New York City Leading Causes of Death

The data consider 6 features; year, leading cause of death, sex, race, deaths, death rate and age-adjusted death rate.

Data Extraction and Exploration

In [1]:
```
import types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It
includes your credentials.
# You might want to remove those credentials before you share the notebook
.
client_11c432be10854a9b9869f676bfc39db7 = ibm_boto3.client(service_name='s
3',
    ibm_api_key_id='RoQ3a72rfJwtvFJsCDXKv8HQVkgk8r819S0k9ES0wc1e',
    ibm_auth_endpoint="https://iam.ng.bluemix.net/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3-api.us-geo.objectstorage.service.networklayer
.com')

body = client_11c432be10854a9b9869f676bfc39db7.get_object(Bucket='nyc-dono
tdelete-pr-0ua42fmkmna1sa',Key='NYCity.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType( __iter
__, body )

# If you are reading an Excel file into a pandas DataFrame, replace `read_
csv` by `read_excel` in the next statement.
df_data_0 = pd.read_csv(body)
df_data_0.head()
```

Out[1]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281	107.3	170.5
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146	96	143.5
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199	16.7	26.6
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191	16	16.6
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186	15.6	23.2

In [2]:
```python
# The dataframe is renamed df_ny from the original name df_data_0

df_ny = df_data_0
df_ny.head()
```

Out[2]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281	107.3	170.5
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146	96	143.5
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199	16.7	26.6
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191	16	16.6
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186	15.6	23.2

In [3]:
```python
# A description of the dataset

df_ny.describe(include = 'all')
```

Out[3]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
count	1094.000000	1094	1094	1094	1094	1094	1094
unique	NaN	27	2	6	465	442	427
top	NaN	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Female	Not Stated/Unknown	.	.	.
freq	NaN	96	554	200	138	386	386
mean	2010.477148	NaN	NaN	NaN	NaN	NaN	NaN
std	2.293419	NaN	NaN	NaN	NaN	NaN	NaN
min	2007.000000	NaN	NaN	NaN	NaN	NaN	NaN
25%	2008.000000	NaN	NaN	NaN	NaN	NaN	NaN
50%	2010.000000	NaN	NaN	NaN	NaN	NaN	NaN
75%	2012.000000	NaN	NaN	NaN	NaN	NaN	NaN
max	2014.000000	NaN	NaN	NaN	NaN	NaN	NaN

In [4]:
```python
# Data grouping according to leading cause of death in New York

df_grp4 = df_ny[["Deaths", "Leading_Cause", "Year"]].groupby(["Leading_Cau
se"], as_index = False).mean()
df_grp4
```

Out[4]:

	Leading_Cause	Year
0	Accidents Except Drug Poisoning (V01-X39, X43,...	2010.350000
1	All Other Causes	2010.500000
2	Alzheimer's Disease (G30)	2011.093750

3	Aortic Aneurysm and Dissection (I71)	2009.000000
4	Assault (Homicide: Y87.1, X85-Y09)	2009.650000
5	Atherosclerosis (I70)	2008.666667
6	Cerebrovascular Disease (Stroke: I60-I69)	2010.544444
7	Certain Conditions originating in the Perinata...	2010.500000
8	Chronic Liver Disease and Cirrhosis (K70, K73)	2010.551724
9	Chronic Lower Respiratory Diseases (J40-J47)	2010.488636
10	Congenital Malformations, Deformations, and Ch...	2010.875000
11	Diabetes Mellitus (E10-E14)	2010.543478
12	Diseases of Heart (I00-I09, I11, I13, I20-I51)	2010.500000
13	Essential Hypertension and Renal Diseases (I10...	2010.586667
14	Human Immunodeficiency Virus Disease (HIV: B20...	2010.186047
15	In Situ or Benign / Uncertain Neoplasms (D00-D48)	2008.500000
16	In situ or Benign / Uncertain Neoplasms (D00-D48)	2008.000000
17	Influenza (Flu) and Pneumonia (J09-J18)	2010.500000
18	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	2010.578947
19	Malignant Neoplasms (Cancer: C00-C97)	2010.500000
20	Mental and Behavioral Disorders due to Acciden...	2010.435897
21	Mental and Behavioral Disorders due to Use of ...	2008.500000
22	Nephritis, Nephrotic Syndrome and Nephrosis (N...	2010.294118
23	Parkinson's Disease (G20)	2011.000000
24	Septicemia (A40-A41)	2011.076923
25	Tuberculosis (A16-A19)	2011.000000
26	Viral Hepatitis (B15-B19)	2010.400000

In [5]:
```
# Checking for the type of data per variable

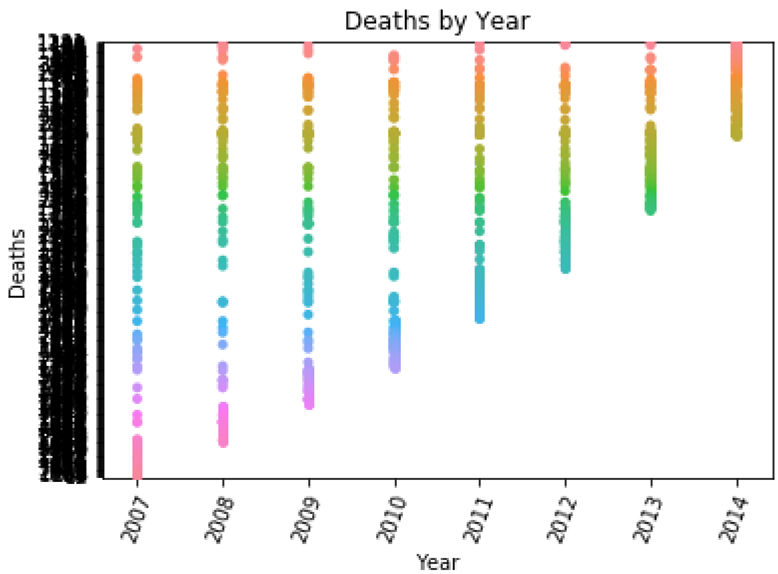
df_ny.dtypes
```

Out[5]:
```
Year                  int64
Leading_Cause        object
Sex                  object
Race                 object
Deaths               object
Death_Rate           object
AADR                 object
dtype: object
```

In [6]:
```
# In this cell libraries and modules required for plotting are imported an
d a swarm plot is drawn;
# the swarm plot shows that some data such as deaths that would be conside
```

```
red numerical are actually entered as strings

import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
plot = sns.swarmplot(x = "Year", y = 'Deaths', data = df_ny)
plt.setp(plot.get_xticklabels(), rotation = 70)
plt.title('Deaths by Year')
plt.show()
```



In [7]:
```
# Missing values in the dataset are being checked for

missing_data = df_ny.isnull()
missing_data.head(30)
```

Out[7]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False
5	False	False	False	False	False	False	False
6	False	False	False	False	False	False	False
7	False	False	False	False	False	False	False
8	False	False	False	False	False	False	False
9	False	False	False	False	False	False	False
10	False	False	False	False	False	False	False
11	False	False	False	False	False	False	False
12	False	False	False	False	False	False	False

13	False	False	False	False	False	False	False
14	False	False	False	False	False	False	False
15	False	False	False	False	False	False	False
16	False	False	False	False	False	False	False
17	False	False	False	False	False	False	False
18	False	False	False	False	False	False	False
19	False	False	False	False	False	False	False
20	False	False	False	False	False	False	False
21	False	False	False	False	False	False	False
22	False	False	False	False	False	False	False
23	False	False	False	False	False	False	False
24	False	False	False	False	False	False	False
25	False	False	False	False	False	False	False
26	False	False	False	False	False	False	False
27	False	False	False	False	False	False	False
28	False	False	False	False	False	False	False
29	False	False	False	False	False	False	False

In [8]:
```
missing_data2 = df_ny.notnull()
missing_data2.head()
```

Out[8]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	True	True	True	True	True	True	True
1	True	True	True	True	True	True	True
2	True	True	True	True	True	True	True
3	True	True	True	True	True	True	True
4	True	True	True	True	True	True	True

In [9]:
```
# Counting the missing values

for column in missing_data.columns.values.tolist():
    print(column)
    print(missing_data[column].value_counts())
    print("")
```

```
Year
False    1094
Name: Year, dtype: int64

Leading_Cause
False    1094
Name: Leading Cause, dtype: int64
```

```
Sex
False    1094
Name: Sex, dtype: int64

Race
False    1094
Name: Race, dtype: int64

Deaths
False    1094
Name: Deaths, dtype: int64

Death_Rate
False    1094
Name: Death_Rate, dtype: int64

AADR
False    1094
Name: AADR, dtype: int64
```

In [10]:

```
df_ny.head(50)
```

Out[10]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281	107.3	170.5
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146	96	143.5
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199	16.7	26.6
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191	16	16.6
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186	15.6	23.2
5	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Hispanic	176	14.7	16.9
6	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Hispanic	165	13.8	20.4
7	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Hispanic	164	13.7	16.7
8	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Hispanic	145	12.1	19.3
9	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Hispanic	92	7.7	8.7
10	2014	All Other Causes	Male	Hispanic	1195	100.1	143.3
11	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Asian and Pacific Islander	657	114.5	129.5
		Diseases of Heart (I00-I09, I11, I13, I20-		Asian and Pacific			

12	2014	I51)	Male	Islander	554	96.5	118.5
13	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Asian and Pacific Islander	105	18.3	25
14	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Asian and Pacific Islander	95	16.6	22.9
15	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Asian and Pacific Islander	91	15.9	19.3
16	2014	Diabetes Mellitus (E10-E14)	Male	Asian and Pacific Islander	71	12.4	14.2
17	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Asian and Pacific Islander	68	11.9	13.3
18	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	Asian and Pacific Islander	50	8.7	8.7
19	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Asian and Pacific Islander	31	5.4	5.3
20	2014	Nephritis, Nephrotic Syndrome and Nephrosis (N...	Male	Asian and Pacific Islander	28	4.9	5.8
21	2014	All Other Causes	Male	Asian and Pacific Islander	424	73.9	90.4
22	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	White Non-Hispanic	3990	297.1	238.4
23	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	White Non-Hispanic	3142	234	195.1
24	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	White Non-Hispanic	502	37.4	29.7
25	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	White Non-Hispanic	399	29.7	24
26	2014	Mental and Behavioral Disorders due to Acciden...	Male	White Non-Hispanic	314	23.4	21.4
27	2014	Diabetes Mellitus (E10-E14)	Male	White Non-Hispanic	292	21.7	18.1
28	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	White Non-Hispanic	277	20.6	16.8
29	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	White Non-Hispanic	258	19.2	16.4
30	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	White Non-Hispanic	204	15.2	13.4
31	2014	Essential Hypertension and Renal Diseases (I10...	Male	White Non-Hispanic	175	13	10.5
32	2014	All Other Causes	Male	White Non-Hispanic	2275	169.4	141.3
33	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Black Non-Hispanic	1958	226.8	264.7

34	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Black Non-Hispanic	1532	177.5	199.6
35	2014	Diabetes Mellitus (E10-E14)	Male	Black Non-Hispanic	318	36.8	42.2
36	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Black Non-Hispanic	242	28	33.9
37	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Black Non-Hispanic	197	22.8	26.4
38	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Black Non-Hispanic	196	22.7	21.7
39	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Black Non-Hispanic	186	21.5	25.4
40	2014	Assault (Homicide: Y87.1, X85-Y09)	Male	Black Non-Hispanic	186	21.5	21.5
41	2014	Essential Hypertension and Renal Diseases (I10...	Male	Black Non-Hispanic	155	18	21.6
42	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Black Non-Hispanic	148	17.1	17.7
43	2014	All Other Causes	Male	Black Non-Hispanic	1375	159.3	177.8
44	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Other Race/ Ethnicity	63	.	.
45	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Other Race/ Ethnicity	50	.	.
46	2014	Diabetes Mellitus (E10-E14)	Male	Other Race/ Ethnicity	18	.	.
47	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Other Race/ Ethnicity	12	.	.
48	2014	Mental and Behavioral Disorders due to Acciden...	Male	Other Race/ Ethnicity	12	.	.
49	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Other Race/ Ethnicity	11	.	.

In [28]:
```
df_ny = df_ny.fillna(df_ny.mean())
df_ny.head(50)
```

Out[28]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281.0	107.300000	170.500000
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146.0	96.000000	143.500000
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199.0	16.700000	26.600000
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191.0	16.000000	16.600000
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186.0	15.600000	23.200000

5	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Hispanic	176.0	14.700000	16.900000
6	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Hispanic	165.0	13.800000	20.400000
7	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Hispanic	164.0	13.700000	16.700000
8	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Hispanic	145.0	12.100000	19.300000
9	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Hispanic	92.0	7.700000	8.700000
10	2014	All Other Causes	Male	Hispanic	1195.0	100.100000	143.300000
11	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Asian and Pacific Islander	657.0	114.500000	129.500000
12	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Asian and Pacific Islander	554.0	96.500000	118.500000
13	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Asian and Pacific Islander	105.0	18.300000	25.000000
14	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Asian and Pacific Islander	95.0	16.600000	22.900000
15	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Asian and Pacific Islander	91.0	15.900000	19.300000
16	2014	Diabetes Mellitus (E10-E14)	Male	Asian and Pacific Islander	71.0	12.400000	14.200000
17	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Asian and Pacific Islander	68.0	11.900000	13.300000
18	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	Asian and Pacific Islander	50.0	8.700000	8.700000
19	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Asian and Pacific Islander	31.0	5.400000	5.300000
20	2014	Nephritis, Nephrotic Syndrome and Nephrosis (N...	Male	Asian and Pacific Islander	28.0	4.900000	5.800000
21	2014	All Other Causes	Male	Asian and Pacific Islander	424.0	73.900000	90.400000
22	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	White Non-Hispanic	3990.0	297.100000	238.400000
23	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	White Non-Hispanic	3142.0	234.000000	195.100000
24	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	White Non-Hispanic	502.0	37.400000	29.700000
25	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	White Non-Hispanic	399.0	29.700000	24.000000
26	2014	Mental and Behavioral Disorders due to Acciden...	Male	White Non-Hispanic	314.0	23.400000	21.400000
				White Non-			

27	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	292.0	21.700000	18.100000
28	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	White Non-Hispanic	277.0	20.600000	16.800000
29	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	White Non-Hispanic	258.0	19.200000	16.400000
30	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	White Non-Hispanic	204.0	15.200000	13.400000
31	2014	Essential Hypertension and Renal Diseases (I10...	Male	White Non-Hispanic	175.0	13.000000	10.500000
32	2014	All Other Causes	Male	White Non-Hispanic	2275.0	169.400000	141.300000
33	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Black Non-Hispanic	1958.0	226.800000	264.700000
34	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Black Non-Hispanic	1532.0	177.500000	199.600000
35	2014	Diabetes Mellitus (E10-E14)	Male	Black Non-Hispanic	318.0	36.800000	42.200000
36	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Black Non-Hispanic	242.0	28.000000	33.900000
37	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Black Non-Hispanic	197.0	22.800000	26.400000
38	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Black Non-Hispanic	196.0	22.700000	21.700000
39	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Black Non-Hispanic	186.0	21.500000	25.400000
40	2014	Assault (Homicide: Y87.1, X85-Y09)	Male	Black Non-Hispanic	186.0	21.500000	21.500000
41	2014	Essential Hypertension and Renal Diseases (I10...	Male	Black Non-Hispanic	155.0	18.000000	21.600000
42	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Black Non-Hispanic	148.0	17.100000	17.700000
43	2014	All Other Causes	Male	Black Non-Hispanic	1375.0	159.300000	177.800000
44	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Other Race/ Ethnicity	63.0	53.438842	53.462288
45	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Other Race/ Ethnicity	50.0	53.438842	53.462288
46	2014	Diabetes Mellitus (E10-E14)	Male	Other Race/ Ethnicity	18.0	53.438842	53.462288
47	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Other Race/ Ethnicity	12.0	53.438842	53.462288
48	2014	Mental and Behavioral Disorders due to Acciden...	Male	Other Race/ Ethnicity	12.0	53.438842	53.462288

49	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Other Race/ Ethnicity	11.0	53.438842	53.462288

In [29]:
```
# Determining the value_counts for each sex

df_ny["Sex"].value_counts()
```

Out[29]:
```
Female    554
Male      540
Name: Sex, dtype: int64
```

In [30]:
```
# Determining the value_counts for each race

df_ny["Race"].value_counts()
```

Out[30]:
```
Not Stated/Unknown            200
Other Race/ Ethnicity         186
Black Non-Hispanic            178
Hispanic                      177
Asian and Pacific Islander    177
White Non-Hispanic            176
Name: Race, dtype: int64
```

Extract, Transform, Load (ETL)

In [31]:
```
# Data types

df_ny.dtypes
```

Out[31]:
```
Year                int64
Leading_Cause      object
Sex                object
Race               object
Deaths            float64
Death_Rate        float64
AADR              float64
dtype: object
```

In [32]:
```
df_ny.describe(include = "all")
```

Out[32]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
count	1094.000000	1094	1094	1094	1094.000000	1094.000000	1094.000000
unique	NaN	27	2	6	NaN	NaN	NaN
top	NaN	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Female	Not Stated/Unknown	NaN	NaN	NaN
freq	NaN	96	554	200	NaN	NaN	NaN
mean	2010.477148	NaN	NaN	NaN	444.558577	53.438842	53.462288
std	2.293419	NaN	NaN	NaN	822.673477	61.546202	55.575360

min	2007.000000	NaN	NaN	NaN	5.000000	2.400000	2.500000
25%	2008.000000	NaN	NaN	NaN	47.000000	15.800000	16.950000
50%	2010.000000	NaN	NaN	NaN	186.000000	53.438842	53.462288
75%	2012.000000	NaN	NaN	NaN	444.558577	53.438842	53.462288
max	2014.000000	NaN	NaN	NaN	7050.000000	491.400000	350.700000

In [33]:
```
df_ny["Deaths"].min()
```
Out[33]: 5.0

In [34]:
```
df_ny["Deaths"].max()
```
Out[34]: 7050.0

In [35]:
```
import numpy as np
df_ny.replace(".", np.nan, inplace = True)
```

In [36]:
```
df_ny["Deaths"] = df_ny["Deaths"].astype(float)
```

In [37]:
```
df_ny["Death_Rate"] = df_ny["Death_Rate"].astype(float)
```

In [38]:
```
df_ny["Deaths"].mean()
```
Out[38]: 444.55857740585924

In [39]:
```
df_ny["Death_Rate"].mean()
```
Out[39]: 53.43884180790981

In [40]:
```
df_ny["AADR"].mean()
```
Out[40]: 53.46228813559277

In [41]:
```
df_ny["AADR"] = df_ny["AADR"].astype(float)
```

In [42]:
```
df_grp1 = df_ny[["Deaths", "Sex"]].groupby(['Sex'], as_index = False).mean
()
df_grp1
```
Out[42]:

	Sex	Deaths
0	Female	464.848070
1	Male	423.743061

In [45]:
```
import scipy.stats
scipy.stats.pearsonr(df_ny["Deaths"], df_ny["Death_Rate"])
```
Out[45]: (0.9324294842131633, 0.0)

In [46]:
```
scipy.stats.pearsonr(df_ny["Deaths"], df_ny["AADR"])
```
Out[46]: (0.7931153989191558, 2.1919824608206278e-237)

In [47]:
```
scipy.stats.pearsonr(df_ny["Death_Rate"], df_ny["AADR"])
```
Out[47]: (0.9195200324490621, 0.0)

In [48]:
```
# Average number of Deaths per year

df_grp2 = df_ny[["Deaths", "Year"]].groupby(['Year'], as_index = False).me
an()
df_grp2
```
Out[48]:

	Year	Deaths
0	2007	464.925695
1	2008	460.180978
2	2009	463.705842
3	2010	451.342672
4	2011	449.612808
5	2012	431.005246
6	2013	421.461289
7	2014	412.631691

In [49]:
```
# Average number of Deaths per race

df_grp5 = df_ny[["Deaths", "Race"]].groupby(['Race'], as_index = False).me
an()
df_grp5
```
Out[49]:

	Race	Deaths
0	Asian and Pacific Islander	148.898305
1	Black Non-Hispanic	624.247191
2	Hispanic	422.610169
3	Not Stated/Unknown	140.525816
4	Other Race/ Ethnicity	212.268390
5	White Non-Hispanic	1173.221591

In [50]:
```
# Average number of Deaths by sex

df_grp6 = df_ny[["Deaths", "Sex"]].groupby(['Sex'], as_index = False).mean
()
df_grp6
```

Out[50]:

	Sex	Deaths
0	Female	464.848070
1	Male	423.743061

In [51]:
```
# In this cell, the mean of all variables by race is indicated

df_ny.groupby("Race").mean()
```

Out[51]:

	Year	Deaths	Death_Rate	AADR
Race				
Asian and Pacific Islander	2010.485876	148.898305	27.313559	34.387006
Black Non-Hispanic	2010.460674	624.247191	65.946629	69.571348
Hispanic	2010.491525	422.610169	35.858757	49.824294
Not Stated/Unknown	2010.480000	140.525816	53.438842	53.462288
Other Race/ Ethnicity	2010.446237	212.268390	53.438842	53.462288
White Non-Hispanic	2010.500000	1173.221591	84.742614	60.012500

In [52]:
```
# Collections-extended library is installed to enable proper variable coun
ting

!pip install collections-extended
```

```
Collecting collections-extended
  Downloading https://files.pythonhosted.org/packages/4e/1e/3440dfc8036621
832e33634bd8ae6fe691c0ee951441903417c8879c242e/collections_extended-1.0.3-
py2.py3-none-any.whl
Requirement already satisfied: setuptools in /opt/conda/envs/Python36/lib/
python3.6/site-packages (from collections-extended) (40.8.0)
Installing collected packages: collections-extended
Successfully installed collections-extended-1.0.3
```

In [53]:
```
from collections import Counter
import collections, numpy
df_sex = df_ny["Sex"]
collections.Counter(df_sex)
```

Out[53]:
```
Counter({'Male': 540, 'Female': 554})
```

In [54]:
```
from collections import Counter
import collections, numpy
df_Leading = df_ny["Leading_Cause"]
collections.Counter(df_Leading)
```

Out[54]:
```
Counter({'Diseases of Heart (I00-I09, I11, I13, I20-I51)': 96,
         'Malignant Neoplasms (Cancer: C00-C97)': 96,
         'Influenza (Flu) and Pneumonia (J09-J18)': 96,
         'Mental and Behavioral Disorders due to Accidental Poisoning and
Other Psychoactive Substance Use (F11-F16, F18-F19, X40-X42, X44)': 39,
```

```
            'Diabetes Mellitus (E10-E14)': 92,
            'Accidents Except Drug Poisoning (V01-X39, X43, X45-X59, Y85-Y86)
': 80,
            'Cerebrovascular Disease (Stroke: I60-I69)': 90,
            'Chronic Liver Disease and Cirrhosis (K70, K73)': 29,
            'Chronic Lower Respiratory Diseases (J40-J47)': 88,
            'Human Immunodeficiency Virus Disease (HIV: B20-B24)': 43,
            'All Other Causes': 96,
            'Intentional Self-Harm (Suicide: X60-X84, Y87.0)': 38,
            'Nephritis, Nephrotic Syndrome and Nephrosis (N00-N07, N17-N19, N
25-N27)': 17,
            'Essential Hypertension and Renal Diseases (I10, I12)': 75,
            'Assault (Homicide: Y87.1, X85-Y09)': 20,
            'Certain Conditions originating in the Perinatal Period (P00-P96)
': 26,
            'Septicemia (A40-A41)': 13,
            "Alzheimer's Disease (G30)": 32,
            'Congenital Malformations, Deformations, and Chromosomal Abnormal
ities (Q00-Q99)': 8,
            'Viral Hepatitis (B15-B19)': 5,
            'Aortic Aneurysm and Dissection (I71)': 3,
            "Parkinson's Disease (G20)": 1,
            'Tuberculosis (A16-A19)': 1,
            'Mental and Behavioral Disorders due to Use of Alcohol (F10)': 2,
            'In Situ or Benign / Uncertain Neoplasms (D00-D48)': 4,
            'Atherosclerosis (I70)': 3,
            'In situ or Benign / Uncertain Neoplasms (D00-D48)': 1})
```

In [55]:

```
from collections import Counter
import collections, numpy
df_race = df_ny["Race"]
collections.Counter(df_race)
```

Out[55]:

```
Counter({'Hispanic': 177,
         'Asian and Pacific Islander': 177,
         'White Non-Hispanic': 176,
         'Black Non-Hispanic': 178,
         'Other Race/ Ethnicity': 186,
         'Not Stated/Unknown': 200})
```

Transforming the data

In [61]:

```
df_ny["AADR"] = df_ny["AADR"].astype(float)
```

In [62]:

```
df_ny["Death_Rate"] = df_ny["Death_Rate"].astype(float)
```

In [63]:

```
df_ny["Deaths"] = df_ny["Deaths"].astype(float)
```

In [64]:

```
df_ny.mean()
```

Out[64]:

```
Year          2010.477148
Deaths         444.558577
Death_Rate      53.438842
AADR            53.462288
```

```
dtype: float64
```

In [65]:
```
df_ny.mean()
```

Out[65]:
```
Year          2010.477148
Deaths         444.558577
Death_Rate      53.438842
AADR            53.462288
dtype: float64
```

In [66]:
```
# Missing numerical variables (NaN) are being replaced by the column means

df_ny = df_ny.fillna(df_ny.mean())
df_ny.head(50)
```

Out[66]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281.0	107.300000	170.500000
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146.0	96.000000	143.500000
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199.0	16.700000	26.600000
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191.0	16.000000	16.600000
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186.0	15.600000	23.200000
5	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Hispanic	176.0	14.700000	16.900000
6	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Hispanic	165.0	13.800000	20.400000
7	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Hispanic	164.0	13.700000	16.700000
8	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Hispanic	145.0	12.100000	19.300000
9	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Hispanic	92.0	7.700000	8.700000
10	2014	All Other Causes	Male	Hispanic	1195.0	100.100000	143.300000
11	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Asian and Pacific Islander	657.0	114.500000	129.500000
12	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Asian and Pacific Islander	554.0	96.500000	118.500000
13	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Asian and Pacific Islander	105.0	18.300000	25.000000
14	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Asian and Pacific Islander	95.0	16.600000	22.900000
15	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Asian and Pacific Islander	91.0	15.900000	19.300000

16	2014	Diabetes Mellitus (E10-E14)	Male	Asian and Pacific Islander	71.0	12.400000	14.200000
17	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Asian and Pacific Islander	68.0	11.900000	13.300000
18	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	Asian and Pacific Islander	50.0	8.700000	8.700000
19	2014	Chronic Liver Disease and Cirrhosis (K70, K73)	Male	Asian and Pacific Islander	31.0	5.400000	5.300000
20	2014	Nephritis, Nephrotic Syndrome and Nephrosis (N...	Male	Asian and Pacific Islander	28.0	4.900000	5.800000
21	2014	All Other Causes	Male	Asian and Pacific Islander	424.0	73.900000	90.400000
22	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	White Non-Hispanic	3990.0	297.100000	238.400000
23	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	White Non-Hispanic	3142.0	234.000000	195.100000
24	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	White Non-Hispanic	502.0	37.400000	29.700000
25	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	White Non-Hispanic	399.0	29.700000	24.000000
26	2014	Mental and Behavioral Disorders due to Acciden...	Male	White Non-Hispanic	314.0	23.400000	21.400000
27	2014	Diabetes Mellitus (E10-E14)	Male	White Non-Hispanic	292.0	21.700000	18.100000
28	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	White Non-Hispanic	277.0	20.600000	16.800000
29	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	White Non-Hispanic	258.0	19.200000	16.400000
30	2014	Intentional Self-Harm (Suicide: X60-X84, Y87.0)	Male	White Non-Hispanic	204.0	15.200000	13.400000
31	2014	Essential Hypertension and Renal Diseases (I10...	Male	White Non-Hispanic	175.0	13.000000	10.500000
32	2014	All Other Causes	Male	White Non-Hispanic	2275.0	169.400000	141.300000
33	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Black Non-Hispanic	1958.0	226.800000	264.700000
34	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Black Non-Hispanic	1532.0	177.500000	199.600000
35	2014	Diabetes Mellitus (E10-E14)	Male	Black Non-Hispanic	318.0	36.800000	42.200000
36	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Black Non-Hispanic	242.0	28.000000	33.900000
37	2014	Cerebrovascular Disease (Stroke: I60-I69)	Male	Black Non-Hispanic	197.0	22.800000	26.400000

38	2014	Human Immunodeficiency Virus Disease (HIV: B20...	Male	Black Non-Hispanic	196.0	22.700000	21.700000
39	2014	Chronic Lower Respiratory Diseases (J40-J47)	Male	Black Non-Hispanic	186.0	21.500000	25.400000
40	2014	Assault (Homicide: Y87.1, X85-Y09)	Male	Black Non-Hispanic	186.0	21.500000	21.500000
41	2014	Essential Hypertension and Renal Diseases (I10...	Male	Black Non-Hispanic	155.0	18.000000	21.600000
42	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Black Non-Hispanic	148.0	17.100000	17.700000
43	2014	All Other Causes	Male	Black Non-Hispanic	1375.0	159.300000	177.800000
44	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Other Race/ Ethnicity	63.0	53.438842	53.462288
45	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Other Race/ Ethnicity	50.0	53.438842	53.462288
46	2014	Diabetes Mellitus (E10-E14)	Male	Other Race/ Ethnicity	18.0	53.438842	53.462288
47	2014	Accidents Except Drug Poisoning (V01-X39, X43,...	Male	Other Race/ Ethnicity	12.0	53.438842	53.462288
48	2014	Mental and Behavioral Disorders due to Acciden...	Male	Other Race/ Ethnicity	12.0	53.438842	53.462288
49	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Other Race/ Ethnicity	11.0	53.438842	53.462288

In [67]:
```
df_ny.mean()
```

Out[67]:
```
Year          2010.477148
Deaths         444.558577
Death_Rate      53.438842
AADR            53.462288
dtype: float64
```

In [68]:
```
df_ny.groupby("Race").mean()
```

Out[68]:

Race	Year	Deaths	Death_Rate	AADR
Asian and Pacific Islander	2010.485876	148.898305	27.313559	34.387006
Black Non-Hispanic	2010.460674	624.247191	65.946629	69.571348
Hispanic	2010.491525	422.610169	35.858757	49.824294
Not Stated/Unknown	2010.480000	140.525816	53.438842	53.462288
Other Race/ Ethnicity	2010.446237	212.268390	53.438842	53.462288
White Non-Hispanic	2010.500000	1173.221591	84.742614	60.012500

In [69]:
```
df_ny.groupby("Sex").mean()
```

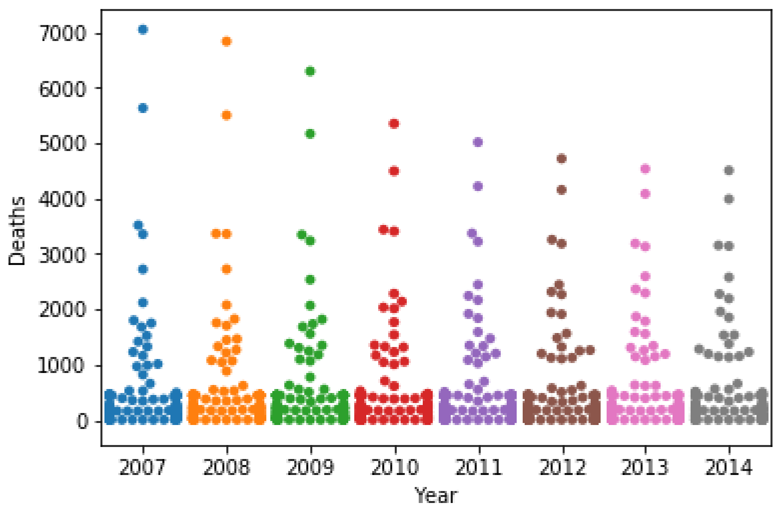
Out[69]:

Sex	Year	Deaths	Death_Rate	AADR
Female	2010.476534	464.848070	52.136766	46.912739
Male	2010.477778	423.743061	54.774675	60.181640

More visualizations of the data

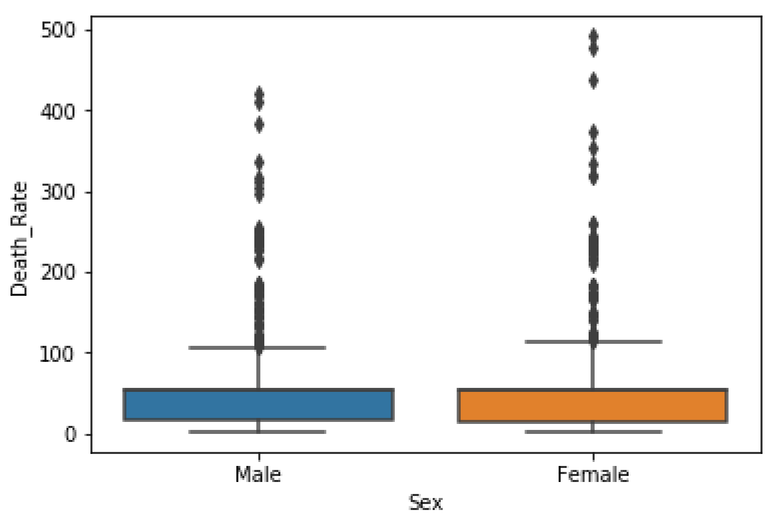
In [70]:
```
# A swarm plot re-drawn after replacing the missing data by the column mea
ns

plot = sns.swarmplot(x = "Year", y = "Deaths", data = df_ny)
```



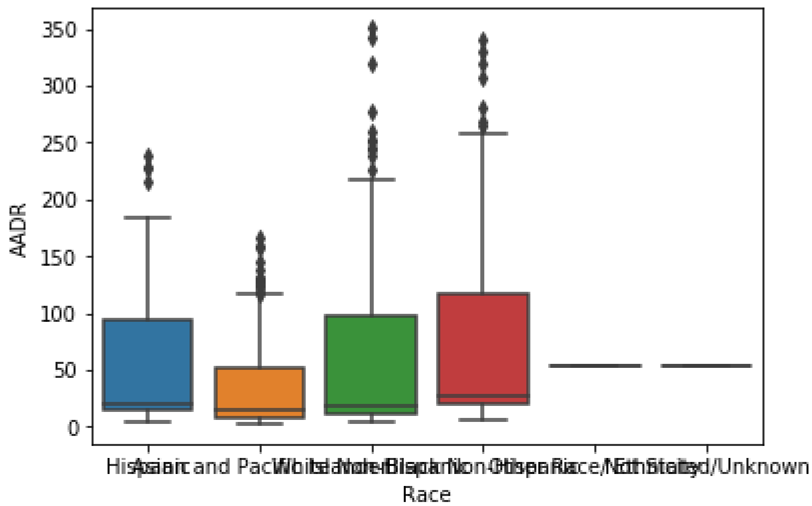
In [71]:
```
sns.boxplot(x = "Sex", y = "Death_Rate", data = df_ny)
```

Out[71]: <matplotlib.axes._subplots.AxesSubplot at 0x7f6718ae07f0>



In [72]:
```
sns.boxplot(x = "Race", y = "AADR", data = df_ny)
```

Out[72]: <matplotlib.axes._subplots.AxesSubplot at 0x7f6718a52a90>



In [73]:
```
df_ny.mean()
```

Out[73]:
```
Year           2010.477148
Deaths          444.558577
Death_Rate       53.438842
AADR             53.462288
dtype: float64
```

In [74]:
```
# The features are undergoing scaling since they are of different scales i
n the original dataset

from sklearn import preprocessing
from sklearn.preprocessing import StandardScaler
SCALE = StandardScaler()
SCALE.fit(df_ny[["Deaths", "Death_Rate", "AADR"]])
```

Out[74]: StandardScaler(copy=True, with_mean=True, with_std=True)

In [75]:
```
df_ny.head()
```

Out[75]:

	Year	Leading_Cause	Sex	Race	Deaths	Death_Rate	AADR
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	Male	Hispanic	1281.0	107.3	170.5
1	2014	Malignant Neoplasms (Cancer: C00-C97)	Male	Hispanic	1146.0	96.0	143.5
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	Male	Hispanic	199.0	16.7	26.6
3	2014	Mental and Behavioral Disorders due to Acciden...	Male	Hispanic	191.0	16.0	16.6
4	2014	Diabetes Mellitus (E10-E14)	Male	Hispanic	186.0	15.6	23.2

The encoding of categorical variables

In [76]:
```
X = df_ny[["Sex", "Race"]].values
```

```
X[0:5]
```

Out[76]:
```
array([['Male', 'Hispanic'],
       ['Male', 'Hispanic'],
       ['Male', 'Hispanic'],
       ['Male', 'Hispanic'],
       ['Male', 'Hispanic']], dtype=object)
```

In [77]:
```
le_Sex = preprocessing.LabelEncoder()
le_Sex.fit(['Female', 'Male'])
X[:,0] = le_Sex.transform(X[:,0])
```

In [78]:
```
df_ny["Race"].value_counts()
```

Out[78]:
```
Not Stated/Unknown            200
Other Race/ Ethnicity         186
Black Non-Hispanic            178
Hispanic                      177
Asian and Pacific Islander    177
White Non-Hispanic            176
Name: Race, dtype: int64
```

In [79]:
```
le_Race = preprocessing.LabelEncoder()
le_Race.fit(['Not Stated/Unknown', 'Other Race/ Ethnicity', 'Black Non-His
panic', 'Hispanic',
                      'Asian and Pacific Islander', 'White Non-Hispanic'])
X[:,1] = le_Race.transform(X[:,1])
```

In [80]:
```
X[0:5]
```

Out[80]:
```
array([[1, 2],
       [1, 2],
       [1, 2],
       [1, 2],
       [1, 2]], dtype=object)
```

Creation of dependent variables (the y's)

In [81]:
```
y1 = df_ny["Deaths"]
y1[0:5]
```

Out[81]:
```
0    1281.0
1    1146.0
2     199.0
3     191.0
4     186.0
Name: Deaths, dtype: float64
```

In [82]:
```
y2 = df_ny["Death_Rate"]
y2[0:5]
```

Out[82]:
```
0    107.3
1     96.0
2     16.7
3     16.0
```

```
4     15.6
Name: Death_Rate, dtype: float64
```

In [83]:
```
y3 = df_ny["AADR"]
y3[0:5]
```

Out[83]:
```
0    170.5
1    143.5
2     26.6
3     16.6
4     23.2
Name: AADR, dtype: float64
```

Model Definition and Training

Analysis of variance (ANOVA)

In [84]:
```
from scipy import stats
df_anova = df_ny[['Sex', "AADR"]]
grouped_anova = df_anova.groupby(['Sex'])
f_val,p_val = stats.f_oneway(grouped_anova.get_group("Male")["AADR"], grou
ped_anova.get_group("Female")["AADR"])
print("ANOVA results:F=", f_val, "P=", p_val)
```

```
ANOVA results:F= 15.79910032940535 P= 7.506366410092774e-05
```

Model Definition and Training: Linear Regression

Given the nature of the data, supervised learning machine learning algorithms and/or linear regression models were used with race and sex as the dependent variables. In this section, the Scikit-Learn library was used for ordinary linear regression. The dependent variables were number of deaths, death rate and age-adjusted death rate (AADR). The latter three were not included together in a single regression model since they represent the same outcome presented in different numerical formats. The data set are first split into train and test sets. A linear regression model is then instantiated and using this object, the model is trained using the train sets. The intercept and beta-coefficient are derived. These steps are carried out for all the three models with number of deaths, death rate and AADR as dependent variables.

In [85]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y1_train, y1_test = train_test_split(X, y1, test_size = 0
.3)
from sklearn.linear_model import LinearRegression
```

In [86]:
```
lr1 = LinearRegression()
lr1.fit(X_train, y1_train)
```

Out[86]:
```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
         normalize=False)
```

In [87]:
```
lr1.coef_
```

Out[87]:
```
array([-69.85160475,  90.9792418 ])
```

In [88]:
```
lr1.intercept_
```

Out[88]:
```
240.6707119535052
```

In [89]:
```
X_train, X_test, y2_train, y2_test = train_test_split(X, y2, test_size = 0
.3)
from sklearn.linear_model import LinearRegression
lr2 = LinearRegression()
lr2.fit(X_train, y2_train)
lr2.coef_
```

Out[89]:
```
array([8.71536122, 7.07887758])
```

In [90]:
```
lr2.intercept_
```

Out[90]:
```
31.16505123956901
```

In [91]:
```
X_train, X_test, y3_train, y3_test = train_test_split(X, y3, test_size = 0
.3)
from sklearn.linear_model import LinearRegression
lr3 = LinearRegression()
lr3.fit(X_train, y3_train)
lr3.coef_
```

Out[91]:
```
array([15.58854644,  2.32053421])
```

In [92]:
```
lr3.intercept_
```

Out[92]:
```
37.83718940881997
```

In order to include more linear regression estimates and/or parameters the Scipy library 'statsmodels.api' was imported. From it, the module 'stats' was imported to allow calculation of the estimates. This first required one-hot encoding or creation of dummy variables before writing the code to derive the estimates.

In [93]:
```
df_ny2 = pd.get_dummies(df_ny, columns = ["Sex", "Race"]).head()
df_ny2.head()
```

Out[93]:

	Year	Leading_Cause	Deaths	Death_Rate	AADR	Sex_Female	Sex_Male	Race_Asian and Pacific Islander	Race_Blac Nor Hispani
0	2014	Diseases of Heart (I00-I09, I11, I13, I20-I51)	1281.0	107.3	170.5	0	1	0	

1	2014	Malignant Neoplasms (Cancer: C00-C97)	1146.0	96.0	143.5	0	1	0
2	2014	Influenza (Flu) and Pneumonia (J09-J18)	199.0	16.7	26.6	0	1	0
3	2014	Mental and Behavioral Disorders due to Acciden...	191.0	16.0	16.6	0	1	0
4	2014	Diabetes Mellitus (E10-E14)	186.0	15.6	23.2	0	1	0

In [94]:

```
X4 = df_ny2[["Sex_Female", "Sex_Male", "Race_Asian and Pacific Islander", 
"Race_Black Non-Hispanic", "Race_Hispanic",
           "Race_Not Stated/Unknown", "Race_Other Race/ Ethnicity", "Race_
White Non-Hispanic"]].values
y4 = df_ny2[["AADR"]]
```

In [95]:

```
import statsmodels.api as sm
from scipy import stats
X5 = sm.add_constant(X4)
est = sm.OLS(y4, X5)
est2 = est.fit()
print(est2.summary())
```

```
                            OLS Regression Results                            
==========================================================================
====
Dep. Variable:                   AADR   R-squared:                       0
.000
Model:                            OLS   Adj. R-squared:                  0
.000
Method:                 Least Squares   F-statistic:                      
 nan
Date:                Wed, 11 Dec 2019   Prob (F-statistic):               
 nan
Time:                        07:56:09   Log-Likelihood:                -28
.096
No. Observations:                   5   AIC:                             5
8.19
Df Residuals:                       4   BIC:                             5
7.80
Df Model:                           0                                     

Covariance Type:            nonrobust                                     

==========================================================================
====
                 coef    std err          t      P>|t|      [0.025      0.
975]
```

```
--------------------------------------------------------------------------
----
const      -7.631e-15   3.34e-15     -2.281      0.085   -1.69e-14    1.66
e-15
x1            38.0400     16.674      2.281      0.085      -8.256      84
.336
x2                  0          0        nan        nan           0
   0
x3                  0          0        nan        nan           0
   0
x4            38.0400     16.674      2.281      0.085      -8.256      84
.336
x5                  0          0        nan        nan           0
   0
x6                  0          0        nan        nan           0
   0
x7                  0          0        nan        nan           0
   0
==========================================================================
====
Omnibus:                          nan   Durbin-Watson:                   0
.654
Prob(Omnibus):                    nan   Jarque-Bera (JB):                0
.787
Skew:                           0.451   Prob(JB):                        0
.675
Kurtosis:                       1.278   Cond. No.
 inf
==========================================================================
====

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is cor
rectly specified.
[2] The input rank is higher than the number of observations.
[3] The smallest eigenvalue is      0. This might indicate that there are
strong multicollinearity problems or that the design matrix is singular.
```

```
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/stats/sta
ttools.py:72: ValueWarning: omni_normtest is not valid with less than 8 ob
servations; 5 samples were given.
  "samples were given." % int(n), ValueWarning)
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/regressio
n/linear_model.py:1633: RuntimeWarning: divide by zero encountered in doub
le_scalars
  return np.sqrt(eigvals[0]/eigvals[-1])
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/regressio
n/linear_model.py:1554: RuntimeWarning: invalid value encountered in doubl
e_scalars
  return self.ess/self.df_model
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/base/mode
l.py:1100: RuntimeWarning: invalid value encountered in true_divide
  return self.params / self.bse
/opt/conda/envs/Python36/lib/python3.6/site-packages/scipy/stats/_distn_in
frastructure.py:877: RuntimeWarning: invalid value encountered in greater
  return (self.a < x) & (x < self.b)
/opt/conda/envs/Python36/lib/python3.6/site-packages/scipy/stats/_distn_in
```

```
frastructure.py:877: RuntimeWarning: invalid value encountered in less
  return (self.a < x) & (x < self.b)
/opt/conda/envs/Python36/lib/python3.6/site-packages/scipy/stats/_distn_in
frastructure.py:1831: RuntimeWarning: invalid value encountered in less_eq
ual
  cond2 = cond0 & (x <= self.a)
```

In [96]:

```
X4 = df_ny2[["Sex_Female", "Sex_Male", "Race_Asian and Pacific Islander",
"Race_Black Non-Hispanic", "Race_Hispanic",
           "Race_Not Stated/Unknown", "Race_Other Race/ Ethnicity", "Race_
White Non-Hispanic"]].values
y5 = df_ny2[["Deaths"]]
```

In [97]:

```
import statsmodels.api as sm
from scipy import stats
X5 = sm.add_constant(X4)
est = sm.OLS(y5, X5)
est2 = est.fit()
print(est2.summary())
```

```
                            OLS Regression Results
==========================================================================
====
Dep. Variable:                 Deaths   R-squared:                       0
.000
Model:                            OLS   Adj. R-squared:                  0
.000
Method:                 Least Squares   F-statistic:
 inf
Date:                Wed, 11 Dec 2019   Prob (F-statistic):
 nan
Time:                        07:56:22   Log-Likelihood:                -38
.190
No. Observations:                   5   AIC:                             7
8.38
Df Residuals:                       4   BIC:                             7
7.99
Df Model:                           0

Covariance Type:            nonrobust

==========================================================================
====
                 coef    std err          t      P>|t|      [0.025      0.
975]
--------------------------------------------------------------------------
----
const      -6.024e-14   2.52e-14     -2.392      0.075    -1.3e-13    9.69
e-15
x1           300.3000    125.566      2.392      0.075     -48.328     648
.928
x2                  0          0        nan        nan           0
   0
x3                  0          0        nan        nan           0
   0
```

```
x4          300.3000    125.566      2.392      0.075     -48.328     648
.928
x5                 0          0        nan        nan           0
   0
x6                 0          0        nan        nan           0
   0
x7                 0          0        nan        nan           0
   0
==========================================================================
====
Omnibus:                        nan   Durbin-Watson:                   0
.726
Prob(Omnibus):                  nan   Jarque-Bera (JB):                0
.818
Skew:                         0.430   Prob(JB):                        0
.664
Kurtosis:                     1.215   Cond. No.
 inf
==========================================================================
====

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is cor
rectly specified.
[2] The input rank is higher than the number of observations.
[3] The smallest eigenvalue is      0. This might indicate that there are
strong multicollinearity problems or that the design matrix is singular.
```

```
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/stats/sta
ttools.py:72: ValueWarning: omni_normtest is not valid with less than 8 ob
servations; 5 samples were given.
  "samples were given." % int(n), ValueWarning)
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/regressio
n/linear_model.py:1554: RuntimeWarning: divide by zero encountered in doub
le_scalars
  return self.ess/self.df_model
```

In [98]:

```
X4 = df_ny2[["Sex_Female", "Sex_Male", "Race_Asian and Pacific Islander",
"Race_Black Non-Hispanic", "Race_Hispanic",
           "Race_Not Stated/Unknown", "Race_Other Race/ Ethnicity", "Race_
White Non-Hispanic"]].values
y6 = df_ny2[["Death_Rate"]]
```

In [99]:

```
import statsmodels.api as sm
from scipy import stats
X5 = sm.add_constant(X4)
est = sm.OLS(y6, X5)
est2 = est.fit()
print(est2.summary())
```

```
                            OLS Regression Results

==========================================================================
====
Dep. Variable:           Death_Rate   R-squared:                       0
.000
Model:                          OLS   Adj. R-squared:                  0
```

```
.000
Method:                 Least Squares   F-statistic:
 nan
Date:                Wed, 11 Dec 2019   Prob (F-statistic):
 nan
Time:                        07:56:27   Log-Likelihood:                 -25
.791
No. Observations:                   5   AIC:                              5
3.58
Df Residuals:                       4   BIC:                              5
3.19
Df Model:                           0

Covariance Type:            nonrobust

===========================================================================
====
                 coef    std err          t      P>|t|      [0.025      0.
975]
---------------------------------------------------------------------------
----
const      -5.047e-15   2.11e-15     -2.393      0.075   -1.09e-14     8.1
e-16
x1            25.1600     10.516      2.393      0.075      -4.037      54
.357
x2                  0          0        nan        nan           0
   0
x3                  0          0        nan        nan           0
   0
x4            25.1600     10.516      2.393      0.075      -4.037      54
.357
x5                  0          0        nan        nan           0
   0
x6                  0          0        nan        nan           0
   0
x7                  0          0        nan        nan           0
   0
===========================================================================
====
Omnibus:                          nan   Durbin-Watson:                    0
.725
Prob(Omnibus):                    nan   Jarque-Bera (JB):                 0
.818
Skew:                           0.430   Prob(JB):                         0
.664
Kurtosis:                       1.215   Cond. No.
 inf
===========================================================================
====

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is cor
rectly specified.
[2] The input rank is higher than the number of observations.
[3] The smallest eigenvalue is      0. This might indicate that there are
strong multicollinearity problems or that the design matrix is singular.
```

```
/opt/conda/envs/Python36/lib/python3.6/site-packages/statsmodels/stats/sta
ttools.py:72: ValueWarning: omni_normtest is not valid with less than 8 ob
servations; 5 samples were given.
  "samples were given." % int(n), ValueWarning)
```

Analysis of variance (ANOVA) with race as predictor and AADR as dependent variable (outcome)

In [100]:
```
groups = df_ny.groupby("Race").groups
Race_Asian = df_ny["AADR"][groups["Asian and Pacific Islander"]]
Race_Black = df_ny["AADR"][groups["Black Non-Hispanic"]]
Race_Hispanic = df_ny["AADR"][groups["Hispanic"]]
Race_Unknown = df_ny["AADR"][groups["Not Stated/Unknown"]]
Race_Other = df_ny["AADR"][groups["Other Race/ Ethnicity"]]
Race_WNonH = df_ny["AADR"][groups["White Non-Hispanic"]]
stats.f_oneway(Race_Asian, Race_Black, Race_Hispanic, Race_Unknown, Race_O
ther, Race_WNonH)
```

Out[100]:
```
F_onewayResult(statistic=8.053927751980025, pvalue=1.8008655089838347e-07)
```

Model Evaluation

Model evaluation was carried out for the three models using R-squared score, mean absolute error and mean squared error.

In [101]:
```
from sklearn import metrics
from sklearn.metrics import r2_score
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
predict1 = lr1.predict(X_test)
predict1[0:5]
```

Out[101]:
```
array([625.71531619, 331.64995375, 170.8191072 , 534.73607439,
       331.64995375])
```

In [102]:
```
r2_score(y1_test, predict1)
```

Out[102]:
```
-0.027907825501596983
```

In [103]:
```
mean_absolute_error(y1_test, predict1)
```

Out[103]:
```
496.89717202034194
```

In [104]:
```
mean_squared_error(y1_test, predict1)
```

Out[104]:
```
912405.9000953499
```

In [105]:
```
predict2 = lr2.predict(X_test)
predict2[0:5]
```

Out[105]:
```
array([75.27480038, 38.24392882, 39.88041246, 68.19592279, 38.24392882])
```

In [106]:
```
r2_score(y2_test, predict2)
```
Out[106]:
```
-0.045601730810380214
```

In [107]:
```
mean_absolute_error(y2_test, predict2)
```
Out[107]:
```
39.23727315032904
```

In [108]:
```
mean_squared_error(y2_test, predict2)
```
Out[108]:
```
4296.122475885754
```

In [109]:
```
predict3 = lr3.predict(X_test)
predict3[0:5]
```
Out[109]:
```
array([65.02840692, 40.15772362, 53.42573585, 62.7078727 , 40.15772362])
```

In [110]:
```
r2_score(y3_test, predict3)
```
Out[110]:
```
-0.008479573873794166
```

In [111]:
```
mean_absolute_error(y3_test, predict3)
```
Out[111]:
```
37.78903980756004
```

In [112]:
```
mean_squared_error(y3_test, predict3)
```
Out[112]:
```
3287.687455471314
```

The R-squared scores show that sex and race explain no variation in the dependent variables 'number of deaths' and 'death rate' and very low variation in the dependent variable 'AADR'. To improve the model, more variables would have to be added. This would entail more data collection, which at the moment is not possible since the data were sourced from a fixed database. However, the results are highly informative in so many ways despite the results of the regression analysis. They explain the differential distribution of leading causes of disease by race and sex and the differences by year. The coefficients are also a guide to further data collection.

Model Definition and Training Using TensorFlow

Machine learning alorithms/models were used with race and sex as the dependent variables. In this section, gradient descent with TensorFlow was used. Like with the ordinary linear regression above, the dependent/output variables were either number of deaths, death rate or age-adjusted death rate (AADR);these were not included together in a single regression model because they represent the same outcome presented in different numerical formats. The necessary libraries for computation of estimates were imported. Fixed seeds for both Numpy

and TensorFlow were set to make the random numbers predictable. Models creation was started by defining placeholders for x and y in order to feed the training examples x and y (y1, y2 and y3) into the optimizer during the process of training. Next, two trainable TensorFlow variables were declared for the weights (w) and bias (b) and initialized using np.random.randn(). Hyperparameters learning rate (0.001) and number of epochs (1000) were then defined. The predictions/hypotheses, cost function and optimizer were then built and the variables were then initialized. The training process was then started insider a TensorFlow and predictions were computed. These steps are carried out for all the three models with number of deaths, death rate and AADR as dependent variables.

In [113]:
```
import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt
np.random.seed(101)
tf.set_random_seed(101)
```

In [114]:
```
x = X

x_new = np.reshape(x, (2,1094)) # Reshaping x for Tensorflow computations
(x_new is the reshaped x)
y = y3
n = len(x)
```

In [115]:
```
x_new.shape
```

Out[115]:
```
(2, 1094)
```

In [116]:
```
X1 = tf.placeholder("float")
Y1 = tf.placeholder("float")
W = tf.Variable(np.random.randn(), name="W")
b = tf.Variable(np.random.randn(), name="b")
```

```
WARNING:tensorflow:From /opt/conda/envs/Python36/lib/python3.6/site-packag
es/tensorflow/python/framework/op_def_library.py:263: colocate_with (from
tensorflow.python.framework.ops) is deprecated and will be removed in a fu
ture version.
Instructions for updating:
Colocations handled automatically by placer.
```

In [117]:
```
learning_rate = 0.001
training_epochs = 1000
```

In [118]:
```
y_pred = tf.add(tf.multiply(X1,W),b)
```

In [119]:
```
cost = tf.reduce_sum(tf.pow(y_pred - Y1, 2))/(2*n)
```

In [120]:
```
optimizer = tf.train.GradientDescentOptimizer(learning_rate).minimize(cost
)
```

```
WARNING:tensorflow:From /opt/conda/envs/Python36/lib/python3.6/site-packag
es/tensorflow/python/ops/math_ops.py:3066: to_int32 (from tensorflow.pytho
```

```
n.ops.math_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.cast instead.
```

In [121]:

```
init = tf.global_variables_initializer()
```

In [122]:

```
# Starting the Tensorflow Session
with tf.Session() as sess:

    # Initializing the Variables
    sess.run(init)

    # Iterating through all the epochs
    for epoch in range(training_epochs):

        # Feeding each data point into the optimizer using Feed Dictionary

        for (_x_new, _y) in zip(x_new, y):
            sess.run(optimizer, feed_dict = {X1 : _x_new, Y1 : _y})

        # Displaying the result after every 50 epochs
        if (epoch + 1) % 50 == 0:
            # Calculating the cost a every epoch
            c = sess.run(cost, feed_dict = {X1 : x_new, Y1 : y})
            print("Epoch", (epoch + 1), ": cost =", c, "W =", sess.run(W),
 "b =", sess.run(b))

    # Storing necessary values to be used outside the Session
    training_cost = sess.run(cost, feed_dict ={X1: x_new, Y1: y})
    weight = sess.run(W)
    bias = sess.run(b)
```

```
Epoch 50 : cost = 4158.2227 W = 19.483673 b = 13.794002
Epoch 100 : cost = 5328.8564 W = 28.44038 b = 23.91537
Epoch 150 : cost = 6644.1567 W = 32.87008 b = 32.144875
Epoch 200 : cost = 7606.429 W = 34.69387 b = 39.160885
Epoch 250 : cost = 8221.636 W = 35.031773 b = 45.36466
Epoch 300 : cost = 8593.332 W = 34.53612 b = 50.99536
Epoch 350 : cost = 8815.213 W = 33.58625 b = 56.19722
Epoch 400 : cost = 8952.373 W = 32.40207 b = 61.058945
Epoch 450 : cost = 9045.73 W = 31.110634 b = 65.636475
Epoch 500 : cost = 9119.416 W = 29.784683 b = 69.96659
Epoch 550 : cost = 9187.019 W = 28.465393 b = 74.07447
Epoch 600 : cost = 9255.769 W = 27.175564 b = 77.9785
Epoch 650 : cost = 9329.231 W = 25.927294 b = 81.69293
Epoch 700 : cost = 9408.74 W = 24.72651 b = 85.22937
Epoch 750 : cost = 9494.54 W = 23.575575 b = 88.59774
Epoch 800 : cost = 9586.174 W = 22.474842 b = 91.8069
Epoch 850 : cost = 9682.982 W = 21.423529 b = 94.86477
Epoch 900 : cost = 9784.096 W = 20.42023 b = 97.77881
Epoch 950 : cost = 9888.653 W = 19.46322 b = 100.55594
Epoch 1000 : cost = 9995.885 W = 18.550661 b = 103.2027
```

In [123]:

```
predictions = weight*x + bias
print("Training cost is", training_cost, "Weight=", weight, "bias=", bias,
 '\n')
```

```
Training cost is 9995.885 Weight= 18.550661 bias= 103.2027
```

In [124]:
```
# Starting the Tensorflow Session
with tf.Session() as sess:

    # Initializing the Variables
    sess.run(init)

    # Iterating through all the epochs
    for epoch in range(training_epochs):

        # Feeding each data point into the optimizer using Feed Dictionary

        for (_x_new, _y1) in zip(x_new, y1):
            sess.run(optimizer, feed_dict = {X1 : _x_new, Y1 : _y1})

        # Displaying the result after every 50 epochs
        if (epoch + 1) % 50 == 0:
            # Calculating the cost a every epoch
            c = sess.run(cost, feed_dict = {X1 : x_new, Y1 : y1})
            print("Epoch", (epoch + 1), ": cost =", c, "W =", sess.run(W),
 "b =", sess.run(b))

    # Storing necessary values to be used outside the Session
    training_cost = sess.run(cost, feed_dict ={X1: x_new, Y1: y1})
    weight = sess.run(W)
    bias = sess.run(b)
```

```
Epoch 50 : cost = 747745.8 W = 139.73703 b = 104.83377
Epoch 100 : cost = 804070.8 W = 213.27309 b = 184.4595
Epoch 150 : cost = 878154.5 W = 250.03694 b = 248.85182
Epoch 200 : cost = 933742.06 W = 265.6181 b = 303.5097
Epoch 250 : cost = 969199.9 W = 269.10623 b = 351.6835
Epoch 300 : cost = 990172.25 W = 265.79593 b = 395.3087
Epoch 350 : cost = 1002148.3 W = 258.76663 b = 435.5513
Epoch 400 : cost = 1009027.9 W = 249.80476 b = 473.1261
Epoch 450 : cost = 1013281.25 W = 239.94202 b = 508.48303
Epoch 500 : cost = 1016374.3 W = 229.7705 b = 541.9158
Epoch 550 : cost = 1019137.9 W = 219.62547 b = 573.6251
Epoch 600 : cost = 1022011.0 W = 209.69316 b = 603.75714
Epoch 650 : cost = 1025209.94 W = 200.07306 b = 632.423
Epoch 700 : cost = 1028817.8 W = 190.81436 b = 659.71356
Epoch 750 : cost = 1032849.25 W = 181.93752 b = 685.7063
Epoch 800 : cost = 1037276.4 W = 173.44637 b = 710.46936
Epoch 850 : cost = 1042057.75 W = 165.33545 b = 734.0655
Epoch 900 : cost = 1047142.3 W = 157.59457 b = 756.5514
Epoch 950 : cost = 1052475.2 W = 150.21053 b = 777.9806
Epoch 1000 : cost = 1058007.8 W = 143.16925 b = 798.4038
```

In [125]:
```
predictions = weight*x + bias
print("Training cost is", training_cost, "Weight=", weight, "bias=", bias,
 '\n')
```

```
Training cost is 1058007.8 Weight= 143.16925 bias= 798.4038
```

In [126]:
```
# Starting the Tensorflow Session
with tf.Session() as sess:

    # Initializing the Variables
    sess.run(init)

    # Iterating through all the epochs
    for epoch in range(training_epochs):

        # Feeding each data point into the optimizer using Feed Dictionary

        for (_x_new, _y2) in zip(x_new, y2):
            sess.run(optimizer, feed_dict = {X1 : _x_new, Y1 : _y2})

        # Displaying the result after every 50 epochs
        if (epoch + 1) % 50 == 0:
            # Calculating the cost a every epoch
            c = sess.run(cost, feed_dict = {X1 : x_new, Y1 : y2})
            print("Epoch", (epoch + 1), ": cost =", c, "W =", sess.run(W),
 "b =", sess.run(b))

    # Storing necessary values to be used outside the Session
    training_cost = sess.run(cost, feed_dict ={X1: x_new, Y1: y2})
    weight = sess.run(W)
    bias = sess.run(b)
```

```
Epoch 50 : cost = 4741.0156 W = 13.185323 b = 9.025084
Epoch 100 : cost = 4650.8057 W = 18.759716 b = 15.505519
Epoch 150 : cost = 4821.548 W = 21.49601 b = 20.792898
Epoch 200 : cost = 4973.959 W = 22.599386 b = 25.313112
Epoch 250 : cost = 5061.64 W = 22.772444 b = 29.318174
Epoch 300 : cost = 5096.7666 W = 22.42435 b = 32.958397
Epoch 350 : cost = 5099.4224 W = 21.79301 b = 36.324543
Epoch 400 : cost = 5085.3896 W = 21.016352 b = 39.47249
Epoch 450 : cost = 5064.901 W = 20.17397 b = 42.43755
Epoch 500 : cost = 5043.9946 W = 19.311445 b = 45.242992
Epoch 550 : cost = 5025.916 W = 18.45454 b = 47.90483
Epoch 600 : cost = 5012.22 W = 17.617483 b = 50.434853
Epoch 650 : cost = 5003.502 W = 16.807806 b = 52.84213
Epoch 700 : cost = 4999.7715 W = 16.029161 b = 55.134117
Epoch 750 : cost = 5000.7593 W = 15.282984 b = 57.317223
Epoch 800 : cost = 5006.0586 W = 14.56943 b = 59.39716
Epoch 850 : cost = 5015.1987 W = 13.887956 b = 61.37909
Epoch 900 : cost = 5027.695 W = 13.237631 b = 63.267796
Epoch 950 : cost = 5043.087 W = 12.617332 b = 65.067764
Epoch 1000 : cost = 5060.9463 W = 12.025838 b = 66.78324
```

In [127]:
```
predictions = weight*x + bias
print("Training cost is", training_cost, "Weight=", weight, "bias=", bias,
 '\n')
```

```
Training cost is 5060.9463 Weight= 12.025838 bias= 66.78324
```

Model Definition and Training using Keras

In [134]:
```
from keras.models import Sequential
from keras.layers import Dense, Activation
from keras.optimizers import SGD

# create model
model = Sequential()
model.add(Dense(1, input_shape=(2,)))
model.add(Activation('linear'))
```

In [135]:
```
model.summary()
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_3 (Dense)              (None, 1)                 3
_________________________________________________________________
activation_3 (Activation)    (None, 1)                 0
=================================================================
Total params: 3
Trainable params: 3
Non-trainable params: 0
_________________________________________________________________
```

In [136]:
```
sgd = SGD(0.0001)
model.compile(loss='mse', optimizer=sgd, metrics=['mse'])
H = model.fit(X, y3, epochs = 1000)
plt.plot(H.history['mean_squared_error'])
plt.title("Graph of Loss vs Number of Epochs")
plt.xlabel("Number of Epochs")
plt.ylabel("Loss")
```

```
Epoch 1/1000
1094/1094 [==============================] - 0s 297us/step - loss: 5827.80
99 - mean_squared_error: 5827.8099
Epoch 2/1000
1094/1094 [==============================] - 0s 36us/step - loss: 5534.790
3 - mean_squared_error: 5534.7903
Epoch 3/1000
1094/1094 [==============================] - 0s 34us/step - loss: 5274.014
5 - mean_squared_error: 5274.0145
Epoch 4/1000
1094/1094 [==============================] - 0s 33us/step - loss: 5037.232
5 - mean_squared_error: 5037.2325
Epoch 5/1000
1094/1094 [==============================] - 0s 35us/step - loss: 4843.195
1 - mean_squared_error: 4843.1951
Epoch 6/1000
1094/1094 [==============================] - 0s 30us/step - loss: 4672.686
6 - mean_squared_error: 4672.6866
Epoch 7/1000
1094/1094 [==============================] - 0s 47us/step - loss: 4526.332
1 - mean_squared_error: 4526.3321
Epoch 8/1000
1094/1094 [==============================] - 0s 36us/step - loss: 4398.548
```

```
6 - mean_squared_error: 4398.5486
Epoch 9/1000
1094/1094 [==============================] - 0s 34us/step - loss: 4288.455
7 - mean_squared_error: 4288.4557
Epoch 10/1000
1094/1094 [==============================] - 0s 35us/step - loss: 4190.049
4 - mean_squared_error: 4190.0494
Epoch 11/1000
1094/1094 [==============================] - 0s 36us/step - loss: 4105.224
6 - mean_squared_error: 4105.2246
Epoch 12/1000
1094/1094 [==============================] - 0s 35us/step - loss: 4030.417
8 - mean_squared_error: 4030.4178
Epoch 13/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3965.325
8 - mean_squared_error: 3965.3258
Epoch 14/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3907.651
0 - mean_squared_error: 3907.6510
Epoch 15/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3855.415
9 - mean_squared_error: 3855.4159
Epoch 16/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3812.646
4 - mean_squared_error: 3812.6464
Epoch 17/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3775.990
3 - mean_squared_error: 3775.9903
Epoch 18/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3742.573
9 - mean_squared_error: 3742.5739
Epoch 19/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3713.258
2 - mean_squared_error: 3713.2582
Epoch 20/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3687.186
0 - mean_squared_error: 3687.1860
Epoch 21/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3665.150
9 - mean_squared_error: 3665.1509
Epoch 22/1000
1094/1094 [==============================] - 0s 48us/step - loss: 3643.025
9 - mean_squared_error: 3643.0259
Epoch 23/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3624.488
8 - mean_squared_error: 3624.4888
Epoch 24/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3608.987
8 - mean_squared_error: 3608.9878
Epoch 25/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3594.865
0 - mean_squared_error: 3594.8650
Epoch 26/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3582.192
5 - mean_squared_error: 3582.1925
Epoch 27/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3571.143
```

```
2 - mean_squared_error: 3571.1432
Epoch 28/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3561.173
6 - mean_squared_error: 3561.1736
Epoch 29/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3551.414
5 - mean_squared_error: 3551.4145
Epoch 30/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3541.174
6 - mean_squared_error: 3541.1746
Epoch 31/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3534.489
8 - mean_squared_error: 3534.4898
Epoch 32/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3528.132
2 - mean_squared_error: 3528.1322
Epoch 33/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3521.841
3 - mean_squared_error: 3521.8413
Epoch 34/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3516.254
9 - mean_squared_error: 3516.2549
Epoch 35/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3510.874
6 - mean_squared_error: 3510.8746
Epoch 36/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3505.260
1 - mean_squared_error: 3505.2601
Epoch 37/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3500.845
3 - mean_squared_error: 3500.8453
Epoch 38/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3496.657
7 - mean_squared_error: 3496.6577
Epoch 39/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3492.734
1 - mean_squared_error: 3492.7341
Epoch 40/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3488.383
6 - mean_squared_error: 3488.3836
Epoch 41/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3484.629
3 - mean_squared_error: 3484.6293
Epoch 42/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3481.078
8 - mean_squared_error: 3481.0788
Epoch 43/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3477.977
0 - mean_squared_error: 3477.9770
Epoch 44/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3474.268
3 - mean_squared_error: 3474.2683
Epoch 45/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3471.151
8 - mean_squared_error: 3471.1518
Epoch 46/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3468.039
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6 - mean_squared_error: 3468.0396
Epoch 47/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3465.087
1 - mean_squared_error: 3465.0871
Epoch 48/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3462.207
1 - mean_squared_error: 3462.2071
Epoch 49/1000
1094/1094 [==============================] - 0s 27us/step - loss: 3459.714
2 - mean_squared_error: 3459.7142
Epoch 50/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3456.830
5 - mean_squared_error: 3456.8305
Epoch 51/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3454.394
8 - mean_squared_error: 3454.3948
Epoch 52/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3452.025
4 - mean_squared_error: 3452.0254
Epoch 53/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3449.425
5 - mean_squared_error: 3449.4255
Epoch 54/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3447.159
9 - mean_squared_error: 3447.1599
Epoch 55/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3444.652
5 - mean_squared_error: 3444.6525
Epoch 56/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3442.204
2 - mean_squared_error: 3442.2042
Epoch 57/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3439.945
2 - mean_squared_error: 3439.9452
Epoch 58/1000
1094/1094 [==============================] - 0s 52us/step - loss: 3437.622
4 - mean_squared_error: 3437.6224
Epoch 59/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3435.214
9 - mean_squared_error: 3435.2149
Epoch 60/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3433.073
1 - mean_squared_error: 3433.0731
Epoch 61/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3430.516
5 - mean_squared_error: 3430.5165
Epoch 62/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3428.314
4 - mean_squared_error: 3428.3144
Epoch 63/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3426.002
7 - mean_squared_error: 3426.0027
Epoch 64/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3423.740
7 - mean_squared_error: 3423.7407
Epoch 65/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3421.537
```

```
1 - mean_squared_error: 3421.5371
Epoch 66/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3419.228
2 - mean_squared_error: 3419.2282
Epoch 67/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3417.132
6 - mean_squared_error: 3417.1326
Epoch 68/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3414.913
4 - mean_squared_error: 3414.9134
Epoch 69/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3412.791
6 - mean_squared_error: 3412.7916
Epoch 70/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3410.540
1 - mean_squared_error: 3410.5401
Epoch 71/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3408.481
0 - mean_squared_error: 3408.4810
Epoch 72/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3406.466
5 - mean_squared_error: 3406.4665
Epoch 73/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3404.432
2 - mean_squared_error: 3404.4322
Epoch 74/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3402.302
4 - mean_squared_error: 3402.3024
Epoch 75/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3400.273
4 - mean_squared_error: 3400.2734
Epoch 76/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3398.318
4 - mean_squared_error: 3398.3184
Epoch 77/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3396.314
3 - mean_squared_error: 3396.3143
Epoch 78/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3394.325
3 - mean_squared_error: 3394.3253
Epoch 79/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3392.234
0 - mean_squared_error: 3392.2340
Epoch 80/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3390.336
8 - mean_squared_error: 3390.3368
Epoch 81/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3388.378
1 - mean_squared_error: 3388.3781
Epoch 82/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3386.408
3 - mean_squared_error: 3386.4083
Epoch 83/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3384.572
8 - mean_squared_error: 3384.5728
Epoch 84/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3382.687
```

```
9 - mean_squared_error: 3382.6879
Epoch 85/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3380.571
8 - mean_squared_error: 3380.5718
Epoch 86/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3378.699
5 - mean_squared_error: 3378.6995
Epoch 87/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3376.821
3 - mean_squared_error: 3376.8213
Epoch 88/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3374.996
8 - mean_squared_error: 3374.9968
Epoch 89/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3373.083
9 - mean_squared_error: 3373.0839
Epoch 90/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3371.289
7 - mean_squared_error: 3371.2897
Epoch 91/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3369.432
8 - mean_squared_error: 3369.4328
Epoch 92/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3367.505
3 - mean_squared_error: 3367.5053
Epoch 93/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3365.665
3 - mean_squared_error: 3365.6653
Epoch 94/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3363.723
3 - mean_squared_error: 3363.7233
Epoch 95/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3361.984
0 - mean_squared_error: 3361.9840
Epoch 96/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3360.097
5 - mean_squared_error: 3360.0975
Epoch 97/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3358.379
9 - mean_squared_error: 3358.3799
Epoch 98/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3356.644
6 - mean_squared_error: 3356.6446
Epoch 99/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3354.849
3 - mean_squared_error: 3354.8493
Epoch 100/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3353.108
0 - mean_squared_error: 3353.1080
Epoch 101/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3351.274
6 - mean_squared_error: 3351.2746
Epoch 102/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3349.450
9 - mean_squared_error: 3349.4509
Epoch 103/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3347.686
```

```
3 - mean_squared_error: 3347.6863
Epoch 104/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3345.962
3 - mean_squared_error: 3345.9623
Epoch 105/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3344.330
2 - mean_squared_error: 3344.3302
Epoch 106/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3342.694
6 - mean_squared_error: 3342.6946
Epoch 107/1000
1094/1094 [==============================] - 0s 48us/step - loss: 3341.057
2 - mean_squared_error: 3341.0572
Epoch 108/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3339.164
0 - mean_squared_error: 3339.1640
Epoch 109/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3337.496
3 - mean_squared_error: 3337.4963
Epoch 110/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3335.846
2 - mean_squared_error: 3335.8462
Epoch 111/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3334.202
7 - mean_squared_error: 3334.2027
Epoch 112/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3332.525
3 - mean_squared_error: 3332.5253
Epoch 113/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3330.908
0 - mean_squared_error: 3330.9080
Epoch 114/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3329.381
5 - mean_squared_error: 3329.3815
Epoch 115/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3327.759
0 - mean_squared_error: 3327.7590
Epoch 116/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3326.238
3 - mean_squared_error: 3326.2383
Epoch 117/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3324.258
1 - mean_squared_error: 3324.2581
Epoch 118/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3322.717
2 - mean_squared_error: 3322.7172
Epoch 119/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3321.166
5 - mean_squared_error: 3321.1665
Epoch 120/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3319.600
2 - mean_squared_error: 3319.6002
Epoch 121/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3318.030
6 - mean_squared_error: 3318.0306
Epoch 122/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3316.478
```

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1 - mean_squared_error: 3316.4781
Epoch 123/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3314.855
6 - mean_squared_error: 3314.8556
Epoch 124/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3313.253
3 - mean_squared_error: 3313.2533
Epoch 125/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3311.572
0 - mean_squared_error: 3311.5720
Epoch 126/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3310.127
0 - mean_squared_error: 3310.1270
Epoch 127/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3308.610
3 - mean_squared_error: 3308.6103
Epoch 128/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3307.006
8 - mean_squared_error: 3307.0068
Epoch 129/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3305.434
7 - mean_squared_error: 3305.4347
Epoch 130/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3303.983
8 - mean_squared_error: 3303.9838
Epoch 131/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3302.537
2 - mean_squared_error: 3302.5372
Epoch 132/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3301.100
8 - mean_squared_error: 3301.1008
Epoch 133/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3299.668
0 - mean_squared_error: 3299.6680
Epoch 134/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3298.038
3 - mean_squared_error: 3298.0383
Epoch 135/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3296.677
1 - mean_squared_error: 3296.6771
Epoch 136/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3295.226
1 - mean_squared_error: 3295.2261
Epoch 137/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3293.889
3 - mean_squared_error: 3293.8893
Epoch 138/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3292.443
5 - mean_squared_error: 3292.4435
Epoch 139/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3290.987
7 - mean_squared_error: 3290.9877
Epoch 140/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3289.633
6 - mean_squared_error: 3289.6336
Epoch 141/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3288.286
```

```
7 - mean_squared_error: 3288.2867
Epoch 142/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3286.930
1 - mean_squared_error: 3286.9301
Epoch 143/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3285.547
1 - mean_squared_error: 3285.5471
Epoch 144/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3284.030
3 - mean_squared_error: 3284.0303
Epoch 145/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3282.730
5 - mean_squared_error: 3282.7305
Epoch 146/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3281.403
4 - mean_squared_error: 3281.4034
Epoch 147/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3280.130
4 - mean_squared_error: 3280.1304
Epoch 148/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3278.805
2 - mean_squared_error: 3278.8052
Epoch 149/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3277.504
2 - mean_squared_error: 3277.5042
Epoch 150/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3276.216
0 - mean_squared_error: 3276.2160
Epoch 151/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3274.923
6 - mean_squared_error: 3274.9236
Epoch 152/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3273.691
8 - mean_squared_error: 3273.6918
Epoch 153/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3272.278
7 - mean_squared_error: 3272.2787
Epoch 154/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3270.959
8 - mean_squared_error: 3270.9598
Epoch 155/1000
1094/1094 [==============================] - 0s 56us/step - loss: 3269.703
6 - mean_squared_error: 3269.7036
Epoch 156/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3268.271
7 - mean_squared_error: 3268.2717
Epoch 157/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3266.980
1 - mean_squared_error: 3266.9801
Epoch 158/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3265.747
6 - mean_squared_error: 3265.7476
Epoch 159/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3264.549
2 - mean_squared_error: 3264.5492
Epoch 160/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3263.069
```

```
9 - mean_squared_error: 3263.0699
Epoch 161/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3261.642
5 - mean_squared_error: 3261.6425
Epoch 162/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3260.343
3 - mean_squared_error: 3260.3433
Epoch 163/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3259.079
3 - mean_squared_error: 3259.0793
Epoch 164/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3258.033
9 - mean_squared_error: 3258.0339
Epoch 165/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3256.771
7 - mean_squared_error: 3256.7717
Epoch 166/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3255.694
4 - mean_squared_error: 3255.6944
Epoch 167/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3254.431
3 - mean_squared_error: 3254.4313
Epoch 168/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3253.267
6 - mean_squared_error: 3253.2676
Epoch 169/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3252.033
7 - mean_squared_error: 3252.0337
Epoch 170/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3250.981
2 - mean_squared_error: 3250.9812
Epoch 171/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3249.773
6 - mean_squared_error: 3249.7736
Epoch 172/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3248.701
9 - mean_squared_error: 3248.7019
Epoch 173/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3247.462
8 - mean_squared_error: 3247.4628
Epoch 174/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3246.229
9 - mean_squared_error: 3246.2299
Epoch 175/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3245.169
0 - mean_squared_error: 3245.1690
Epoch 176/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3243.954
3 - mean_squared_error: 3243.9543
Epoch 177/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3242.954
1 - mean_squared_error: 3242.9541
Epoch 178/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3241.803
4 - mean_squared_error: 3241.8034
Epoch 179/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3240.663
```

```
1 - mean_squared_error: 3240.6631
Epoch 180/1000
1094/1094 [==============================] - 0s 47us/step - loss: 3239.593
8 - mean_squared_error: 3239.5938
Epoch 181/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3238.490
7 - mean_squared_error: 3238.4907
Epoch 182/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3237.475
2 - mean_squared_error: 3237.4752
Epoch 183/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3236.348
1 - mean_squared_error: 3236.3481
Epoch 184/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3235.208
3 - mean_squared_error: 3235.2083
Epoch 185/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3234.083
3 - mean_squared_error: 3234.0833
Epoch 186/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3233.178
1 - mean_squared_error: 3233.1781
Epoch 187/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3232.067
0 - mean_squared_error: 3232.0670
Epoch 188/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3230.981
4 - mean_squared_error: 3230.9814
Epoch 189/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3229.898
4 - mean_squared_error: 3229.8984
Epoch 190/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3228.776
1 - mean_squared_error: 3228.7761
Epoch 191/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3227.807
6 - mean_squared_error: 3227.8076
Epoch 192/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3226.739
9 - mean_squared_error: 3226.7399
Epoch 193/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3225.801
6 - mean_squared_error: 3225.8016
Epoch 194/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3224.725
7 - mean_squared_error: 3224.7257
Epoch 195/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3223.751
5 - mean_squared_error: 3223.7515
Epoch 196/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3222.662
6 - mean_squared_error: 3222.6626
Epoch 197/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3221.803
2 - mean_squared_error: 3221.8032
Epoch 198/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3220.639
```

```
7 - mean_squared_error: 3220.6397
Epoch 199/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3219.688
2 - mean_squared_error: 3219.6882
Epoch 200/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3218.678
1 - mean_squared_error: 3218.6781
Epoch 201/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3217.615
7 - mean_squared_error: 3217.6157
Epoch 202/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3216.732
4 - mean_squared_error: 3216.7324
Epoch 203/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3215.789
7 - mean_squared_error: 3215.7897
Epoch 204/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3214.864
8 - mean_squared_error: 3214.8648
Epoch 205/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3213.895
1 - mean_squared_error: 3213.8951
Epoch 206/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3213.047
4 - mean_squared_error: 3213.0474
Epoch 207/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3211.959
3 - mean_squared_error: 3211.9593
Epoch 208/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3211.053
2 - mean_squared_error: 3211.0532
Epoch 209/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3210.105
7 - mean_squared_error: 3210.1057
Epoch 210/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3209.007
4 - mean_squared_error: 3209.0074
Epoch 211/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3208.159
0 - mean_squared_error: 3208.1590
Epoch 212/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3207.236
2 - mean_squared_error: 3207.2362
Epoch 213/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3206.294
4 - mean_squared_error: 3206.2944
Epoch 214/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3205.422
8 - mean_squared_error: 3205.4228
Epoch 215/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3204.579
6 - mean_squared_error: 3204.5796
Epoch 216/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3203.383
6 - mean_squared_error: 3203.3836
Epoch 217/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3202.489
```

```
4 - mean_squared_error: 3202.4894
Epoch 218/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3201.620
7 - mean_squared_error: 3201.6207
Epoch 219/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3200.761
3 - mean_squared_error: 3200.7613
Epoch 220/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3199.838
3 - mean_squared_error: 3199.8383
Epoch 221/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3199.001
3 - mean_squared_error: 3199.0013
Epoch 222/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3198.067
0 - mean_squared_error: 3198.0670
Epoch 223/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3197.274
7 - mean_squared_error: 3197.2747
Epoch 224/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3196.228
6 - mean_squared_error: 3196.2286
Epoch 225/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3195.508
0 - mean_squared_error: 3195.5080
Epoch 226/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3194.562
1 - mean_squared_error: 3194.5621
Epoch 227/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3193.617
9 - mean_squared_error: 3193.6179
Epoch 228/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3192.681
4 - mean_squared_error: 3192.6814
Epoch 229/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3191.892
2 - mean_squared_error: 3191.8922
Epoch 230/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3191.115
4 - mean_squared_error: 3191.1154
Epoch 231/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3190.271
0 - mean_squared_error: 3190.2710
Epoch 232/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3189.533
8 - mean_squared_error: 3189.5338
Epoch 233/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3188.549
7 - mean_squared_error: 3188.5497
Epoch 234/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3187.776
5 - mean_squared_error: 3187.7765
Epoch 235/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3186.916
3 - mean_squared_error: 3186.9163
Epoch 236/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3186.142
```

```
3 - mean_squared_error: 3186.1423
Epoch 237/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3185.404
1 - mean_squared_error: 3185.4041
Epoch 238/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3184.488
4 - mean_squared_error: 3184.4884
Epoch 239/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3183.741
4 - mean_squared_error: 3183.7414
Epoch 240/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3183.002
9 - mean_squared_error: 3183.0029
Epoch 241/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3182.258
6 - mean_squared_error: 3182.2586
Epoch 242/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3181.507
9 - mean_squared_error: 3181.5079
Epoch 243/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3180.763
5 - mean_squared_error: 3180.7635
Epoch 244/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3179.809
1 - mean_squared_error: 3179.8091
Epoch 245/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3179.058
7 - mean_squared_error: 3179.0587
Epoch 246/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3178.409
3 - mean_squared_error: 3178.4093
Epoch 247/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3177.618
7 - mean_squared_error: 3177.6187
Epoch 248/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3176.889
9 - mean_squared_error: 3176.8899
Epoch 249/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3176.086
9 - mean_squared_error: 3176.0869
Epoch 250/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3175.400
8 - mean_squared_error: 3175.4008
Epoch 251/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3174.714
1 - mean_squared_error: 3174.7141
Epoch 252/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3174.027
1 - mean_squared_error: 3174.0271
Epoch 253/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3173.205
5 - mean_squared_error: 3173.2055
Epoch 254/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3172.475
2 - mean_squared_error: 3172.4752
Epoch 255/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3171.682
```

```
2 - mean_squared_error: 3171.6822
Epoch 256/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3171.026
8 - mean_squared_error: 3171.0268
Epoch 257/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3170.338
0 - mean_squared_error: 3170.3380
Epoch 258/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3169.707
7 - mean_squared_error: 3169.7077
Epoch 259/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3168.999
8 - mean_squared_error: 3168.9998
Epoch 260/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3168.250
8 - mean_squared_error: 3168.2508
Epoch 261/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3167.607
6 - mean_squared_error: 3167.6076
Epoch 262/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3166.857
2 - mean_squared_error: 3166.8572
Epoch 263/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3166.233
0 - mean_squared_error: 3166.2330
Epoch 264/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3165.512
3 - mean_squared_error: 3165.5123
Epoch 265/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3164.629
1 - mean_squared_error: 3164.6291
Epoch 266/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3164.105
7 - mean_squared_error: 3164.1057
Epoch 267/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3163.334
8 - mean_squared_error: 3163.3348
Epoch 268/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3162.670
3 - mean_squared_error: 3162.6703
Epoch 269/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3162.052
1 - mean_squared_error: 3162.0521
Epoch 270/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3161.450
2 - mean_squared_error: 3161.4502
Epoch 271/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3160.761
6 - mean_squared_error: 3160.7616
Epoch 272/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3160.050
1 - mean_squared_error: 3160.0501
Epoch 273/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3159.394
6 - mean_squared_error: 3159.3946
Epoch 274/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3158.723
```

```
0 - mean_squared_error: 3158.7230
Epoch 275/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3158.002
5 - mean_squared_error: 3158.0025
Epoch 276/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3157.353
0 - mean_squared_error: 3157.3530
Epoch 277/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3156.630
8 - mean_squared_error: 3156.6308
Epoch 278/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3156.083
5 - mean_squared_error: 3156.0835
Epoch 279/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3155.383
6 - mean_squared_error: 3155.3836
Epoch 280/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3154.748
9 - mean_squared_error: 3154.7489
Epoch 281/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3154.190
8 - mean_squared_error: 3154.1908
Epoch 282/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3153.592
6 - mean_squared_error: 3153.5926
Epoch 283/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3153.049
4 - mean_squared_error: 3153.0494
Epoch 284/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3152.261
8 - mean_squared_error: 3152.2618
Epoch 285/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3151.654
1 - mean_squared_error: 3151.6541
Epoch 286/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3151.020
6 - mean_squared_error: 3151.0206
Epoch 287/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3150.417
2 - mean_squared_error: 3150.4172
Epoch 288/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3149.867
1 - mean_squared_error: 3149.8671
Epoch 289/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3149.237
9 - mean_squared_error: 3149.2379
Epoch 290/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3148.854
2 - mean_squared_error: 3148.8542
Epoch 291/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3148.202
9 - mean_squared_error: 3148.2029
Epoch 292/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3147.413
3 - mean_squared_error: 3147.4133
Epoch 293/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3146.808
```

```
2 - mean_squared_error: 3146.8082
Epoch 294/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3146.256
6 - mean_squared_error: 3146.2566
Epoch 295/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3145.747
3 - mean_squared_error: 3145.7473
Epoch 296/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3145.090
0 - mean_squared_error: 3145.0900
Epoch 297/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3144.358
2 - mean_squared_error: 3144.3582
Epoch 298/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3143.803
8 - mean_squared_error: 3143.8038
Epoch 299/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3143.356
1 - mean_squared_error: 3143.3561
Epoch 300/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3142.793
1 - mean_squared_error: 3142.7931
Epoch 301/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3142.090
8 - mean_squared_error: 3142.0908
Epoch 302/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3141.747
6 - mean_squared_error: 3141.7476
Epoch 303/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3141.068
5 - mean_squared_error: 3141.0685
Epoch 304/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3140.444
4 - mean_squared_error: 3140.4444
Epoch 305/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3139.910
4 - mean_squared_error: 3139.9104
Epoch 306/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3139.277
2 - mean_squared_error: 3139.2772
Epoch 307/1000
1094/1094 [==============================] - 0s 46us/step - loss: 3138.778
1 - mean_squared_error: 3138.7781
Epoch 308/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3138.265
0 - mean_squared_error: 3138.2650
Epoch 309/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3137.656
7 - mean_squared_error: 3137.6567
Epoch 310/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3137.209
3 - mean_squared_error: 3137.2093
Epoch 311/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3136.640
5 - mean_squared_error: 3136.6405
Epoch 312/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3136.060
```

```
3 - mean_squared_error: 3136.0603
Epoch 313/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3135.618
6 - mean_squared_error: 3135.6186
Epoch 314/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3135.116
3 - mean_squared_error: 3135.1163
Epoch 315/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3134.582
9 - mean_squared_error: 3134.5829
Epoch 316/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3134.080
7 - mean_squared_error: 3134.0807
Epoch 317/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3133.725
9 - mean_squared_error: 3133.7259
Epoch 318/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3133.166
4 - mean_squared_error: 3133.1664
Epoch 319/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3132.653
9 - mean_squared_error: 3132.6539
Epoch 320/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3132.071
6 - mean_squared_error: 3132.0716
Epoch 321/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3131.640
1 - mean_squared_error: 3131.6401
Epoch 322/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3131.089
3 - mean_squared_error: 3131.0893
Epoch 323/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3130.603
9 - mean_squared_error: 3130.6039
Epoch 324/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3130.076
6 - mean_squared_error: 3130.0766
Epoch 325/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3129.670
9 - mean_squared_error: 3129.6709
Epoch 326/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3129.030
7 - mean_squared_error: 3129.0307
Epoch 327/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3128.581
4 - mean_squared_error: 3128.5814
Epoch 328/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3128.101
2 - mean_squared_error: 3128.1012
Epoch 329/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3127.646
9 - mean_squared_error: 3127.6469
Epoch 330/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3127.148
8 - mean_squared_error: 3127.1488
Epoch 331/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3126.763
```

```
1 - mean_squared_error: 3126.7631
Epoch 332/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3126.268
4 - mean_squared_error: 3126.2684
Epoch 333/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3125.737
6 - mean_squared_error: 3125.7376
Epoch 334/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3125.410
1 - mean_squared_error: 3125.4101
Epoch 335/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3124.900
0 - mean_squared_error: 3124.9000
Epoch 336/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3124.400
2 - mean_squared_error: 3124.4002
Epoch 337/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3123.947
1 - mean_squared_error: 3123.9471
Epoch 338/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3123.395
4 - mean_squared_error: 3123.3954
Epoch 339/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3123.008
2 - mean_squared_error: 3123.0082
Epoch 340/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3122.456
8 - mean_squared_error: 3122.4568
Epoch 341/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3122.035
2 - mean_squared_error: 3122.0352
Epoch 342/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3121.561
6 - mean_squared_error: 3121.5616
Epoch 343/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3121.140
2 - mean_squared_error: 3121.1402
Epoch 344/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3120.587
3 - mean_squared_error: 3120.5873
Epoch 345/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3120.253
2 - mean_squared_error: 3120.2532
Epoch 346/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3119.719
8 - mean_squared_error: 3119.7198
Epoch 347/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3119.334
2 - mean_squared_error: 3119.3342
Epoch 348/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3118.985
5 - mean_squared_error: 3118.9855
Epoch 349/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3118.472
5 - mean_squared_error: 3118.4725
Epoch 350/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3118.053
```

```
2 - mean_squared_error: 3118.0532
Epoch 351/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3117.586
9 - mean_squared_error: 3117.5869
Epoch 352/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3117.148
6 - mean_squared_error: 3117.1486
Epoch 353/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3116.798
3 - mean_squared_error: 3116.7983
Epoch 354/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3116.445
8 - mean_squared_error: 3116.4458
Epoch 355/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3115.947
5 - mean_squared_error: 3115.9475
Epoch 356/1000
1094/1094 [==============================] - 0s 58us/step - loss: 3115.559
0 - mean_squared_error: 3115.5590
Epoch 357/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3115.202
1 - mean_squared_error: 3115.2021
Epoch 358/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3114.786
0 - mean_squared_error: 3114.7860
Epoch 359/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3114.353
8 - mean_squared_error: 3114.3538
Epoch 360/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3113.950
6 - mean_squared_error: 3113.9506
Epoch 361/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3113.542
3 - mean_squared_error: 3113.5423
Epoch 362/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3113.087
6 - mean_squared_error: 3113.0876
Epoch 363/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3112.653
8 - mean_squared_error: 3112.6538
Epoch 364/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3112.292
3 - mean_squared_error: 3112.2923
Epoch 365/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3111.882
5 - mean_squared_error: 3111.8825
Epoch 366/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3111.594
7 - mean_squared_error: 3111.5947
Epoch 367/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3111.292
1 - mean_squared_error: 3111.2921
Epoch 368/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3110.941
2 - mean_squared_error: 3110.9412
Epoch 369/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3110.482
```

```
5 - mean_squared_error: 3110.4825
Epoch 370/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3109.977
3 - mean_squared_error: 3109.9773
Epoch 371/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3109.554
9 - mean_squared_error: 3109.5549
Epoch 372/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3109.309
5 - mean_squared_error: 3109.3095
Epoch 373/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3108.822
9 - mean_squared_error: 3108.8229
Epoch 374/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3108.468
1 - mean_squared_error: 3108.4681
Epoch 375/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3108.044
2 - mean_squared_error: 3108.0442
Epoch 376/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3107.599
5 - mean_squared_error: 3107.5995
Epoch 377/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3107.244
7 - mean_squared_error: 3107.2447
Epoch 378/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3106.760
3 - mean_squared_error: 3106.7603
Epoch 379/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3106.394
5 - mean_squared_error: 3106.3945
Epoch 380/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3106.091
8 - mean_squared_error: 3106.0918
Epoch 381/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3105.661
1 - mean_squared_error: 3105.6611
Epoch 382/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3105.446
5 - mean_squared_error: 3105.4465
Epoch 383/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3104.994
5 - mean_squared_error: 3104.9945
Epoch 384/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3104.762
8 - mean_squared_error: 3104.7628
Epoch 385/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3104.396
6 - mean_squared_error: 3104.3966
Epoch 386/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3103.912
3 - mean_squared_error: 3103.9123
Epoch 387/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3103.640
4 - mean_squared_error: 3103.6404
Epoch 388/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3103.278
```

```
5 - mean_squared_error: 3103.2785
Epoch 389/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3102.883
0 - mean_squared_error: 3102.8830
Epoch 390/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3102.478
0 - mean_squared_error: 3102.4780
Epoch 391/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3102.132
3 - mean_squared_error: 3102.1323
Epoch 392/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3101.854
1 - mean_squared_error: 3101.8541
Epoch 393/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3101.451
2 - mean_squared_error: 3101.4512
Epoch 394/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3101.146
9 - mean_squared_error: 3101.1469
Epoch 395/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3100.778
5 - mean_squared_error: 3100.7785
Epoch 396/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3100.508
8 - mean_squared_error: 3100.5088
Epoch 397/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3100.118
0 - mean_squared_error: 3100.1180
Epoch 398/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3099.769
5 - mean_squared_error: 3099.7695
Epoch 399/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3099.364
5 - mean_squared_error: 3099.3645
Epoch 400/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3099.093
0 - mean_squared_error: 3099.0930
Epoch 401/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3098.899
8 - mean_squared_error: 3098.8998
Epoch 402/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3098.442
4 - mean_squared_error: 3098.4424
Epoch 403/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3098.205
2 - mean_squared_error: 3098.2052
Epoch 404/1000
1094/1094 [==============================] - 0s 47us/step - loss: 3097.805
8 - mean_squared_error: 3097.8058
Epoch 405/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3097.517
3 - mean_squared_error: 3097.5173
Epoch 406/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3097.141
6 - mean_squared_error: 3097.1416
Epoch 407/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3096.967
```

```
5 - mean_squared_error: 3096.9675
Epoch 408/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3096.616
4 - mean_squared_error: 3096.6164
Epoch 409/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3096.296
4 - mean_squared_error: 3096.2964
Epoch 410/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3095.986
6 - mean_squared_error: 3095.9866
Epoch 411/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3095.585
6 - mean_squared_error: 3095.5856
Epoch 412/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3095.419
3 - mean_squared_error: 3095.4193
Epoch 413/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3095.143
8 - mean_squared_error: 3095.1438
Epoch 414/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3094.674
4 - mean_squared_error: 3094.6744
Epoch 415/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3094.483
3 - mean_squared_error: 3094.4833
Epoch 416/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3094.048
4 - mean_squared_error: 3094.0484
Epoch 417/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3093.805
8 - mean_squared_error: 3093.8058
Epoch 418/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3093.428
1 - mean_squared_error: 3093.4281
Epoch 419/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3093.193
5 - mean_squared_error: 3093.1935
Epoch 420/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3092.850
2 - mean_squared_error: 3092.8502
Epoch 421/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3092.655
2 - mean_squared_error: 3092.6552
Epoch 422/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3092.319
7 - mean_squared_error: 3092.3197
Epoch 423/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3091.956
1 - mean_squared_error: 3091.9561
Epoch 424/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3091.687
5 - mean_squared_error: 3091.6875
Epoch 425/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3091.517
3 - mean_squared_error: 3091.5173
Epoch 426/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3091.156
```

```
7 - mean_squared_error: 3091.1567
Epoch 427/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3090.902
5 - mean_squared_error: 3090.9025
Epoch 428/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3090.637
1 - mean_squared_error: 3090.6371
Epoch 429/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3090.276
3 - mean_squared_error: 3090.2763
Epoch 430/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3090.067
3 - mean_squared_error: 3090.0673
Epoch 431/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3089.725
0 - mean_squared_error: 3089.7250
Epoch 432/1000
1094/1094 [==============================] - 0s 44us/step - loss: 3089.479
9 - mean_squared_error: 3089.4799
Epoch 433/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3089.236
9 - mean_squared_error: 3089.2369
Epoch 434/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3088.896
5 - mean_squared_error: 3088.8965
Epoch 435/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3088.689
8 - mean_squared_error: 3088.6898
Epoch 436/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3088.467
2 - mean_squared_error: 3088.4672
Epoch 437/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3088.104
0 - mean_squared_error: 3088.1040
Epoch 438/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3087.881
6 - mean_squared_error: 3087.8816
Epoch 439/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3087.565
0 - mean_squared_error: 3087.5650
Epoch 440/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3087.333
5 - mean_squared_error: 3087.3335
Epoch 441/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3087.013
5 - mean_squared_error: 3087.0135
Epoch 442/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3086.721
9 - mean_squared_error: 3086.7219
Epoch 443/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3086.554
1 - mean_squared_error: 3086.5541
Epoch 444/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3086.264
2 - mean_squared_error: 3086.2642
Epoch 445/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3086.003
```

```
7 - mean_squared_error: 3086.0037
Epoch 446/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3085.751
5 - mean_squared_error: 3085.7515
Epoch 447/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3085.579
7 - mean_squared_error: 3085.5797
Epoch 448/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3085.268
4 - mean_squared_error: 3085.2684
Epoch 449/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3084.988
7 - mean_squared_error: 3084.9887
Epoch 450/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3084.792
8 - mean_squared_error: 3084.7928
Epoch 451/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3084.538
7 - mean_squared_error: 3084.5387
Epoch 452/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3084.361
6 - mean_squared_error: 3084.3616
Epoch 453/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3084.168
2 - mean_squared_error: 3084.1682
Epoch 454/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3083.868
8 - mean_squared_error: 3083.8688
Epoch 455/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3083.696
3 - mean_squared_error: 3083.6963
Epoch 456/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3083.283
2 - mean_squared_error: 3083.2832
Epoch 457/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3083.142
4 - mean_squared_error: 3083.1424
Epoch 458/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3082.806
5 - mean_squared_error: 3082.8065
Epoch 459/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3082.532
4 - mean_squared_error: 3082.5324
Epoch 460/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3082.310
4 - mean_squared_error: 3082.3104
Epoch 461/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3081.959
1 - mean_squared_error: 3081.9591
Epoch 462/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3081.756
1 - mean_squared_error: 3081.7561
Epoch 463/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3081.499
5 - mean_squared_error: 3081.4995
Epoch 464/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3081.354
```

```
9 - mean_squared_error: 3081.3549
Epoch 465/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3081.098
2 - mean_squared_error: 3081.0982
Epoch 466/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3080.856
3 - mean_squared_error: 3080.8563
Epoch 467/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3080.609
8 - mean_squared_error: 3080.6098
Epoch 468/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3080.394
3 - mean_squared_error: 3080.3943
Epoch 469/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3080.113
3 - mean_squared_error: 3080.1133
Epoch 470/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3079.954
3 - mean_squared_error: 3079.9543
Epoch 471/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3079.648
7 - mean_squared_error: 3079.6487
Epoch 472/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3079.557
5 - mean_squared_error: 3079.5575
Epoch 473/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3079.303
9 - mean_squared_error: 3079.3039
Epoch 474/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3079.010
6 - mean_squared_error: 3079.0106
Epoch 475/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3078.861
5 - mean_squared_error: 3078.8615
Epoch 476/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3078.589
2 - mean_squared_error: 3078.5892
Epoch 477/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3078.398
5 - mean_squared_error: 3078.3985
Epoch 478/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3078.173
3 - mean_squared_error: 3078.1733
Epoch 479/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3078.045
4 - mean_squared_error: 3078.0454
Epoch 480/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3077.811
2 - mean_squared_error: 3077.8112
Epoch 481/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3077.592
9 - mean_squared_error: 3077.5929
Epoch 482/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3077.368
5 - mean_squared_error: 3077.3685
Epoch 483/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3077.216
```

```
0 - mean_squared_error: 3077.2160
Epoch 484/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3076.936
8 - mean_squared_error: 3076.9368
Epoch 485/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3076.721
2 - mean_squared_error: 3076.7212
Epoch 486/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3076.405
2 - mean_squared_error: 3076.4052
Epoch 487/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3076.125
4 - mean_squared_error: 3076.1254
Epoch 488/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3075.981
1 - mean_squared_error: 3075.9811
Epoch 489/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3075.779
4 - mean_squared_error: 3075.7794
Epoch 490/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3075.606
0 - mean_squared_error: 3075.6060
Epoch 491/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3075.313
4 - mean_squared_error: 3075.3134
Epoch 492/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3075.241
3 - mean_squared_error: 3075.2413
Epoch 493/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3074.946
8 - mean_squared_error: 3074.9468
Epoch 494/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3074.621
1 - mean_squared_error: 3074.6211
Epoch 495/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3074.456
4 - mean_squared_error: 3074.4564
Epoch 496/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3074.222
5 - mean_squared_error: 3074.2225
Epoch 497/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3074.034
4 - mean_squared_error: 3074.0344
Epoch 498/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3073.828
3 - mean_squared_error: 3073.8283
Epoch 499/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3073.650
6 - mean_squared_error: 3073.6506
Epoch 500/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3073.587
8 - mean_squared_error: 3073.5878
Epoch 501/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3073.317
3 - mean_squared_error: 3073.3173
Epoch 502/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3073.074
```

```
3 - mean_squared_error: 3073.0743
Epoch 503/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3072.939
2 - mean_squared_error: 3072.9392
Epoch 504/1000
1094/1094 [==============================] - 0s 45us/step - loss: 3072.816
2 - mean_squared_error: 3072.8162
Epoch 505/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3072.542
7 - mean_squared_error: 3072.5427
Epoch 506/1000
1094/1094 [==============================] - 0s 49us/step - loss: 3072.357
8 - mean_squared_error: 3072.3578
Epoch 507/1000
1094/1094 [==============================] - 0s 52us/step - loss: 3072.215
1 - mean_squared_error: 3072.2151
Epoch 508/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3072.031
2 - mean_squared_error: 3072.0312
Epoch 509/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3071.876
8 - mean_squared_error: 3071.8768
Epoch 510/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3071.627
8 - mean_squared_error: 3071.6278
Epoch 511/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3071.522
4 - mean_squared_error: 3071.5224
Epoch 512/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3071.246
3 - mean_squared_error: 3071.2463
Epoch 513/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3071.120
6 - mean_squared_error: 3071.1206
Epoch 514/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3070.781
0 - mean_squared_error: 3070.7810
Epoch 515/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3070.594
2 - mean_squared_error: 3070.5942
Epoch 516/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3070.455
3 - mean_squared_error: 3070.4553
Epoch 517/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3070.281
3 - mean_squared_error: 3070.2813
Epoch 518/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3070.106
1 - mean_squared_error: 3070.1061
Epoch 519/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3069.967
0 - mean_squared_error: 3069.9670
Epoch 520/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3069.782
4 - mean_squared_error: 3069.7824
Epoch 521/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3069.523
```

```
9 - mean_squared_error: 3069.5239
Epoch 522/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3069.412
2 - mean_squared_error: 3069.4122
Epoch 523/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3069.242
8 - mean_squared_error: 3069.2428
Epoch 524/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3069.040
4 - mean_squared_error: 3069.0404
Epoch 525/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3068.822
2 - mean_squared_error: 3068.8222
Epoch 526/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3068.589
9 - mean_squared_error: 3068.5899
Epoch 527/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3068.472
9 - mean_squared_error: 3068.4729
Epoch 528/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3068.265
3 - mean_squared_error: 3068.2653
Epoch 529/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3068.151
4 - mean_squared_error: 3068.1514
Epoch 530/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3067.902
6 - mean_squared_error: 3067.9026
Epoch 531/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3067.808
0 - mean_squared_error: 3067.8080
Epoch 532/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3067.661
4 - mean_squared_error: 3067.6614
Epoch 533/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3067.474
8 - mean_squared_error: 3067.4748
Epoch 534/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3067.355
2 - mean_squared_error: 3067.3552
Epoch 535/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3067.109
4 - mean_squared_error: 3067.1094
Epoch 536/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3067.035
4 - mean_squared_error: 3067.0354
Epoch 537/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3066.749
2 - mean_squared_error: 3066.7492
Epoch 538/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3066.591
8 - mean_squared_error: 3066.5918
Epoch 539/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3066.483
8 - mean_squared_error: 3066.4838
Epoch 540/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3066.275
```

```
6 - mean_squared_error: 3066.2756
Epoch 541/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3066.193
3 - mean_squared_error: 3066.1933
Epoch 542/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3065.979
5 - mean_squared_error: 3065.9795
Epoch 543/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3065.842
6 - mean_squared_error: 3065.8426
Epoch 544/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3065.691
0 - mean_squared_error: 3065.6910
Epoch 545/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3065.521
4 - mean_squared_error: 3065.5214
Epoch 546/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3065.302
7 - mean_squared_error: 3065.3027
Epoch 547/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3065.258
3 - mean_squared_error: 3065.2583
Epoch 548/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3065.112
7 - mean_squared_error: 3065.1127
Epoch 549/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3065.009
8 - mean_squared_error: 3065.0098
Epoch 550/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3064.764
8 - mean_squared_error: 3064.7648
Epoch 551/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3064.603
8 - mean_squared_error: 3064.6038
Epoch 552/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3064.459
3 - mean_squared_error: 3064.4593
Epoch 553/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3064.314
2 - mean_squared_error: 3064.3142
Epoch 554/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3064.142
0 - mean_squared_error: 3064.1420
Epoch 555/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3064.040
9 - mean_squared_error: 3064.0409
Epoch 556/1000
1094/1094 [==============================] - 0s 51us/step - loss: 3063.826
2 - mean_squared_error: 3063.8262
Epoch 557/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3063.676
8 - mean_squared_error: 3063.6768
Epoch 558/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3063.547
8 - mean_squared_error: 3063.5478
Epoch 559/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3063.437
```

```
7 - mean_squared_error: 3063.4377
Epoch 560/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3063.258
3 - mean_squared_error: 3063.2583
Epoch 561/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3063.139
7 - mean_squared_error: 3063.1397
Epoch 562/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3063.035
6 - mean_squared_error: 3063.0356
Epoch 563/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3062.876
8 - mean_squared_error: 3062.8768
Epoch 564/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3062.788
7 - mean_squared_error: 3062.7887
Epoch 565/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3062.600
7 - mean_squared_error: 3062.6007
Epoch 566/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3062.390
2 - mean_squared_error: 3062.3902
Epoch 567/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3062.232
1 - mean_squared_error: 3062.2321
Epoch 568/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3062.154
9 - mean_squared_error: 3062.1549
Epoch 569/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3061.984
3 - mean_squared_error: 3061.9843
Epoch 570/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3061.877
2 - mean_squared_error: 3061.8772
Epoch 571/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3061.818
5 - mean_squared_error: 3061.8185
Epoch 572/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3061.628
2 - mean_squared_error: 3061.6282
Epoch 573/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3061.490
9 - mean_squared_error: 3061.4909
Epoch 574/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3061.398
0 - mean_squared_error: 3061.3980
Epoch 575/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3061.237
4 - mean_squared_error: 3061.2374
Epoch 576/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3061.108
6 - mean_squared_error: 3061.1086
Epoch 577/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3060.987
6 - mean_squared_error: 3060.9876
Epoch 578/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3060.749
```

```
8 - mean_squared_error: 3060.7498
Epoch 579/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3060.743
4 - mean_squared_error: 3060.7434
Epoch 580/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3060.553
9 - mean_squared_error: 3060.5539
Epoch 581/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3060.412
7 - mean_squared_error: 3060.4127
Epoch 582/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3060.184
8 - mean_squared_error: 3060.1848
Epoch 583/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3060.060
4 - mean_squared_error: 3060.0604
Epoch 584/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3060.006
2 - mean_squared_error: 3060.0062
Epoch 585/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3059.897
5 - mean_squared_error: 3059.8975
Epoch 586/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3059.750
2 - mean_squared_error: 3059.7502
Epoch 587/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3059.667
5 - mean_squared_error: 3059.6675
Epoch 588/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3059.566
2 - mean_squared_error: 3059.5662
Epoch 589/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3059.355
5 - mean_squared_error: 3059.3555
Epoch 590/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3059.252
8 - mean_squared_error: 3059.2528
Epoch 591/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3059.136
9 - mean_squared_error: 3059.1369
Epoch 592/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3058.950
7 - mean_squared_error: 3058.9507
Epoch 593/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3058.893
3 - mean_squared_error: 3058.8933
Epoch 594/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3058.721
7 - mean_squared_error: 3058.7217
Epoch 595/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3058.695
4 - mean_squared_error: 3058.6954
Epoch 596/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3058.441
0 - mean_squared_error: 3058.4410
Epoch 597/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3058.373
```

```
6 - mean_squared_error: 3058.3736
Epoch 598/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3058.321
5 - mean_squared_error: 3058.3215
Epoch 599/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3058.207
8 - mean_squared_error: 3058.2078
Epoch 600/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3058.010
0 - mean_squared_error: 3058.0100
Epoch 601/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3057.863
8 - mean_squared_error: 3057.8638
Epoch 602/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3057.751
1 - mean_squared_error: 3057.7511
Epoch 603/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3057.731
2 - mean_squared_error: 3057.7312
Epoch 604/1000
1094/1094 [==============================] - 0s 51us/step - loss: 3057.526
6 - mean_squared_error: 3057.5266
Epoch 605/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3057.367
9 - mean_squared_error: 3057.3679
Epoch 606/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3057.287
4 - mean_squared_error: 3057.2874
Epoch 607/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3057.181
0 - mean_squared_error: 3057.1810
Epoch 608/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3057.086
5 - mean_squared_error: 3057.0865
Epoch 609/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3056.991
5 - mean_squared_error: 3056.9915
Epoch 610/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3056.877
9 - mean_squared_error: 3056.8779
Epoch 611/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3056.769
8 - mean_squared_error: 3056.7698
Epoch 612/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3056.630
7 - mean_squared_error: 3056.6307
Epoch 613/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3056.554
5 - mean_squared_error: 3056.5545
Epoch 614/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3056.499
4 - mean_squared_error: 3056.4994
Epoch 615/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3056.353
1 - mean_squared_error: 3056.3531
Epoch 616/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3056.175
```

```
9 - mean_squared_error: 3056.1759
Epoch 617/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3056.128
5 - mean_squared_error: 3056.1285
Epoch 618/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3056.003
0 - mean_squared_error: 3056.0030
Epoch 619/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3055.861
3 - mean_squared_error: 3055.8613
Epoch 620/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3055.731
5 - mean_squared_error: 3055.7315
Epoch 621/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3055.706
4 - mean_squared_error: 3055.7064
Epoch 622/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3055.555
8 - mean_squared_error: 3055.5558
Epoch 623/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3055.350
6 - mean_squared_error: 3055.3506
Epoch 624/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3055.294
9 - mean_squared_error: 3055.2949
Epoch 625/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3055.197
9 - mean_squared_error: 3055.1979
Epoch 626/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3055.132
4 - mean_squared_error: 3055.1324
Epoch 627/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3054.991
0 - mean_squared_error: 3054.9910
Epoch 628/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3054.853
4 - mean_squared_error: 3054.8534
Epoch 629/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3054.783
7 - mean_squared_error: 3054.7837
Epoch 630/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3054.707
6 - mean_squared_error: 3054.7076
Epoch 631/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3054.545
5 - mean_squared_error: 3054.5455
Epoch 632/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3054.494
9 - mean_squared_error: 3054.4949
Epoch 633/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3054.332
2 - mean_squared_error: 3054.3322
Epoch 634/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3054.199
8 - mean_squared_error: 3054.1998
Epoch 635/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3054.155
```

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4 - mean_squared_error: 3054.1554
Epoch 636/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3054.009
9 - mean_squared_error: 3054.0099
Epoch 637/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3053.932
8 - mean_squared_error: 3053.9328
Epoch 638/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3053.789
0 - mean_squared_error: 3053.7890
Epoch 639/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3053.823
3 - mean_squared_error: 3053.8233
Epoch 640/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3053.664
4 - mean_squared_error: 3053.6644
Epoch 641/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3053.525
4 - mean_squared_error: 3053.5254
Epoch 642/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3053.475
0 - mean_squared_error: 3053.4750
Epoch 643/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3053.410
5 - mean_squared_error: 3053.4105
Epoch 644/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3053.285
4 - mean_squared_error: 3053.2854
Epoch 645/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3053.176
5 - mean_squared_error: 3053.1765
Epoch 646/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3053.109
6 - mean_squared_error: 3053.1096
Epoch 647/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3053.025
6 - mean_squared_error: 3053.0256
Epoch 648/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3052.915
5 - mean_squared_error: 3052.9155
Epoch 649/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3052.903
0 - mean_squared_error: 3052.9030
Epoch 650/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3052.817
2 - mean_squared_error: 3052.8172
Epoch 651/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3052.627
0 - mean_squared_error: 3052.6270
Epoch 652/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3052.503
1 - mean_squared_error: 3052.5031
Epoch 653/1000
1094/1094 [==============================] - 0s 49us/step - loss: 3052.469
1 - mean_squared_error: 3052.4691
Epoch 654/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3052.429
```

```
3 - mean_squared_error: 3052.4293
Epoch 655/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3052.313
6 - mean_squared_error: 3052.3136
Epoch 656/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3052.070
1 - mean_squared_error: 3052.0701
Epoch 657/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3051.999
5 - mean_squared_error: 3051.9995
Epoch 658/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3051.902
2 - mean_squared_error: 3051.9022
Epoch 659/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3051.890
4 - mean_squared_error: 3051.8904
Epoch 660/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3051.759
2 - mean_squared_error: 3051.7592
Epoch 661/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3051.675
4 - mean_squared_error: 3051.6754
Epoch 662/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3051.608
4 - mean_squared_error: 3051.6084
Epoch 663/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3051.525
5 - mean_squared_error: 3051.5255
Epoch 664/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3051.413
3 - mean_squared_error: 3051.4133
Epoch 665/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3051.254
1 - mean_squared_error: 3051.2541
Epoch 666/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3051.226
9 - mean_squared_error: 3051.2269
Epoch 667/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3051.098
7 - mean_squared_error: 3051.0987
Epoch 668/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3050.966
5 - mean_squared_error: 3050.9665
Epoch 669/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3051.026
3 - mean_squared_error: 3051.0263
Epoch 670/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3050.894
8 - mean_squared_error: 3050.8948
Epoch 671/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3050.722
0 - mean_squared_error: 3050.7220
Epoch 672/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3050.647
0 - mean_squared_error: 3050.6470
Epoch 673/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3050.571
```

```
4 - mean_squared_error: 3050.5714
Epoch 674/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3050.478
0 - mean_squared_error: 3050.4780
Epoch 675/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3050.495
4 - mean_squared_error: 3050.4954
Epoch 676/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3050.373
9 - mean_squared_error: 3050.3739
Epoch 677/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3050.284
4 - mean_squared_error: 3050.2844
Epoch 678/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3050.149
5 - mean_squared_error: 3050.1495
Epoch 679/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3050.122
7 - mean_squared_error: 3050.1227
Epoch 680/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3050.107
3 - mean_squared_error: 3050.1073
Epoch 681/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.972
1 - mean_squared_error: 3049.9721
Epoch 682/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3050.013
9 - mean_squared_error: 3050.0139
Epoch 683/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3049.756
5 - mean_squared_error: 3049.7565
Epoch 684/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.738
2 - mean_squared_error: 3049.7382
Epoch 685/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3049.622
4 - mean_squared_error: 3049.6224
Epoch 686/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.523
7 - mean_squared_error: 3049.5237
Epoch 687/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.539
2 - mean_squared_error: 3049.5392
Epoch 688/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3049.382
3 - mean_squared_error: 3049.3823
Epoch 689/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3049.286
8 - mean_squared_error: 3049.2868
Epoch 690/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3049.207
0 - mean_squared_error: 3049.2070
Epoch 691/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3049.146
1 - mean_squared_error: 3049.1461
Epoch 692/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.007
```

```
9 - mean_squared_error: 3049.0079
Epoch 693/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3049.004
2 - mean_squared_error: 3049.0042
Epoch 694/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3048.934
8 - mean_squared_error: 3048.9348
Epoch 695/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3048.859
3 - mean_squared_error: 3048.8593
Epoch 696/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3048.750
9 - mean_squared_error: 3048.7509
Epoch 697/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3048.795
7 - mean_squared_error: 3048.7957
Epoch 698/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3048.541
5 - mean_squared_error: 3048.5415
Epoch 699/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3048.477
2 - mean_squared_error: 3048.4772
Epoch 700/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3048.435
9 - mean_squared_error: 3048.4359
Epoch 701/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3048.375
8 - mean_squared_error: 3048.3758
Epoch 702/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3048.277
1 - mean_squared_error: 3048.2771
Epoch 703/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3048.165
7 - mean_squared_error: 3048.1657
Epoch 704/1000
1094/1094 [==============================] - 0s 51us/step - loss: 3048.163
4 - mean_squared_error: 3048.1634
Epoch 705/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3048.093
7 - mean_squared_error: 3048.0937
Epoch 706/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3047.909
0 - mean_squared_error: 3047.9090
Epoch 707/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3047.920
1 - mean_squared_error: 3047.9201
Epoch 708/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3047.789
2 - mean_squared_error: 3047.7892
Epoch 709/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3047.754
5 - mean_squared_error: 3047.7545
Epoch 710/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3047.675
3 - mean_squared_error: 3047.6753
Epoch 711/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3047.601
```

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1 - mean_squared_error: 3047.6011
Epoch 712/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3047.532
8 - mean_squared_error: 3047.5328
Epoch 713/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3047.513
2 - mean_squared_error: 3047.5132
Epoch 714/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3047.399
1 - mean_squared_error: 3047.3991
Epoch 715/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3047.313
6 - mean_squared_error: 3047.3136
Epoch 716/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3047.257
1 - mean_squared_error: 3047.2571
Epoch 717/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3047.158
1 - mean_squared_error: 3047.1581
Epoch 718/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3047.217
2 - mean_squared_error: 3047.2172
Epoch 719/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3047.063
8 - mean_squared_error: 3047.0638
Epoch 720/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3046.971
6 - mean_squared_error: 3046.9716
Epoch 721/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3046.895
2 - mean_squared_error: 3046.8952
Epoch 722/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3046.789
4 - mean_squared_error: 3046.7894
Epoch 723/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3046.737
3 - mean_squared_error: 3046.7373
Epoch 724/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3046.710
2 - mean_squared_error: 3046.7102
Epoch 725/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3046.566
5 - mean_squared_error: 3046.5665
Epoch 726/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.546
7 - mean_squared_error: 3046.5467
Epoch 727/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3046.540
4 - mean_squared_error: 3046.5404
Epoch 728/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.329
7 - mean_squared_error: 3046.3297
Epoch 729/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.323
3 - mean_squared_error: 3046.3233
Epoch 730/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.260
```

```
3 - mean_squared_error: 3046.2603
Epoch 731/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3046.178
6 - mean_squared_error: 3046.1786
Epoch 732/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3046.175
7 - mean_squared_error: 3046.1757
Epoch 733/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.104
1 - mean_squared_error: 3046.1041
Epoch 734/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3046.046
9 - mean_squared_error: 3046.0469
Epoch 735/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3045.999
1 - mean_squared_error: 3045.9991
Epoch 736/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3045.897
3 - mean_squared_error: 3045.8973
Epoch 737/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3045.890
8 - mean_squared_error: 3045.8908
Epoch 738/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3045.866
1 - mean_squared_error: 3045.8661
Epoch 739/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3045.729
9 - mean_squared_error: 3045.7299
Epoch 740/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3045.715
3 - mean_squared_error: 3045.7153
Epoch 741/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3045.605
6 - mean_squared_error: 3045.6056
Epoch 742/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3045.488
4 - mean_squared_error: 3045.4884
Epoch 743/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3045.451
4 - mean_squared_error: 3045.4514
Epoch 744/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3045.407
6 - mean_squared_error: 3045.4076
Epoch 745/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3045.260
5 - mean_squared_error: 3045.2605
Epoch 746/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3045.227
0 - mean_squared_error: 3045.2270
Epoch 747/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3045.131
3 - mean_squared_error: 3045.1313
Epoch 748/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3045.055
9 - mean_squared_error: 3045.0559
Epoch 749/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3045.033
```

```
9 - mean_squared_error: 3045.0339
Epoch 750/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3044.948
4 - mean_squared_error: 3044.9484
Epoch 751/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3044.957
7 - mean_squared_error: 3044.9577
Epoch 752/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3044.803
1 - mean_squared_error: 3044.8031
Epoch 753/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3044.904
8 - mean_squared_error: 3044.9048
Epoch 754/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3044.738
5 - mean_squared_error: 3044.7385
Epoch 755/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3044.716
9 - mean_squared_error: 3044.7169
Epoch 756/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3044.707
9 - mean_squared_error: 3044.7079
Epoch 757/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3044.569
9 - mean_squared_error: 3044.5699
Epoch 758/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3044.561
9 - mean_squared_error: 3044.5619
Epoch 759/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3044.388
1 - mean_squared_error: 3044.3881
Epoch 760/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3044.381
7 - mean_squared_error: 3044.3817
Epoch 761/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3044.323
7 - mean_squared_error: 3044.3237
Epoch 762/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3044.247
8 - mean_squared_error: 3044.2478
Epoch 763/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3044.253
3 - mean_squared_error: 3044.2533
Epoch 764/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3044.216
8 - mean_squared_error: 3044.2168
Epoch 765/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3044.108
9 - mean_squared_error: 3044.1089
Epoch 766/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3044.091
9 - mean_squared_error: 3044.0919
Epoch 767/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3043.992
2 - mean_squared_error: 3043.9922
Epoch 768/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3043.890
```

```
5 - mean_squared_error: 3043.8905
Epoch 769/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3043.814
6 - mean_squared_error: 3043.8146
Epoch 770/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3043.840
5 - mean_squared_error: 3043.8405
Epoch 771/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3043.663
2 - mean_squared_error: 3043.6632
Epoch 772/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3043.722
3 - mean_squared_error: 3043.7223
Epoch 773/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3043.644
7 - mean_squared_error: 3043.6447
Epoch 774/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3043.559
6 - mean_squared_error: 3043.5596
Epoch 775/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3043.537
8 - mean_squared_error: 3043.5378
Epoch 776/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3043.313
5 - mean_squared_error: 3043.3135
Epoch 777/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3043.304
3 - mean_squared_error: 3043.3043
Epoch 778/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3043.238
8 - mean_squared_error: 3043.2388
Epoch 779/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3043.170
4 - mean_squared_error: 3043.1704
Epoch 780/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3043.226
2 - mean_squared_error: 3043.2262
Epoch 781/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3043.077
3 - mean_squared_error: 3043.0773
Epoch 782/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3043.155
9 - mean_squared_error: 3043.1559
Epoch 783/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3043.078
0 - mean_squared_error: 3043.0780
Epoch 784/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3042.946
2 - mean_squared_error: 3042.9462
Epoch 785/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3042.942
8 - mean_squared_error: 3042.9428
Epoch 786/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.821
4 - mean_squared_error: 3042.8214
Epoch 787/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.882
```

```
9 - mean_squared_error: 3042.8829
Epoch 788/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3042.725
7 - mean_squared_error: 3042.7257
Epoch 789/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3042.740
5 - mean_squared_error: 3042.7405
Epoch 790/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.690
8 - mean_squared_error: 3042.6908
Epoch 791/1000
1094/1094 [==============================] - 0s 49us/step - loss: 3042.612
2 - mean_squared_error: 3042.6122
Epoch 792/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3042.509
0 - mean_squared_error: 3042.5090
Epoch 793/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3042.460
3 - mean_squared_error: 3042.4603
Epoch 794/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.325
7 - mean_squared_error: 3042.3257
Epoch 795/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.419
7 - mean_squared_error: 3042.4197
Epoch 796/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3042.306
4 - mean_squared_error: 3042.3064
Epoch 797/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3042.198
3 - mean_squared_error: 3042.1983
Epoch 798/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.238
5 - mean_squared_error: 3042.2385
Epoch 799/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3042.164
1 - mean_squared_error: 3042.1641
Epoch 800/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3042.131
6 - mean_squared_error: 3042.1316
Epoch 801/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3042.044
7 - mean_squared_error: 3042.0447
Epoch 802/1000
1094/1094 [==============================] - 0s 45us/step - loss: 3041.949
7 - mean_squared_error: 3041.9497
Epoch 803/1000
1094/1094 [==============================] - 0s 47us/step - loss: 3041.942
7 - mean_squared_error: 3041.9427
Epoch 804/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.898
9 - mean_squared_error: 3041.8989
Epoch 805/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.819
6 - mean_squared_error: 3041.8196
Epoch 806/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3041.814
```

```
7 - mean_squared_error: 3041.8147
Epoch 807/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.716
1 - mean_squared_error: 3041.7161
Epoch 808/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.759
2 - mean_squared_error: 3041.7592
Epoch 809/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.616
6 - mean_squared_error: 3041.6166
Epoch 810/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3041.492
7 - mean_squared_error: 3041.4927
Epoch 811/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.512
7 - mean_squared_error: 3041.5127
Epoch 812/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3041.432
9 - mean_squared_error: 3041.4329
Epoch 813/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.459
1 - mean_squared_error: 3041.4591
Epoch 814/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3041.379
1 - mean_squared_error: 3041.3791
Epoch 815/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3041.284
8 - mean_squared_error: 3041.2848
Epoch 816/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3041.246
4 - mean_squared_error: 3041.2464
Epoch 817/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3041.339
8 - mean_squared_error: 3041.3398
Epoch 818/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3041.259
5 - mean_squared_error: 3041.2595
Epoch 819/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3041.144
7 - mean_squared_error: 3041.1447
Epoch 820/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3041.053
4 - mean_squared_error: 3041.0534
Epoch 821/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3040.954
9 - mean_squared_error: 3040.9549
Epoch 822/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3040.988
9 - mean_squared_error: 3040.9889
Epoch 823/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3040.887
7 - mean_squared_error: 3040.8877
Epoch 824/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.960
3 - mean_squared_error: 3040.9603
Epoch 825/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.773
```

```
5 - mean_squared_error: 3040.7735
Epoch 826/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.715
8 - mean_squared_error: 3040.7158
Epoch 827/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3040.700
2 - mean_squared_error: 3040.7002
Epoch 828/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3040.581
6 - mean_squared_error: 3040.5816
Epoch 829/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.599
2 - mean_squared_error: 3040.5992
Epoch 830/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.571
9 - mean_squared_error: 3040.5719
Epoch 831/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3040.512
2 - mean_squared_error: 3040.5122
Epoch 832/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.511
7 - mean_squared_error: 3040.5117
Epoch 833/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.372
7 - mean_squared_error: 3040.3727
Epoch 834/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3040.363
8 - mean_squared_error: 3040.3638
Epoch 835/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3040.381
1 - mean_squared_error: 3040.3811
Epoch 836/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.340
0 - mean_squared_error: 3040.3400
Epoch 837/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3040.263
1 - mean_squared_error: 3040.2631
Epoch 838/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.331
0 - mean_squared_error: 3040.3310
Epoch 839/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.189
3 - mean_squared_error: 3040.1893
Epoch 840/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3040.142
6 - mean_squared_error: 3040.1426
Epoch 841/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.038
1 - mean_squared_error: 3040.0381
Epoch 842/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.030
1 - mean_squared_error: 3040.0301
Epoch 843/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3040.061
7 - mean_squared_error: 3040.0617
Epoch 844/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3040.074
```

```
2 - mean_squared_error: 3040.0742
Epoch 845/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3039.894
8 - mean_squared_error: 3039.8948
Epoch 846/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3039.813
4 - mean_squared_error: 3039.8134
Epoch 847/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3039.868
3 - mean_squared_error: 3039.8683
Epoch 848/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3039.709
7 - mean_squared_error: 3039.7097
Epoch 849/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3039.755
9 - mean_squared_error: 3039.7559
Epoch 850/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3039.635
0 - mean_squared_error: 3039.6350
Epoch 851/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3039.676
7 - mean_squared_error: 3039.6767
Epoch 852/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3039.520
8 - mean_squared_error: 3039.5208
Epoch 853/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3039.497
4 - mean_squared_error: 3039.4974
Epoch 854/1000
1094/1094 [==============================] - 0s 47us/step - loss: 3039.547
3 - mean_squared_error: 3039.5473
Epoch 855/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3039.373
5 - mean_squared_error: 3039.3735
Epoch 856/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3039.441
1 - mean_squared_error: 3039.4411
Epoch 857/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3039.481
1 - mean_squared_error: 3039.4811
Epoch 858/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3039.316
9 - mean_squared_error: 3039.3169
Epoch 859/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3039.405
7 - mean_squared_error: 3039.4057
Epoch 860/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3039.280
9 - mean_squared_error: 3039.2809
Epoch 861/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3039.164
3 - mean_squared_error: 3039.1643
Epoch 862/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3039.277
1 - mean_squared_error: 3039.2771
Epoch 863/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3039.121
```

```
4 - mean_squared_error: 3039.1214
Epoch 864/1000
1094/1094 [==============================] - 0s 44us/step - loss: 3039.139
3 - mean_squared_error: 3039.1393
Epoch 865/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3039.179
1 - mean_squared_error: 3039.1791
Epoch 866/1000
1094/1094 [==============================] - 0s 40us/step - loss: 3039.059
7 - mean_squared_error: 3039.0597
Epoch 867/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3039.034
3 - mean_squared_error: 3039.0343
Epoch 868/1000
1094/1094 [==============================] - 0s 43us/step - loss: 3038.998
4 - mean_squared_error: 3038.9984
Epoch 869/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3038.966
5 - mean_squared_error: 3038.9665
Epoch 870/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.931
5 - mean_squared_error: 3038.9315
Epoch 871/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.826
5 - mean_squared_error: 3038.8265
Epoch 872/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.797
6 - mean_squared_error: 3038.7976
Epoch 873/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3038.857
7 - mean_squared_error: 3038.8577
Epoch 874/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.797
1 - mean_squared_error: 3038.7971
Epoch 875/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3038.673
1 - mean_squared_error: 3038.6731
Epoch 876/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.771
3 - mean_squared_error: 3038.7713
Epoch 877/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.673
5 - mean_squared_error: 3038.6735
Epoch 878/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3038.583
6 - mean_squared_error: 3038.5836
Epoch 879/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.566
0 - mean_squared_error: 3038.5660
Epoch 880/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.545
8 - mean_squared_error: 3038.5458
Epoch 881/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.461
5 - mean_squared_error: 3038.4615
Epoch 882/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.474
```

```
2 - mean_squared_error: 3038.4742
Epoch 883/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.492
0 - mean_squared_error: 3038.4920
Epoch 884/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3038.544
3 - mean_squared_error: 3038.5443
Epoch 885/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.429
2 - mean_squared_error: 3038.4292
Epoch 886/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.441
9 - mean_squared_error: 3038.4419
Epoch 887/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.297
2 - mean_squared_error: 3038.2972
Epoch 888/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.347
1 - mean_squared_error: 3038.3471
Epoch 889/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.164
3 - mean_squared_error: 3038.1643
Epoch 890/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3038.155
0 - mean_squared_error: 3038.1550
Epoch 891/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3038.127
4 - mean_squared_error: 3038.1274
Epoch 892/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3038.141
3 - mean_squared_error: 3038.1413
Epoch 893/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3038.069
6 - mean_squared_error: 3038.0696
Epoch 894/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3037.997
7 - mean_squared_error: 3037.9977
Epoch 895/1000
1094/1094 [==============================] - 0s 41us/step - loss: 3037.965
6 - mean_squared_error: 3037.9656
Epoch 896/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3037.852
5 - mean_squared_error: 3037.8525
Epoch 897/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3037.903
5 - mean_squared_error: 3037.9035
Epoch 898/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3037.938
5 - mean_squared_error: 3037.9385
Epoch 899/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3037.924
6 - mean_squared_error: 3037.9246
Epoch 900/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3037.753
8 - mean_squared_error: 3037.7538
Epoch 901/1000
1094/1094 [==============================] - 0s 45us/step - loss: 3037.692
```

```
7 - mean_squared_error: 3037.6927
Epoch 902/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3037.698
2 - mean_squared_error: 3037.6982
Epoch 903/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3037.659
6 - mean_squared_error: 3037.6596
Epoch 904/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3037.612
9 - mean_squared_error: 3037.6129
Epoch 905/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3037.555
5 - mean_squared_error: 3037.5555
Epoch 906/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3037.531
9 - mean_squared_error: 3037.5319
Epoch 907/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3037.538
9 - mean_squared_error: 3037.5389
Epoch 908/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.466
1 - mean_squared_error: 3037.4661
Epoch 909/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3037.448
2 - mean_squared_error: 3037.4482
Epoch 910/1000
1094/1094 [==============================] - 0s 31us/step - loss: 3037.436
8 - mean_squared_error: 3037.4368
Epoch 911/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.456
9 - mean_squared_error: 3037.4569
Epoch 912/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3037.334
9 - mean_squared_error: 3037.3349
Epoch 913/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.295
0 - mean_squared_error: 3037.2950
Epoch 914/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3037.383
1 - mean_squared_error: 3037.3831
Epoch 915/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.236
1 - mean_squared_error: 3037.2361
Epoch 916/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.232
3 - mean_squared_error: 3037.2323
Epoch 917/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.124
5 - mean_squared_error: 3037.1245
Epoch 918/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3037.131
6 - mean_squared_error: 3037.1316
Epoch 919/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3037.081
4 - mean_squared_error: 3037.0814
Epoch 920/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3037.104
```

```
9 - mean_squared_error: 3037.1049
Epoch 921/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3037.023
4 - mean_squared_error: 3037.0234
Epoch 922/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3037.089
8 - mean_squared_error: 3037.0898
Epoch 923/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.987
4 - mean_squared_error: 3036.9874
Epoch 924/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.922
3 - mean_squared_error: 3036.9223
Epoch 925/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3036.936
3 - mean_squared_error: 3036.9363
Epoch 926/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.924
2 - mean_squared_error: 3036.9242
Epoch 927/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3036.974
0 - mean_squared_error: 3036.9740
Epoch 928/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3036.792
4 - mean_squared_error: 3036.7924
Epoch 929/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.818
9 - mean_squared_error: 3036.8189
Epoch 930/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.766
4 - mean_squared_error: 3036.7664
Epoch 931/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.789
4 - mean_squared_error: 3036.7894
Epoch 932/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.700
1 - mean_squared_error: 3036.7001
Epoch 933/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3036.701
8 - mean_squared_error: 3036.7018
Epoch 934/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.701
7 - mean_squared_error: 3036.7017
Epoch 935/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.652
1 - mean_squared_error: 3036.6521
Epoch 936/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.592
1 - mean_squared_error: 3036.5921
Epoch 937/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3036.601
6 - mean_squared_error: 3036.6016
Epoch 938/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.504
7 - mean_squared_error: 3036.5047
Epoch 939/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3036.524
```

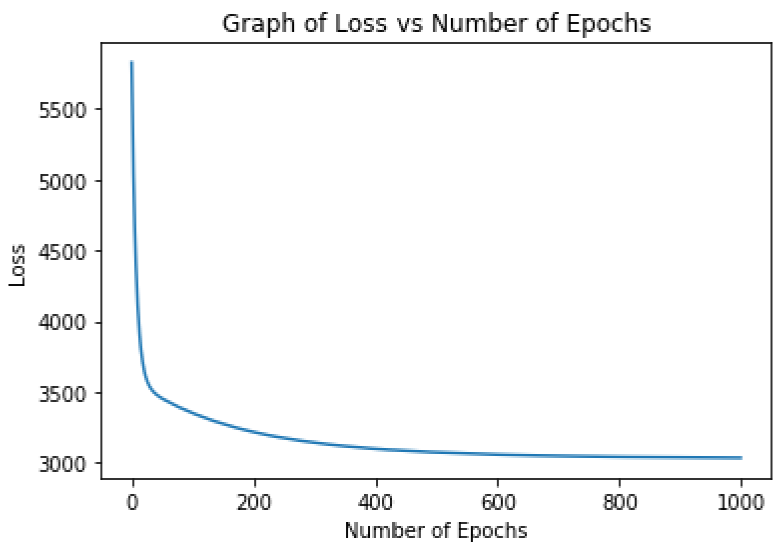
```
0 - mean_squared_error: 3036.5240
Epoch 940/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.512
8 - mean_squared_error: 3036.5128
Epoch 941/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.446
3 - mean_squared_error: 3036.4463
Epoch 942/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.411
5 - mean_squared_error: 3036.4115
Epoch 943/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3036.411
1 - mean_squared_error: 3036.4111
Epoch 944/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3036.446
7 - mean_squared_error: 3036.4467
Epoch 945/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3036.330
3 - mean_squared_error: 3036.3303
Epoch 946/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3036.326
9 - mean_squared_error: 3036.3269
Epoch 947/1000
1094/1094 [==============================] - 0s 32us/step - loss: 3036.265
0 - mean_squared_error: 3036.2650
Epoch 948/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.221
2 - mean_squared_error: 3036.2212
Epoch 949/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3036.277
5 - mean_squared_error: 3036.2775
Epoch 950/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.275
8 - mean_squared_error: 3036.2758
Epoch 951/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3036.179
8 - mean_squared_error: 3036.1798
Epoch 952/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3036.113
6 - mean_squared_error: 3036.1136
Epoch 953/1000
1094/1094 [==============================] - 0s 42us/step - loss: 3036.110
2 - mean_squared_error: 3036.1102
Epoch 954/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3036.059
4 - mean_squared_error: 3036.0594
Epoch 955/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3036.015
6 - mean_squared_error: 3036.0156
Epoch 956/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.898
9 - mean_squared_error: 3035.8989
Epoch 957/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3036.062
1 - mean_squared_error: 3036.0621
Epoch 958/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.975
```

```
3 - mean_squared_error: 3035.9753
Epoch 959/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.920
3 - mean_squared_error: 3035.9203
Epoch 960/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.963
0 - mean_squared_error: 3035.9630
Epoch 961/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.919
2 - mean_squared_error: 3035.9192
Epoch 962/1000
1094/1094 [==============================] - 0s 44us/step - loss: 3035.861
8 - mean_squared_error: 3035.8618
Epoch 963/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.783
3 - mean_squared_error: 3035.7833
Epoch 964/1000
1094/1094 [==============================] - 0s 28us/step - loss: 3035.783
7 - mean_squared_error: 3035.7837
Epoch 965/1000
1094/1094 [==============================] - 0s 46us/step - loss: 3035.788
8 - mean_squared_error: 3035.7888
Epoch 966/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3035.749
4 - mean_squared_error: 3035.7494
Epoch 967/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.736
0 - mean_squared_error: 3035.7360
Epoch 968/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.715
0 - mean_squared_error: 3035.7150
Epoch 969/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3035.723
8 - mean_squared_error: 3035.7238
Epoch 970/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3035.664
0 - mean_squared_error: 3035.6640
Epoch 971/1000
1094/1094 [==============================] - 0s 38us/step - loss: 3035.612
8 - mean_squared_error: 3035.6128
Epoch 972/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3035.673
2 - mean_squared_error: 3035.6732
Epoch 973/1000
1094/1094 [==============================] - 0s 39us/step - loss: 3035.715
3 - mean_squared_error: 3035.7153
Epoch 974/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.522
7 - mean_squared_error: 3035.5227
Epoch 975/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3035.478
2 - mean_squared_error: 3035.4782
Epoch 976/1000
1094/1094 [==============================] - 0s 44us/step - loss: 3035.478
4 - mean_squared_error: 3035.4784
Epoch 977/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.523
```

```
8 - mean_squared_error: 3035.5238
Epoch 978/1000
1094/1094 [==============================] - 0s 30us/step - loss: 3035.470
1 - mean_squared_error: 3035.4701
Epoch 979/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3035.451
4 - mean_squared_error: 3035.4514
Epoch 980/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.472
5 - mean_squared_error: 3035.4725
Epoch 981/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.496
6 - mean_squared_error: 3035.4966
Epoch 982/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3035.336
7 - mean_squared_error: 3035.3367
Epoch 983/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3035.278
0 - mean_squared_error: 3035.2780
Epoch 984/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3035.355
6 - mean_squared_error: 3035.3556
Epoch 985/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3035.241
2 - mean_squared_error: 3035.2412
Epoch 986/1000
1094/1094 [==============================] - 0s 33us/step - loss: 3035.173
9 - mean_squared_error: 3035.1739
Epoch 987/1000
1094/1094 [==============================] - 0s 34us/step - loss: 3035.273
7 - mean_squared_error: 3035.2737
Epoch 988/1000
1094/1094 [==============================] - 0s 29us/step - loss: 3035.252
3 - mean_squared_error: 3035.2523
Epoch 989/1000
1094/1094 [==============================] - 0s 35us/step - loss: 3035.147
5 - mean_squared_error: 3035.1475
Epoch 990/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.064
7 - mean_squared_error: 3035.0647
Epoch 991/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.065
6 - mean_squared_error: 3035.0656
Epoch 992/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.120
5 - mean_squared_error: 3035.1205
Epoch 993/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3035.059
9 - mean_squared_error: 3035.0599
Epoch 994/1000
1094/1094 [==============================] - 0s 44us/step - loss: 3035.161
3 - mean_squared_error: 3035.1613
Epoch 995/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3034.962
2 - mean_squared_error: 3034.9622
Epoch 996/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3035.006
```

```
7 - mean_squared_error: 3035.0067
Epoch 997/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3034.961
4 - mean_squared_error: 3034.9614
Epoch 998/1000
1094/1094 [==============================] - 0s 36us/step - loss: 3034.917
5 - mean_squared_error: 3034.9175
Epoch 999/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3034.901
8 - mean_squared_error: 3034.9018
Epoch 1000/1000
1094/1094 [==============================] - 0s 37us/step - loss: 3034.914
6 - mean_squared_error: 3034.9146
```

Out[136]: Text(0, 0.5, 'Loss')



In [137]:
```
y3_pred = model.predict(X)
y3_pred
```

Out[137]:
```
array([[58.89272 ],
       [58.89272 ],
       [58.89272 ],
       ...,
       [45.636673],
       [45.636673],
       [45.636673]], dtype=float32)
```

In [138]:
```
W = model.get_weights()
print(W)
```

```
[array([[16.866497 ],
       [ 3.6104503]], dtype=float32), array([34.80532], dtype=float32)]
```

In [139]:
```
import keras
!pip install pydot
!pip install graphviz
import pydot as pyd
from IPython.display import SVG
from keras.utils.vis_utils import model_to_dot
```

```
keras.utils.vis_utils.pydot = pyd

#Visualize Model

def visualize_model(model):
  return SVG(model_to_dot(model).create(prog='dot', format='svg'))
#create your model
#then call the function on your model
visualize_model(model)
```

```
Collecting pydot
  Downloading https://files.pythonhosted.org/packages/33/d1/b1479a770f66d9
62f545c2101630ce1d5592d90cb4f083d38862e93d16d2/pydot-1.4.1-py2.py3-none-an
y.whl
Requirement already satisfied: pyparsing>=2.1.4 in /opt/conda/envs/Python3
6/lib/python3.6/site-packages (from pydot) (2.3.1)
Installing collected packages: pydot
Successfully installed pydot-1.4.1
Collecting graphviz
  Downloading https://files.pythonhosted.org/packages/f5/74/dbed754c0abd63
768d3a7a7b472da35b08ac442cf87d73d5850a6f32391e/graphviz-0.13.2-py2.py3-non
e-any.whl
Installing collected packages: graphviz
Successfully installed graphviz-0.13.2
```

Out[139]: G 140080160472144 dense_3: Dense 140080160472984 activation_3: Activation 140080160472144->140080160472984 140080160470632 140080160470632 140080160470632->140080160472144