) * np.dot(X.T, (h - y))

            self.theta -= self.alpha * gradient

            # Track the cost function
            cost = np.mean((h - y)**2) / 2
            if i % 1000 == 0:
                print(f"Iteration {i}, Cost: {cost}")

    def predict(self, X):
        X = np.insert(X.reshape(-1, 1), 0, 1, axis=1)
        return np.dot(X, self.theta)
```

We are going to use solve the Week01_Challenge

In [3]:
```
df = pd.read_csv('Valhalla23.csv')
df.head()
```

Out[3]:

	Celsius	Valks
0	61.4720	-139.740
1	70.5790	-156.600
2	-7.3013	73.269
3	71.3380	-165.420
4	43.2360	-75.835

Split the data into train and test sets

In [4]:
```
train_size = 0.8
train = df[:int(len(df)*train_size)]
test = df[int(len(df)*train_size):]
```

Get and scale the X and Y values

In [5]:
```
X_train, y_train = train["Celsius"].values, train["Valks"].values
X_test, y_test = test["Celsius"].values, test["Valks"].values

# Normalize the data
scaler_X = StandardScaler()
scaler_y = StandardScaler()

X_train_scaled = scaler_X.fit_transform(X_train.reshape(-1, 1))
X_test_scaled = scaler_X.transform(X_test.reshape(-1, 1))
y_train_scaled = scaler_y.fit_transform(y_train.reshape(-1, 1)).ravel()
y_test_scaled = scaler_y.transform(y_test.reshape(-1, 1)).ravel()
```

Create and train the model

Iterations: 100+ as requested

Alpha of 0.01: It's a compromise between speed and stability. Smaller values like 0.001 might be too slow, while larger values like 0.1 might cause instability.

In [6]:
```
model = LinearRegression(iterations=10000, alpha=0.01)
model.fit(X_train_scaled, y_train_scaled)
```

```
Iteration 0, Cost: 0.4999999999999999
Iteration 1000, Cost: 0.0025798964683106966
Iteration 2000, Cost: 0.0025798955412406938
Iteration 3000, Cost: 0.002579895541240691
Iteration 4000, Cost: 0.002579895541240692
Iteration 5000, Cost: 0.002579895541240692
Iteration 6000, Cost: 0.002579895541240692
Iteration 7000, Cost: 0.002579895541240692
Iteration 8000, Cost: 0.002579895541240692
Iteration 9000, Cost: 0.002579895541240692
```

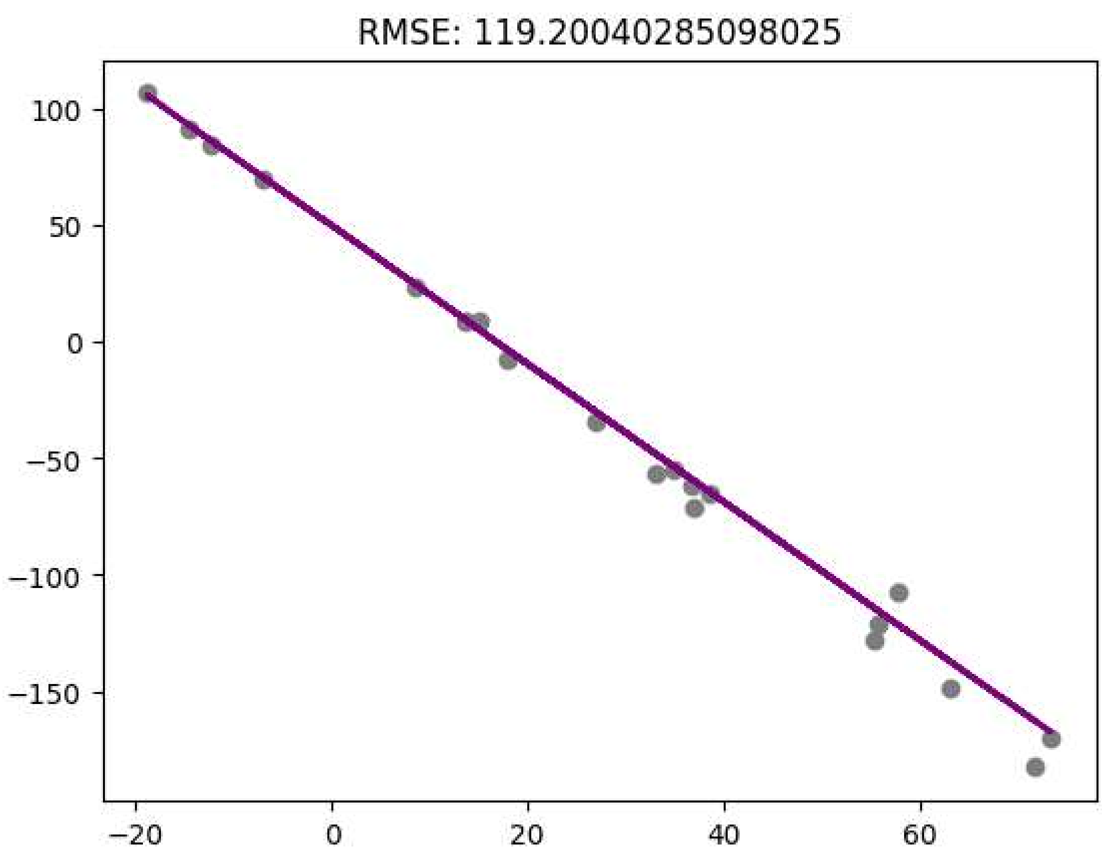
Make predictions and get the cost function of the test data

In [7]:
```python
y_pred_scaled = model.predict(X_test_scaled)
y_pred = scaler_y.inverse_transform(y_pred_scaled.reshape(-1, 1))

# get the rmse error
rmse = np.sqrt(np.mean((y_pred - y_test)**2))

# get the cost function for the test set
X_test_scaled = np.insert(X_test_scaled.reshape(-1, 1), 0, 1, axis=1)
h = np.dot(X_test_scaled, model.theta)
cost = np.mean((h - y_test_scaled)**2) / 2

print(f"RMSE for test data: {rmse}")
print(f"Cost for test data: {cost}")
```

```
RMSE for test data: 119.20040285098025
Cost for test data: 0.003986036063576564
```

Plot the predictions

In [8]:
```python
plt.scatter(X_test, y_test, color='gray')
plt.plot(X_test, y_pred, color='purple', linewidth=2)
plt.title(f'RMSE: {rmse}')
plt.show()
```



In [9]:
```python
print(f"Learned parameters (theta): {model.theta}")
```

```
Learned parameters (theta): [ 1.10422088e-16 -9.97416768e-01]
```