In [4]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [5]:
```
df = pd.read_csv("sales_data_sample.csv")
```

In [6]:
```
df.head()
```

Out[6]:

	ORDERNUMBER	QUANTITYORDERED	PRICEEACH	ORDERLINENUMBER	SALES	ORDERDATE
0	10107	30	95.70	2	2871.00	2/24/2003 0:00
1	10121	34	81.35	5	2765.90	5/7/2003 0:00
2	10134	41	94.74	2	3884.34	7/1/2003 0:00
3	10145	45	83.26	6	3746.70	8/25/2003 0:00
4	10159	49	100.00	14	5205.27	10/10/2003 0:00

5 rows × 25 columns

In [7]:
```
df.dtypes
```

Out[7]:
```
ORDERNUMBER           int64
QUANTITYORDERED       int64
PRICEEACH           float64
ORDERLINENUMBER       int64
SALES               float64
ORDERDATE            object
STATUS               object
QTR_ID                int64
MONTH_ID              int64
YEAR_ID               int64
PRODUCTLINE          object
MSRP                  int64
PRODUCTCODE          object
CUSTOMERNAME         object
PHONE                object
ADDRESSLINE1         object
ADDRESSLINE2         object
CITY                 object
STATE                object
POSTALCODE           object
COUNTRY              object
TERRITORY            object
CONTACTLASTNAME      object
CONTACTFIRSTNAME     object
DEALSIZE             object
dtype: object
```

In [8]:
```
df.isnull().sum()
```

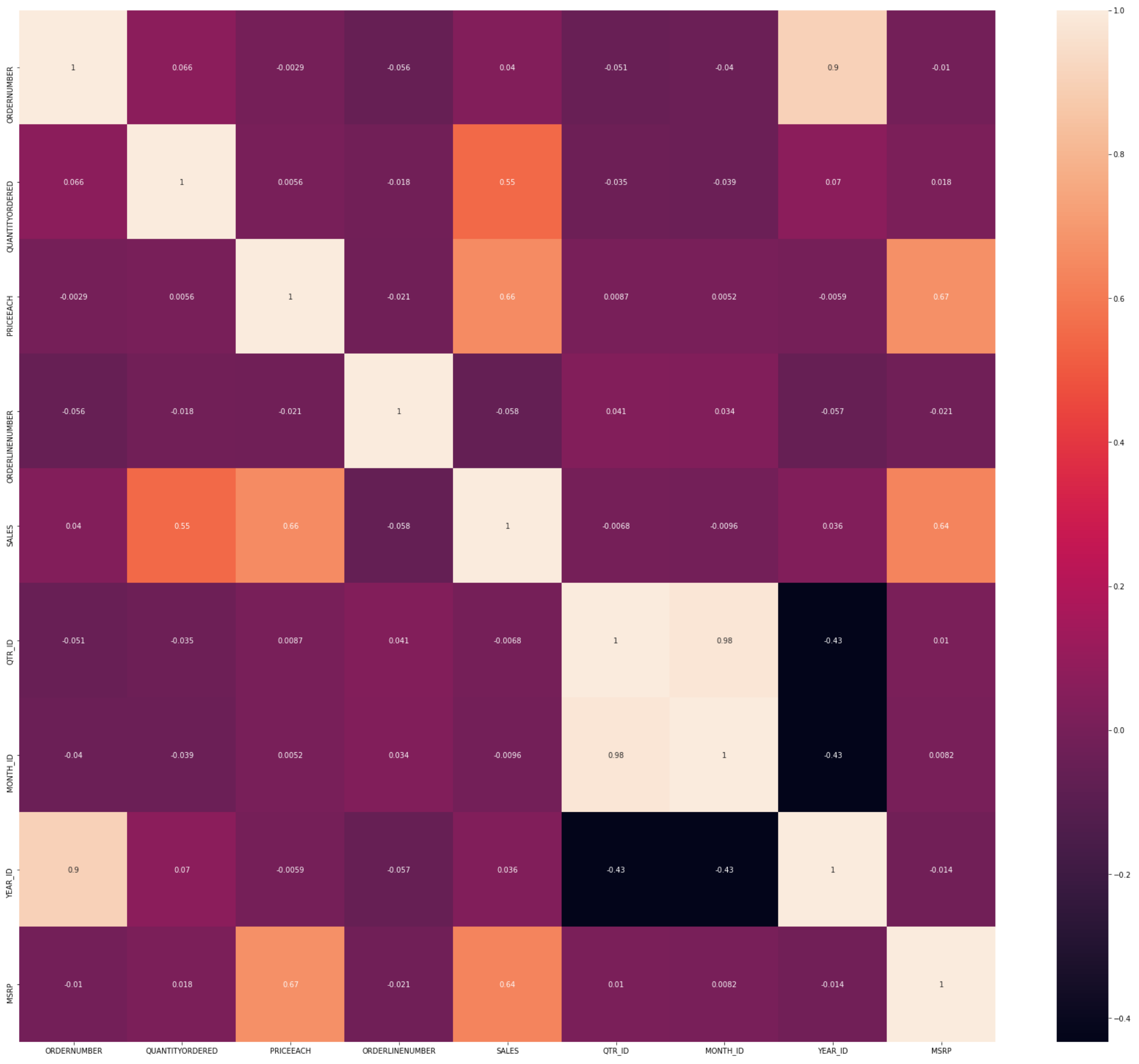
Out[8]:
```
ORDERNUMBER            0
QUANTITYORDERED        0
PRICEEACH              0
ORDERLINENUMBER        0
SALES                  0
ORDERDATE              0
STATUS                 0
QTR_ID                 0
MONTH_ID               0
YEAR_ID                0
PRODUCTLINE            0
MSRP                   0
PRODUCTCODE            0
CUSTOMERNAME           0
PHONE                  0
ADDRESSLINE1           0
ADDRESSLINE2        2521
CITY                   0
STATE               1486
POSTALCODE            76
COUNTRY                0
TERRITORY           1074
CONTACTLASTNAME        0
CONTACTFIRSTNAME       0
DEALSIZE               0
dtype: int64
```

In [9]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2823 entries, 0 to 2822
Data columns (total 25 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   ORDERNUMBER       2823 non-null   int64  
 1   QUANTITYORDERED   2823 non-null   int64  
 2   PRICEEACH         2823 non-null   float64
 3   ORDERLINENUMBER   2823 non-null   int64  
 4   SALES             2823 non-null   float64
 5   ORDERDATE         2823 non-null   object 
 6   STATUS            2823 non-null   object 
 7   QTR_ID            2823 non-null   int64  
 8   MONTH_ID          2823 non-null   int64  
 9   YEAR_ID           2823 non-null   int64  
 10  PRODUCTLINE       2823 non-null   object 
 11  MSRP              2823 non-null   int64  
 12  PRODUCTCODE       2823 non-null   object 
 13  CUSTOMERNAME      2823 non-null   object 
 14  PHONE             2823 non-null   object 
 15  ADDRESSLINE1      2823 non-null   object 
 16  ADDRESSLINE2      302 non-null    object 
 17  CITY              2823 non-null   object 
 18  STATE             1337 non-null   object 
 19  POSTALCODE        2747 non-null   object 
 20  COUNTRY           2823 non-null   object 
 21  TERRITORY         1749 non-null   object 
 22  CONTACTLASTNAME   2823 non-null   object 
 23  CONTACTFIRSTNAME  2823 non-null   object 
 24  DEALSIZE          2823 non-null   object 
dtypes: float64(2), int64(7), object(16)
memory usage: 551.5+ KB
```

In [10]:
```
plt.figure(figsize = (30,26))
sns.heatmap(df.corr(),annot = True)
```

Out[10]:
```
<AxesSubplot:>
```



In [11]:
```
df_drop  = ['ADDRESSLINE1', 'ADDRESSLINE2', 'STATUS','POSTALCODE', 'CITY', 'TERRIT
df = df.drop(df_drop, axis=1)
```

In [12]:
```
df.head()
```

Out[12]:

	QUANTITYORDERED	PRICEEACH	ORDERLINENUMBER	SALES	ORDERDATE	QTR_ID	MONTH
0	30	95.70	2	2871.00	2/24/2003 0:00	1	
1	34	81.35	5	2765.90	5/7/2003 0:00	2	
2	41	94.74	2	3884.34	7/1/2003 0:00	3	
3	45	83.26	6	3746.70	8/25/2003 0:00	3	
4	49	100.00	14	5205.27	10/10/2003 0:00	4	

In [13]:
```
df.shape
```

Out[13]:
```
(2823, 13)
```

In [14]:
```
df.isnull().sum()
```

Out[14]:
```
QUANTITYORDERED    0
PRICEEACH          0
ORDERLINENUMBER    0
SALES              0
ORDERDATE          0
QTR_ID             0
MONTH_ID           0
YEAR_ID            0
PRODUCTLINE        0
MSRP               0
PRODUCTCODE        0
COUNTRY            0
DEALSIZE           0
dtype: int64
```

In [15]:
```
df.dtypes
```

Out[15]:
```
QUANTITYORDERED      int64
PRICEEACH          float64
ORDERLINENUMBER      int64
SALES              float64
ORDERDATE           object
QTR_ID               int64
MONTH_ID             int64
YEAR_ID              int64
PRODUCTLINE         object
MSRP                 int64
PRODUCTCODE         object
COUNTRY             object
DEALSIZE            object
dtype: object
```

In [ ]:
```

```

In [16]:
```
country = pd.get_dummies(df['COUNTRY'])
productline = pd.get_dummies(df['PRODUCTLINE'])
Dealsize = pd.get_dummies(df['DEALSIZE'])
```

In [17]:
```
df = pd.concat([df,country,productline,Dealsize], axis = 1)
```

In [18]:
```
df.head()
```

Out[18]:

	QUANTITYORDERED	PRICEEACH	ORDERLINENUMBER	SALES	ORDERDATE	QTR_ID	MONTH
0	30	95.70	2	2871.00	2/24/2003 0:00	1	
1	34	81.35	5	2765.90	5/7/2003 0:00	2	
2	41	94.74	2	3884.34	7/1/2003 0:00	3	
3	45	83.26	6	3746.70	8/25/2003 0:00	3	
4	49	100.00	14	5205.27	10/10/2003 0:00	4	

5 rows × 42 columns

In [19]:
```
df_drop  = ['COUNTRY','PRODUCTLINE','DEALSIZE']
df = df.drop(df_drop, axis=1)
```

In [20]:
```
df.dtypes
```

```
Out[20]: QUANTITYORDERED       int64
         PRICEEACH           float64
         ORDERLINENUMBER       int64
         SALES               float64
         ORDERDATE            object
         QTR_ID                int64
         MONTH_ID              int64
         YEAR_ID               int64
         MSRP                  int64
         PRODUCTCODE          object
         Australia             uint8
         Austria               uint8
         Belgium               uint8
         Canada                uint8
         Denmark               uint8
         Finland               uint8
         France                uint8
         Germany               uint8
         Ireland               uint8
         Italy                 uint8
         Japan                 uint8
         Norway                uint8
         Philippines           uint8
         Singapore             uint8
         Spain                 uint8
         Sweden                uint8
         Switzerland           uint8
         UK                    uint8
         USA                   uint8
         Classic Cars          uint8
         Motorcycles           uint8
         Planes                uint8
         Ships                 uint8
         Trains                uint8
         Trucks and Buses      uint8
         Vintage Cars          uint8
         Large                 uint8
         Medium                uint8
         Small                 uint8
         dtype: object
```

```
In [21]: df['PRODUCTCODE'] = pd.Categorical(df['PRODUCTCODE']).codes
```

```
In [22]: df.dtypes
```

Out[22]:
```
QUANTITYORDERED       int64
PRICEEACH           float64
ORDERLINENUMBER       int64
SALES               float64
ORDERDATE            object
QTR_ID                int64
MONTH_ID              int64
YEAR_ID               int64
MSRP                  int64
PRODUCTCODE            int8
Australia             uint8
Austria               uint8
Belgium               uint8
Canada                uint8
Denmark               uint8
Finland               uint8
France                uint8
Germany               uint8
Ireland               uint8
Italy                 uint8
Japan                 uint8
Norway                uint8
Philippines           uint8
Singapore             uint8
Spain                 uint8
Sweden                uint8
Switzerland           uint8
UK                    uint8
USA                   uint8
Classic Cars          uint8
Motorcycles           uint8
Planes                uint8
Ships                 uint8
Trains                uint8
Trucks and Buses      uint8
Vintage Cars          uint8
Large                 uint8
Medium                uint8
Small                 uint8
dtype: object
```

In [23]:
```
df.drop('ORDERDATE', axis=1, inplace=True)
```

In [24]:
```
df.dtypes
```

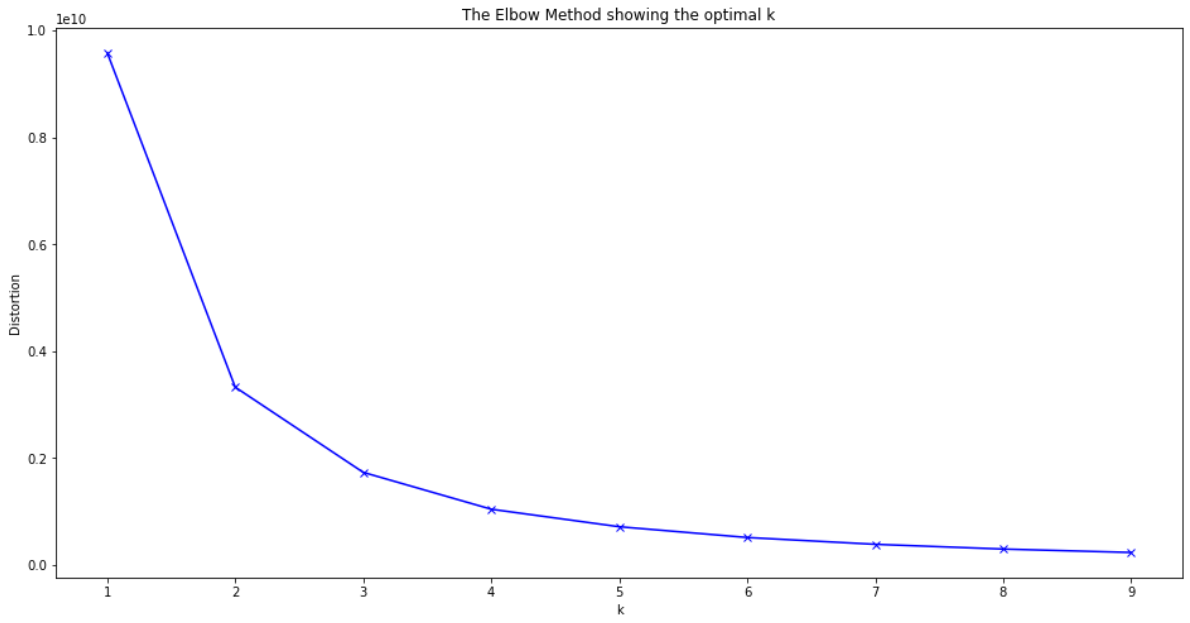
Out[24]:
```
QUANTITYORDERED        int64
PRICEEACH            float64
ORDERLINENUMBER        int64
SALES                float64
QTR_ID                 int64
MONTH_ID               int64
YEAR_ID                int64
MSRP                   int64
PRODUCTCODE             int8
Australia              uint8
Austria                uint8
Belgium                uint8
Canada                 uint8
Denmark                uint8
Finland                uint8
France                 uint8
Germany                uint8
Ireland                uint8
Italy                  uint8
Japan                  uint8
Norway                 uint8
Philippines            uint8
Singapore              uint8
Spain                  uint8
Sweden                 uint8
Switzerland            uint8
UK                     uint8
USA                    uint8
Classic Cars           uint8
Motorcycles            uint8
Planes                 uint8
Ships                  uint8
Trains                 uint8
Trucks and Buses       uint8
Vintage Cars           uint8
Large                  uint8
Medium                 uint8
Small                  uint8
dtype: object
```

In [25]:
```python
from sklearn.cluster import KMeans
```

In [26]:
```python
WCSS = [] # Withhin Cluster Sum of Squares from the centroid
```

In [27]:
```python
distortions = []
K = range(1,10)
for k in K:
    kmeanModel = KMeans(n_clusters=k)
    kmeanModel.fit(df)
    distortions.append(kmeanModel.inertia_)
```

In [28]:
```python
plt.figure(figsize=(16,8))
plt.plot(K, distortions, 'bx-')
plt.xlabel('k')
plt.ylabel('Distortion')
plt.title('The Elbow Method showing the optimal k')
plt.show()
```



In [29]:
```
kmeanModel = KMeans(n_clusters=3)
y_kmeans = kmeanModel.fit_predict
```

In [30]:
```
plt.scatter(df['y'])
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
~\anaconda3\lib\site-packages\pandas\core\indexes\base.py in get_loc(self, key, me
thod, tolerance)
   3079             try:
-> 3080                 return self._engine.get_loc(casted_key)
   3081             except KeyError as err:

pandas\_libs\index.pyx in pandas._libs.index.IndexEngine.get_loc()

pandas\_libs\index.pyx in pandas._libs.index.IndexEngine.get_loc()

pandas\_libs\hashtable_class_helper.pxi in pandas._libs.hashtable.PyObjectHashTabl
e.get_item()

pandas\_libs\hashtable_class_helper.pxi in pandas._libs.hashtable.PyObjectHashTabl
e.get_item()

KeyError: 'y'

The above exception was the direct cause of the following exception:

KeyError                                  Traceback (most recent call last)
<ipython-input-30-00540c767b35> in <module>
----> 1 plt.scatter(df['y'])

~\anaconda3\lib\site-packages\pandas\core\frame.py in __getitem__(self, key)
   3022             if self.columns.nlevels > 1:
   3023                 return self._getitem_multilevel(key)
-> 3024             indexer = self.columns.get_loc(key)
   3025             if is_integer(indexer):
   3026                 indexer = [indexer]

~\anaconda3\lib\site-packages\pandas\core\indexes\base.py in get_loc(self, key, me
thod, tolerance)
   3080                 return self._engine.get_loc(casted_key)
   3081             except KeyError as err:
-> 3082                 raise KeyError(key) from err
   3083 
   3084         if tolerance is not None:

KeyError: 'y'
```

In [ ]:
```
print(y_kmeans)
```

In [ ]:
```
plt.figure(figsize = (30,26))
sns.heatmap(df.corr(),annot = True)
```

In [ ]:
```
pip install yellowbrick
```

In [ ]:
```
from yellowbrick.cluster import KElbowVisualizer
```

In [ ]:
```
model = KMeans()
visualizer = KElbowVisualizer(model,k=(1,0),timings = False)
visualizer.fit(df)
visualizer.show()
```

In [ ]:

In [ ]:

```
In [31]: df.head()
```

Out[31]:

	QUANTITYORDERED	PRICEEACH	ORDERLINENUMBER	SALES	QTR_ID	MONTH_ID	YEAR_ID
0	30	95.70	2	2871.00	1	2	2003
1	34	81.35	5	2765.90	2	5	2003
2	41	94.74	2	3884.34	3	7	2003
3	45	83.26	6	3746.70	3	8	2003
4	49	100.00	14	5205.27	4	10	2003

5 rows × 38 columns

```
In [32]: from sklearn.preprocessing import Normalizer
```

```
In [33]: df_scaled = Normalizer(df)
```

```
In [34]: df_x = pd.DataFrame(df_scaled,columns = df.columns )
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-34-7343a6fbcd9a> in <module>
----> 1 df_x = pd.DataFrame(df_scaled,columns = df.columns )

~\anaconda3\lib\site-packages\pandas\core\frame.py in __init__(self, data, index,
 columns, dtype, copy)
    588         else:
    589             if index is None or columns is None:
--> 590                 raise ValueError("DataFrame constructor not properly calle
d!")
    591 
    592             if not dtype:

ValueError: DataFrame constructor not properly called!
```

```
In [ ]: 
```