In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from warnings import filterwarnings
filterwarnings('ignore')
```

In [2]:
```
Insurance_data = pd.read_csv("insurance.csv")
```

In [3]:
```
Insurance_data.head()
```

Out[3]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

In [4]:
```
Insurance_data.describe()
```

Out[4]:

	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000
75%	51.000000	34.693750	2.000000	16639.912515
max	64.000000	53.130000	5.000000	63770.428010

In [5]:
```
Insurance_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1338 non-null   int64  
 1   sex       1338 non-null   object 
 2   bmi       1338 non-null   float64
 3   children  1338 non-null   int64  
 4   smoker    1338 non-null   object 
 5   region    1338 non-null   object 
 6   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
```

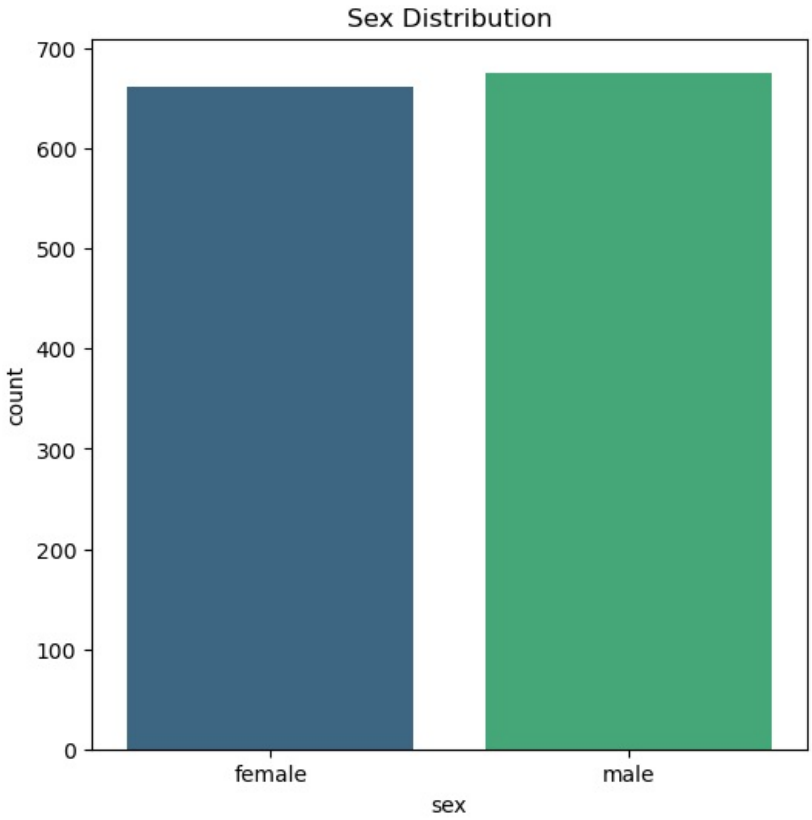
In [6]:
```
Insurance_data.isnull().sum()
```

Out[6]:
```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

In [7]:
```
Insurance_data.sex.value_counts()
```

Out[7]:
```
sex
male      676
female    662
Name: count, dtype: int64
```

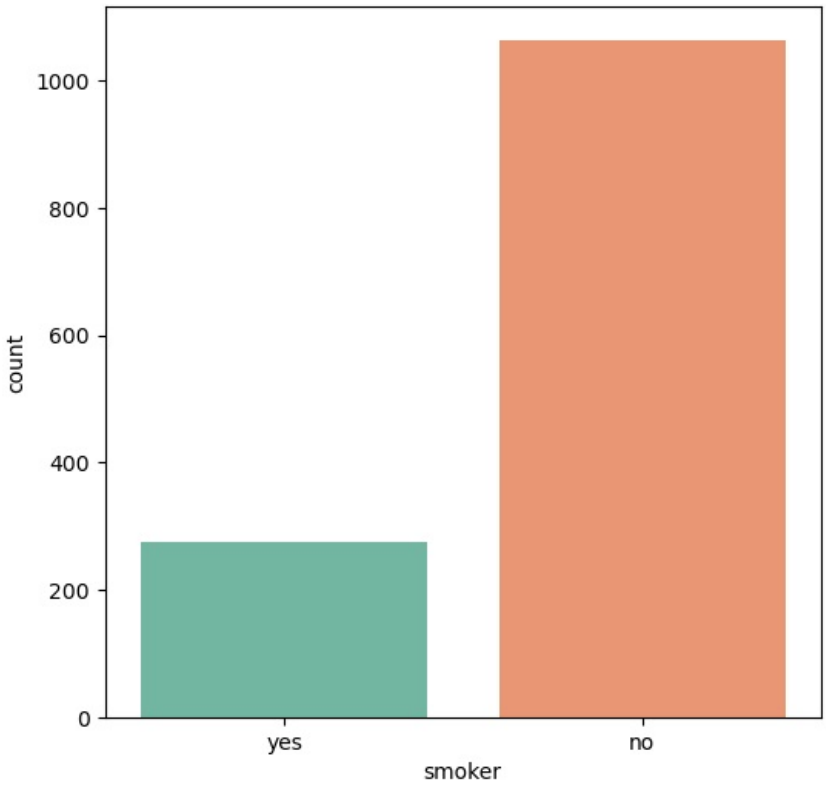
In [15]:
```
# Gender column
plt.figure(figsize=(6,6))
sns.countplot(x='sex', data=Insurance_data, palette='viridis')
plt.title('Sex Distribution')
plt.show()
```



In [8]:
```
Insurance_data.smoker.value_counts()
```

Out[8]:
```
smoker
no     1064
yes     274
Name: count, dtype: int64
```

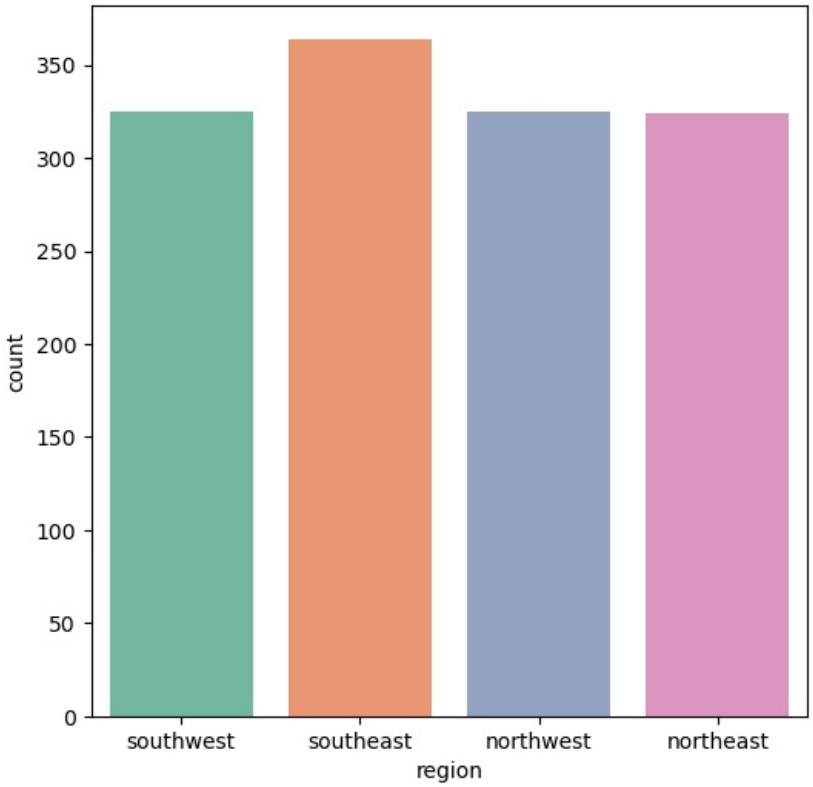
In [19]:
```
# Smoker column
plt.figure(figsize=(6,6))
sns.countplot(x='smoker',data=Insurance_data,palette='Set2')
plt.show()
```



In [20]:
```
Insurance_data.region.value_counts()
```

Out[20]:
```
region
southeast    364
southwest    325
northwest    325
northeast    324
Name: count, dtype: int64
```

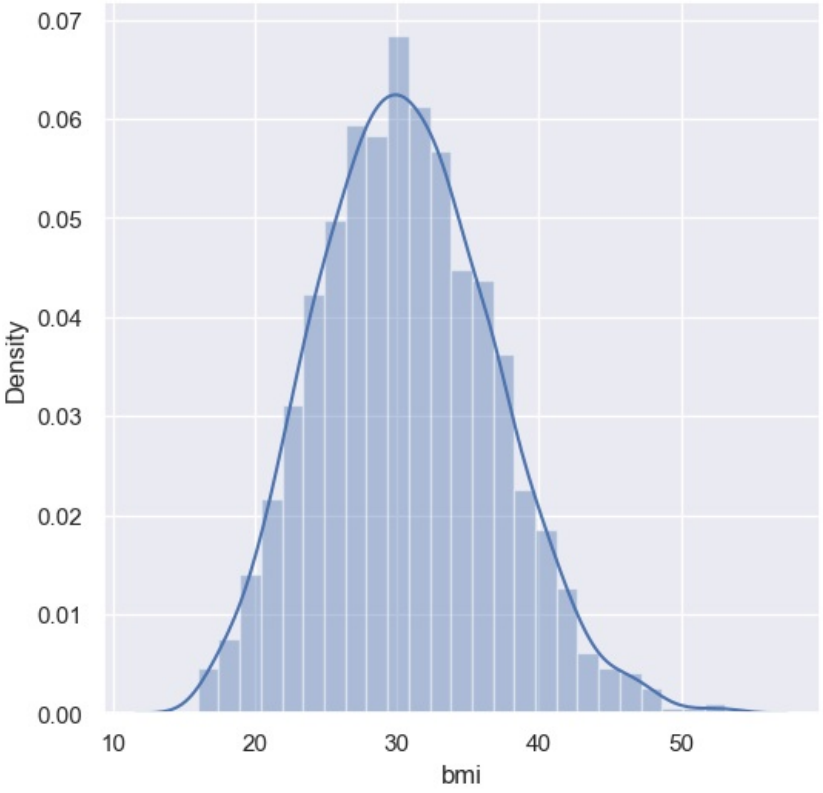
In [22]:
```
plt.figure(figsize=(6,6))
sns.countplot(x='region',data=Insurance_data ,palette='Set2')
plt.show()
```



In [25]:
```
sns.set()
```

In [26]:
```
#bmi column
plt.figure(figsize=(6,6))
sns.distplot(Insurance_data['bmi'])
```

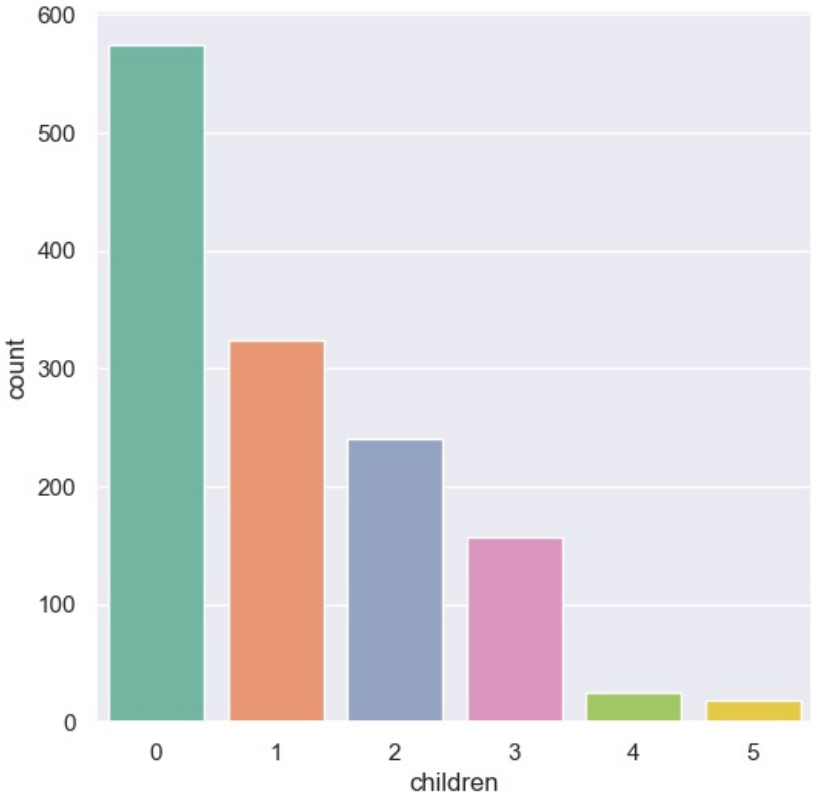
Out[26]:
```
<Axes: xlabel='bmi', ylabel='Density'>
```



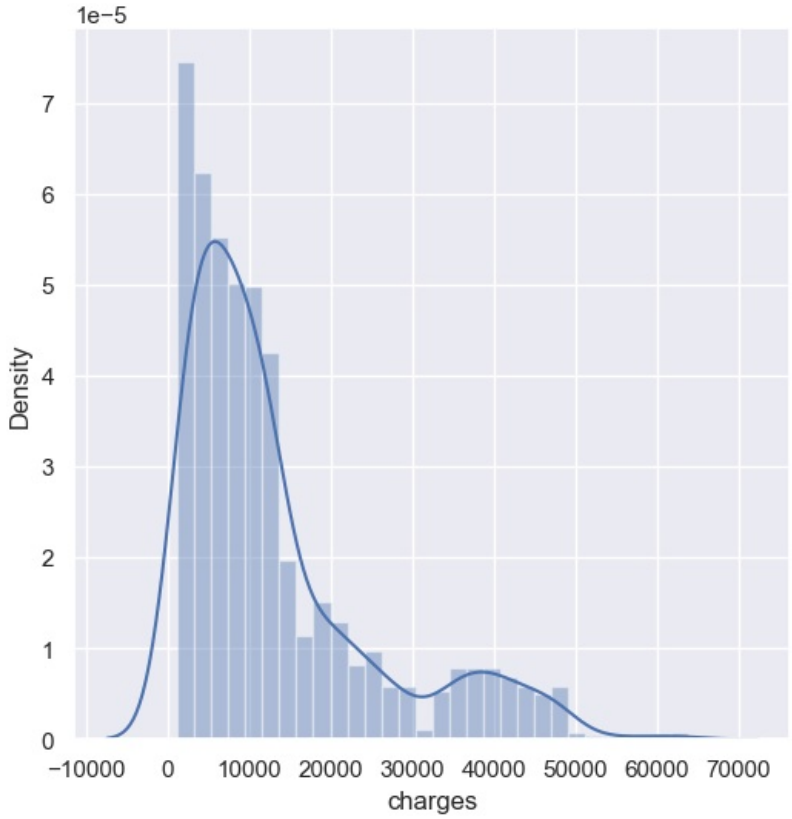
In [28]:
```
# Children column
Insurance_data.children.value_counts()
```

Out[28]:
```
children
0    574
1    324
2    240
3    157
4     25
5     18
Name: count, dtype: int64
```

In [27]:
```
# Children column
plt.figure(figsize=(6,6))
sns.countplot(x='children',data=Insurance_data ,palette='Set2')
plt.show()
```



In [29]:
```
# charges column
plt.figure(figsize=(6,6))
sns.distplot(Insurance_data['charges'])
plt.show()
```



In [30]:
```
Insurance_data
```

Out[30]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520
...	...	...	...	...	...	...	...
1333	50	male	30.970	3	no	northwest	10600.54830
1334	18	female	31.920	0	no	northeast	2205.98080
1335	18	female	36.850	0	no	southeast	1629.83350
1336	21	female	25.800	0	no	southwest	2007.94500
1337	61	female	29.070	0	yes	northwest	29141.36030

1338 rows × 7 columns

Encoding

In [31]:
```
# encoding sex column
Insurance_data.replace({'sex':{'male':0,'female':1}}, inplace=True)

 # encoding 'smoker' column
Insurance_data.replace({'smoker':{'yes':0,'no':1}}, inplace=True)

# encoding 'region' column
Insurance_data.replace({'region':{'southeast':0,'southwest':1,'northeast':2,'northwest':3}}, inplace=True)
```

In [32]:
```
Insurance_data
```

Out[32]:

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.900	0	0	1	16884.92400
1	18	0	33.770	1	1	0	1725.55230
2	28	0	33.000	3	1	0	4449.46200
3	33	0	22.705	0	1	3	21984.47061
4	32	0	28.880	0	1	3	3866.85520
...	...	...	...	...	...	...	...
1333	50	0	30.970	3	1	3	10600.54830
1334	18	1	31.920	0	1	2	2205.98080
1335	18	1	36.850	0	1	0	1629.83350
1336	21	1	25.800	0	1	1	2007.94500
1337	61	1	29.070	0	0	3	29141.36030

1338 rows × 7 columns

Segeregating X and y

In [33]:
```
X = Insurance_data.drop(columns='charges',axis =1)
y = Insurance_data.charges
```

In [34]:
```
from sklearn.model_selection import train_test_split
```

In [35]:
```
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2,random_state=42)
```

In [39]:
```
print("X_train shape :",X_train.shape)
print("y_train shape :",y_train.shape)

print("-"*30)

print("X_test shape :",X_test.shape)
print("y_test shape :",X_test.shape)
```

```
X_train shape : (1070, 6)
y_train shape : (1070,)
------------------------------
X_test shape : (268, 6)
y_test shape : (268, 6)
```

Build Model

Linear Regeression

In [40]:
```
from sklearn.linear_model import LinearRegression
```

In [41]:
```
model = LinearRegression()
```

In [42]:
```
model.fit(X_train,y_train)
```

Out[42]:

▾ LinearRegression

```
LinearRegression()
```

In [43]:
```
# Prediction Training data
training_data_prediction = model.predict(X_train)
```

In [45]:
```
pd.DataFrame(training_data_prediction,columns=['Predicted'])
```

Out[45]:

	Predicted
0	7268.839756
1	7978.774526
2	9111.244782
3	11058.254952
4	10253.816911
...	...
1065	4582.866086
1066	7556.504440
1067	11071.027587
1068	37565.496228
1069	11718.673772

1070 rows × 1 columns

In [46]:
```
pd.DataFrame(y_train)
```

Out[46]:

	charges
560	9193.83850
1285	8534.67180
1142	27117.99378
969	8596.82780
486	12475.35130
...	...
1095	4561.18850
1130	8582.30230
1294	11931.12525
860	46113.51100
1126	10214.63600

1070 rows × 1 columns

Evaluation Metrics

In [47]:
```
from sklearn.metrics import mean_absolute_error,mean_squared_error,root_mean_squared_error,r2_score
```

In [52]:
```
print("Mean Absolute error :",mean_absolute_error(y_train,training_data_prediction))
print("Mean sqaured error :",mean_squared_error(y_train,training_data_prediction))
print("Root Mean sqaured error :",root_mean_squared_error(y_train,training_data_prediction))
print("R squared :",r2_score(y_train,training_data_prediction))
```

```
Mean Absolute error : 4214.89744476707
Mean sqaured error : 37337214.4107756
Root Mean sqaured error : 6110.418513553356
R squared : 0.7413131194887537
```

In [57]:
```
# Prediction Testing data
testing_data_prediction = model.predict(X_test)
pd.DataFrame(testing_train_prediction,columns=['Predicted'])
```

Out[57]:

	Predicted
0	8597.284895
1	7231.743882
2	37039.232090
3	9616.212129
4	27161.155047
...	...
263	39017.518638
264	11922.482922
265	7316.166925
266	40853.403071
267	12572.845350

268 rows × 1 columns

In [55]:
```
pd.DataFrame(y_test)
```

Out[55]:

	charges
764	9095.06825
887	5272.17580
890	29330.98315
1293	9301.89355
259	33750.29180
...	...
109	47055.53210
575	12222.89830
535	6067.12675
543	63770.42801
846	9872.70100

268 rows × 1 columns

In [58]:
```
print("R squared :",r2_score(y_test,testing_data_prediction))
```

```
R squared : 0.783021587162344
```

Buliding Predictive System

In [61]:
```
input_data = (31,1,25.74,0,1,0)

# changing input_data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the array
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

predicted = model.predict(input_data_reshaped)
print(predicted)
```

```
[4016.99266999]
```

In [ ]:
```

```