```
In [ ]:  %pip install pandas
         %pip install nbconvert
```

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Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (2.
1.4)
Requirement already satisfied: numpy<2,>=1.22.4 in /usr/local/lib/python3.10/dist-pac
kages (from pandas) (1.26.4)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.10/di
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rom python-dateutil>=2.8.2->pandas) (1.16.0)
Requirement already satisfied: nbconvert in /usr/local/lib/python3.10/dist-packages
(6.5.4)
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(from nbconvert) (24.1)
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Requirement already satisfied: six>=1.9.0 in /usr/local/lib/python3.10/dist-packages
(from bleach->nbconvert) (1.16.0)
```

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Requirement already satisfied: webencodings in /usr/local/lib/python3.10/dist-package
s (from bleach->nbconvert) (0.5.1)
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b/python3.10/dist-packages (from jsonschema>=2.6->nbformat>=5.1->nbconvert) (2023.12.
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Requirement already satisfied: rpds-py>=0.7.1 in /usr/local/lib/python3.10/dist-packa
ges (from jsonschema>=2.6->nbformat>=5.1->nbconvert) (0.20.0)
Requirement already satisfied: pyzmq>=13 in /usr/local/lib/python3.10/dist-packages
(from jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (24.0.1)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.10/dist
-packages (from jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (2.8.2)
Requirement already satisfied: tornado>=4.1 in /usr/local/lib/python3.10/dist-package
s (from jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (6.3.3)
```

In [92]:
```python
import pandas as pd
import math
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import SGDRegressor
from sklearn.metrics import  mean_squared_error
import numpy as np

oCelsiusValhalla = pd.read_csv('/content/Valhalla23.csv')
```

In [93]:
```python
# Dividir los datos en conjuntos de entrenamiento y prueba
oCelsiusValhallaTrain, oTest = train_test_split(oCelsiusValhalla, test_size=0.2)
oTrain, oValidacion = train_test_split(oCelsiusValhallaTrain, test_size=0.5)

print("Tamaño Train: ", len(oTrain))
print("Tamaño Validacion: ", len(oValidacion))
print("Tamaño Test: ", len(oTest))
# Crear el modelo de regresión lineal
oModelo1 = SGDRegressor(eta0=1E-4,max_iter=1000000,random_state=835194)

oModelo1.fit(oTrain[["Celsius"]], oTrain["Valks"])

oYPredTrain = oModelo1.predict(oTrain[["Celsius"]])
oYPredValidacion = oModelo1.predict(oValidacion[["Celsius"]])
oYPredTest = oModelo1.predict(oTest[["Celsius"]])
```

```
Tamaño Train:  40
Tamaño Validacion:   40
Tamaño Test:  20
```

In [110…
```python
fTrainMSE = mean_squared_error(oTrain["Valks"], oYPredTrain)
print("Mean Squared Error Training: ", fTrainMSE)

plt.scatter(oTrain["Valks"], oYPredTrain, color='red', label='Predicciones Entrenamier
plt.plot([oTrain["Valks"].min(), oTrain["Valks"].max()], [oTrain["Valks"].min(), oTrai
plt.xlabel('Valores Reales')
plt.ylabel('Predicciones')
plt.title('Valores Reales vs Predicciones')
plt.legend()
plt.show()
```

```
Mean Squared Error Training:  1271.507141428822
```

Valores Reales vs Predicciones
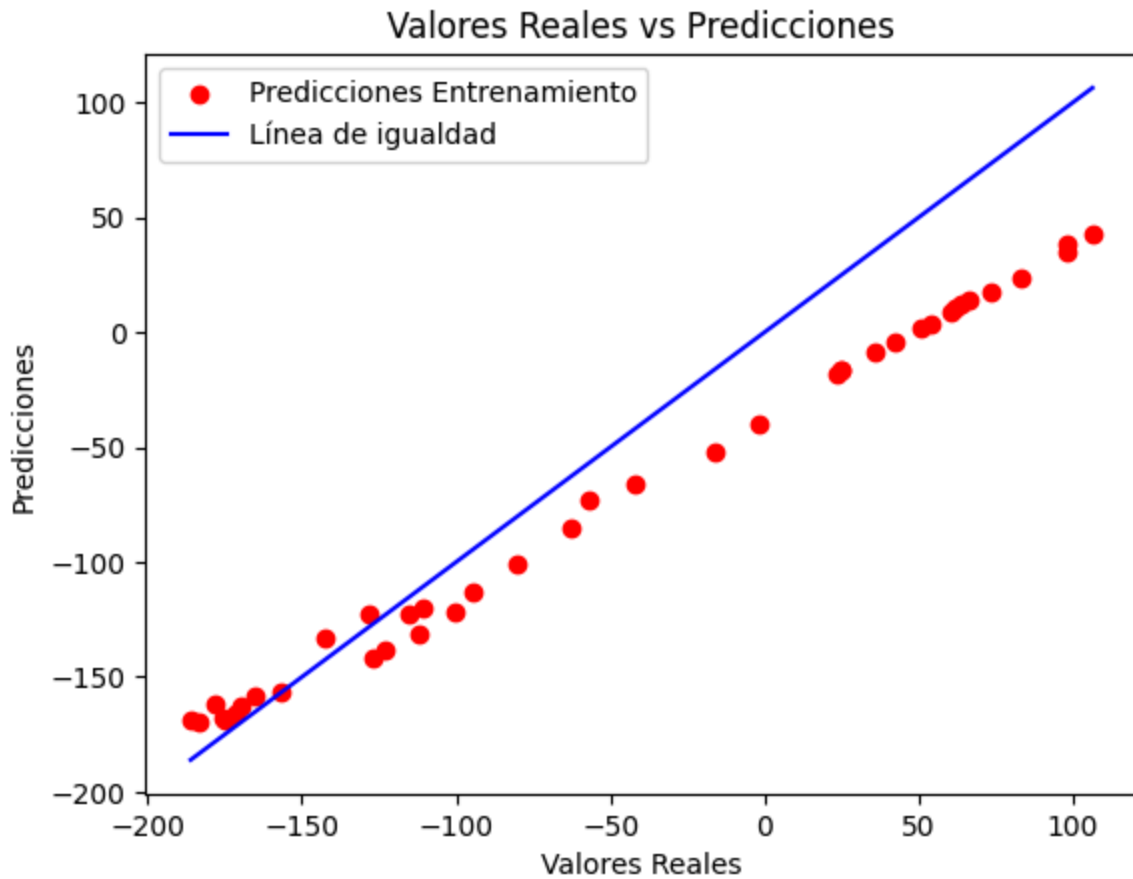

```
In [111…   fValidacionMSE = mean_squared_error(oValidacion["Valks"], oYPredValidacion)
           print("Mean Squared Error Validacion: ", fValidacionMSE)

           plt.scatter(oValidacion["Valks"], oYPredValidacion, color='red', label='Predicciones \
           plt.plot([oValidacion["Valks"].min(), oValidacion["Valks"].max()], [oValidacion["Valks
           plt.xlabel('Valores Reales')
           plt.ylabel('Predicciones')
           plt.title('Valores Reales vs Predicciones')
           plt.legend()
           plt.show()
```

```
Mean Squared Error Validacion:   793.0406433319511
```

Valores Reales vs Predicciones
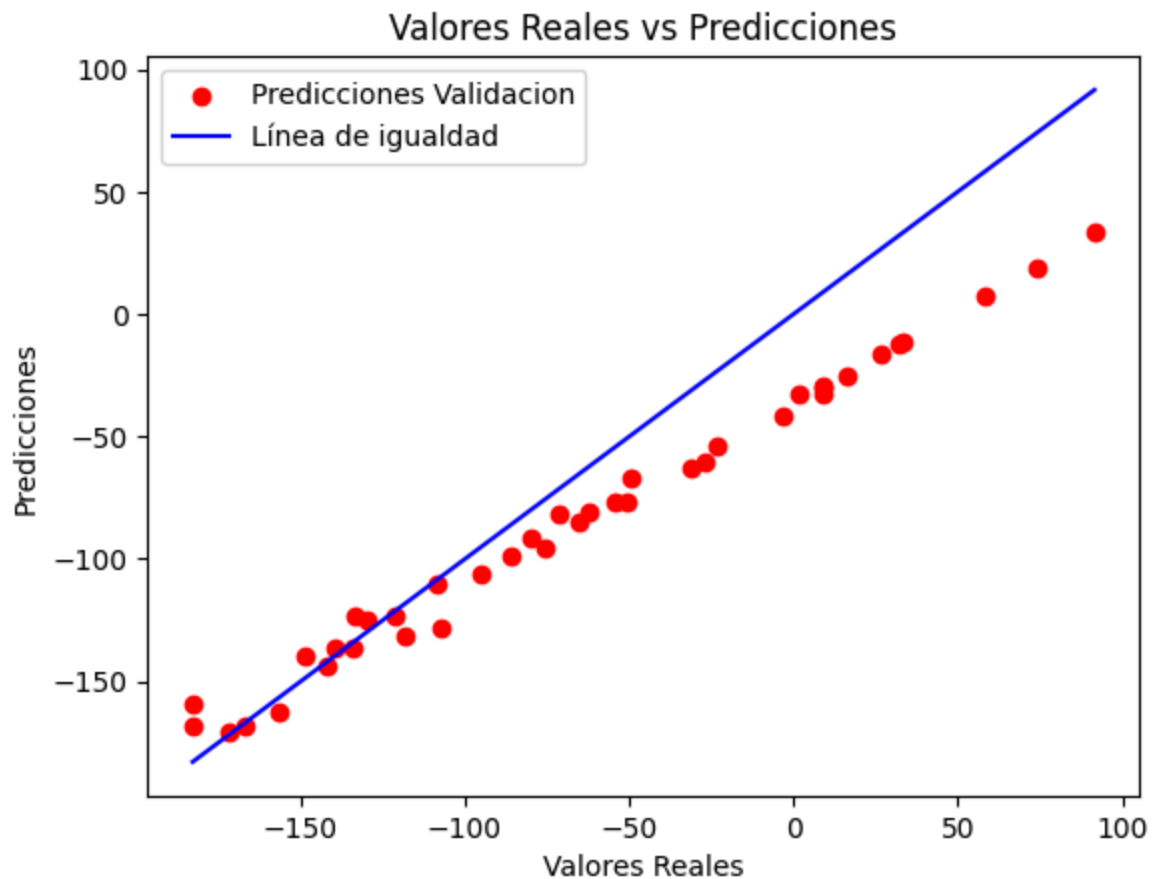

```
In [96]:  fTestMSE = mean_squared_error(oTest["Valks"], oYPredTest)
          print("Mean Squared Error Test: ", mse)

          plt.scatter(oTest["Valks"], oYPredTest, color='red', label='Predicciones Test')
          plt.plot([oTest["Valks"].min(), oTest["Valks"].max()], [oTest["Valks"].min(), oTest["V
          plt.xlabel('Valores Reales')
          plt.ylabel('Predicciones')
          plt.title('Valores Reales vs Predicciones')
          plt.legend()
          plt.show()
```

Mean Squared Error Test: 793.0406433319511

Valores Reales vs Predicciones
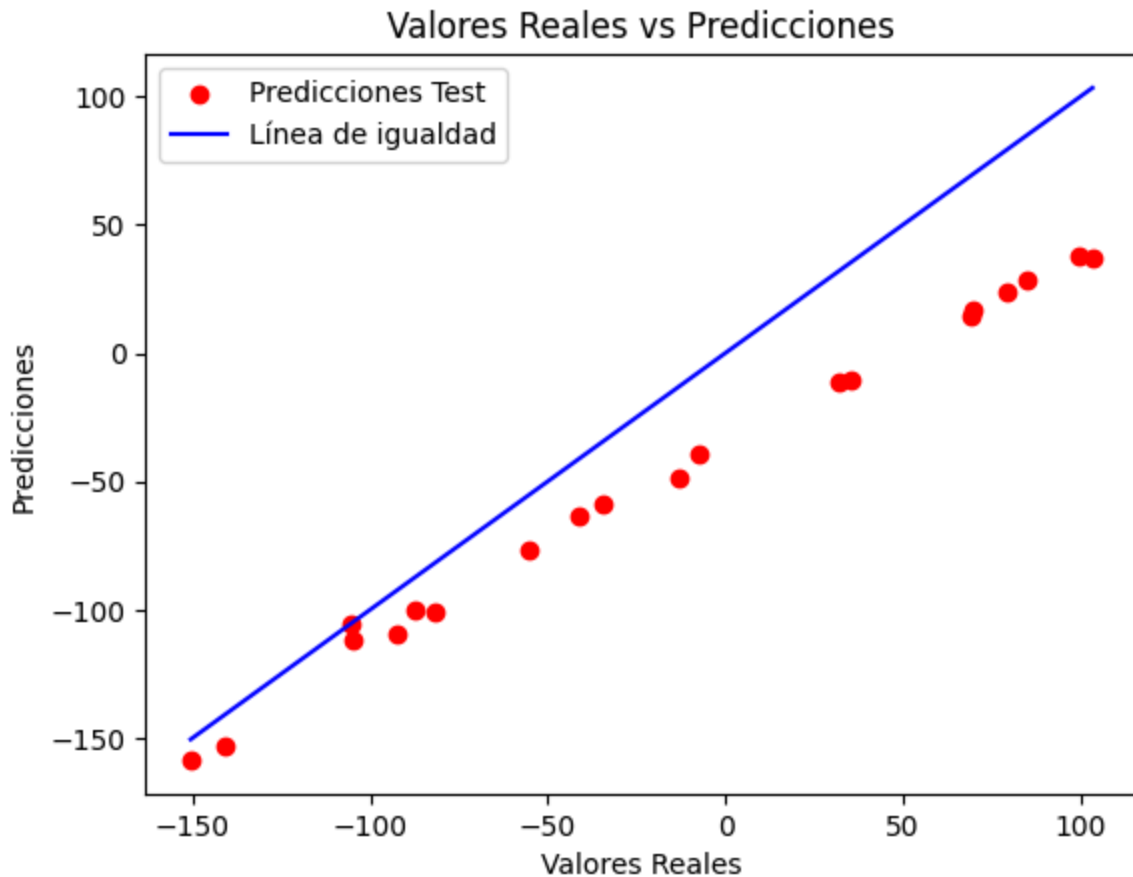

```
In [97]:  oInstances = np.random.choice(range(3, 40), 20, replace=False)
          oInstances[0] = 2 # Para que siempre tenga el valor 2
          oInstances = sorted(oInstances) # Ordenamos las instancias
          print(oInstances)
```

```
[2, 4, 7, 8, 9, 10, 11, 13, 17, 18, 21, 23, 26, 27, 30, 31, 32, 36, 38, 39]
```

```
In [104…  oTrainErrors = []
          oValErrors = []

          for instance in oInstances:
              oTrainMSETemp = []
              oValMSETemp = []
              for _ in range(100):

                  oTrainSubset = oCelsiusValhalla.sample(n=instance)
                  oModeloTemp = SGDRegressor(eta0=1E-4, max_iter=1000000)
                  oModeloTemp.fit(oTrainSubset[['Celsius']], oTrainSubset['Valks'])

                  # Cálculo del MSE
                  fTrainingMSE = mean_squared_error(oTrainSubset['Valks'], oModeloTemp.predict(c
                  fValidacionMSE = mean_squared_error(oValidacion['Valks'], oModeloTemp.predict(
                  oTrainMSETemp.append(fTrainingMSE)
                  oValMSETemp.append(fValidacionMSE)

              # Almacenar los errores promedios
              oTrainErrors.append(np.mean(oTrainMSETemp))
              oValErrors.append(np.mean(oValMSETemp))
```

```
In [105…  print(len(oTrainErrors))
          print(len(oValErrors))
```

```
20
20
```

In [106…
```python
plt.figure(figsize=(10, 6))
plt.plot(oInstances , oTrainErrors, label='Train Error')
plt.plot(oInstances , oValErrors, label='Validation Error')
plt.axhline(y=fTestMSE, color='red', linestyle='--', label='Test Error (Base)')
plt.xlabel('Tamaño de muestra')
plt.ylabel('Error cuadrático medio')
plt.title('Evolución del error promedio de entrenamiento y validación')
plt.legend()
plt.show()
```
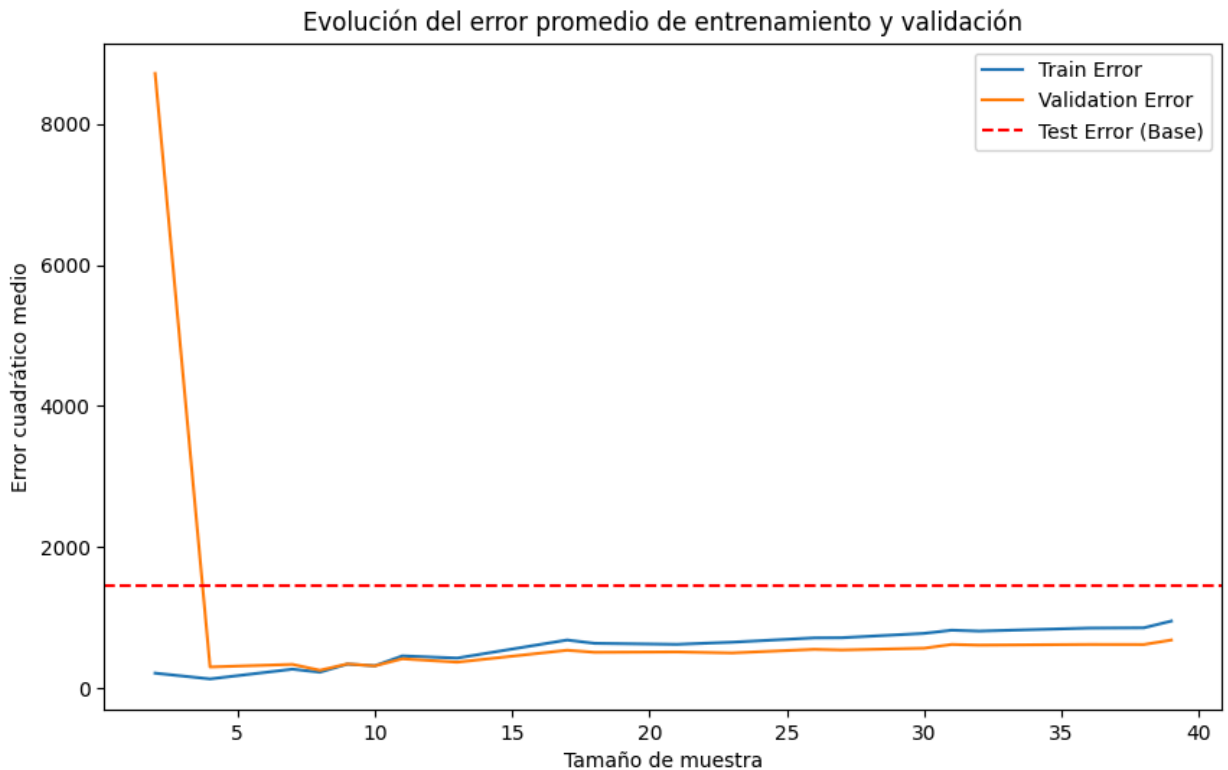

En esta grafica se puede ver que el caso de validacion empezo con un error muy grande y fue disminuyendo mientras más modelos iban siendo ejecutados. En el caso de los datos de Training el tamaño de la muestra era muy importante para el error cuadratico, ya que mientras el tamaño de la muestra iba aumentando el Error Cuadratico tambien lo hacia.

Despues de ver la grafica el tamaño de muestra adecuado podemos dejarlo a 20 muestas para tener suficiente información sin necesidad de aumentar mucho el error cuadratico

In [121…
```python
iTamañoOptimo = 20
oTrainOptimal = oCelsiusValhalla.sample(n=iTamañoOptimo)
oModeloOptimo = SGDRegressor( eta0=1E-4, max_iter=1000000)
oModeloOptimo.fit(oTrainOptimal[['Celsius']], oTrainOptimal['Valks'])

oYPredTrainOpt = oModeloOptimo.predict(oTrain[["Celsius"]])
oYPredValidacionOpt = oModeloOptimo.predict(oValidacion[["Celsius"]])
oYPredTestOpt = oModeloOptimo.predict(oTest[["Celsius"]])
```

```
In [122…  fTrainOptMSE = mean_squared_error(oTrain["Valks"], oYPredTrainOpt)
          fValidacionOptMSE = mean_squared_error(oValidacion["Valks"], oYPredValidacionOpt)
          fTestOptMSE = mean_squared_error(oTest["Valks"], oYPredTestOpt)

          print("Modelo 1")
          print("Mean Squared Error Training: ", fTrainMSE)
          print("Mean Squared Error Validation: ", fValidacionMSE)
          print("Mean Squared Error Test: ", fTestMSE)

          print("Modelo Optimo")
          print("Mean Squared Error Training: ", fTrainOptMSE)
          print("Mean Squared Error Validation: ", fValidacionOptMSE)
          print("Mean Squared Error Test: ", fTestOptMSE)
```

```
Modelo 1
Mean Squared Error Training:  1271.507141428822
Mean Squared Error Validation:  793.0406433319511
Mean Squared Error Test:  1459.7224788768303
Modelo Optimo
Mean Squared Error Training:  87.82765616177105
Mean Squared Error Validation:  73.54517172970229
Mean Squared Error Test:  75.09330504002091
```

Con estos datos se puede confirmar que el error si bajo mucho con el numero de muestra, asi que con esto podemos confirmar que con un numero adecuado de muestras la prediccion puede ser mucho mejor sin necesidad de agregar todos los datos

```
In [123…  from google.colab import files
          f = files.upload()

          # Convert ipynb to html
          import subprocess
          file0 = list(f.keys())[0]
          _ = subprocess.run(["pip", "install", "nbconvert"])
          _ = subprocess.run(["jupyter", "nbconvert", file0, "--to", "html"])

          # download the html
          files.download(file0[:-5]+"html")
```

Choose Files   No file chosen   Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
<ipython-input-123-b13a234a1857> in <cell line: 2>()
      1 from google.colab import files
----> 2 f = files.upload()
      3
      4 # Convert ipynb to html
      5 import subprocess

/usr/local/lib/python3.10/dist-packages/google/colab/files.py in upload()
     67     """
     68
---> 69     uploaded_files = _upload_files(multiple=True)
     70     # Mapping from original filename to filename as saved locally.
     71     local_filenames = dict()

/usr/local/lib/python3.10/dist-packages/google/colab/files.py in _upload_files(multip
le)
    154
    155     # First result is always an indication that the file picker has completed.
--> 156     result = _output.eval_js(
    157         'google.colab._files._uploadFiles("{input_id}", "{output_id}")'.format(
    158             input_id=input_id, output_id=output_id

/usr/local/lib/python3.10/dist-packages/google/colab/output/_js.py in eval_js(script,
ignore_result, timeout_sec)
     38     if ignore_result:
     39       return
---> 40     return _message.read_reply_from_input(request_id, timeout_sec)
     41
     42

/usr/local/lib/python3.10/dist-packages/google/colab/_message.py in read_reply_from_i
nput(message_id, timeout_sec)
     94       reply = _read_next_input_message()
     95       if reply == _NOT_READY or not isinstance(reply, dict):
---> 96         time.sleep(0.025)
     97         continue
     98       if (

KeyboardInterrupt:
```