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GitHub: https://github.com/desaivedika/ML_Exp2.git

```
import numpy as np
import pandas as pd

import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
import warnings
warnings.filterwarnings("ignore")
```

```
df_train = pd.read_csv('train.csv')
df_test = pd.read_csv('test.csv')
```

```
print(df_train.shape)
df_train.head()
```

```
(891, 12)
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S

Next steps: Generate code with df_train | View recommended plots | New interactive sheet

Exploratory Data Analysis

```
df_train.info(verbose=True)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  891 non-null    int64
 1   Survived     891 non-null    int64
 2   Pclass       891 non-null    int64
 3   Name         891 non-null    object
 4   Sex          891 non-null    object
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64
 7   Parch        891 non-null    int64
 8   Ticket       891 non-null    object
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object
 11  Embarked     889 non-null    object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

```
train = df_train.copy()
```

Visualization

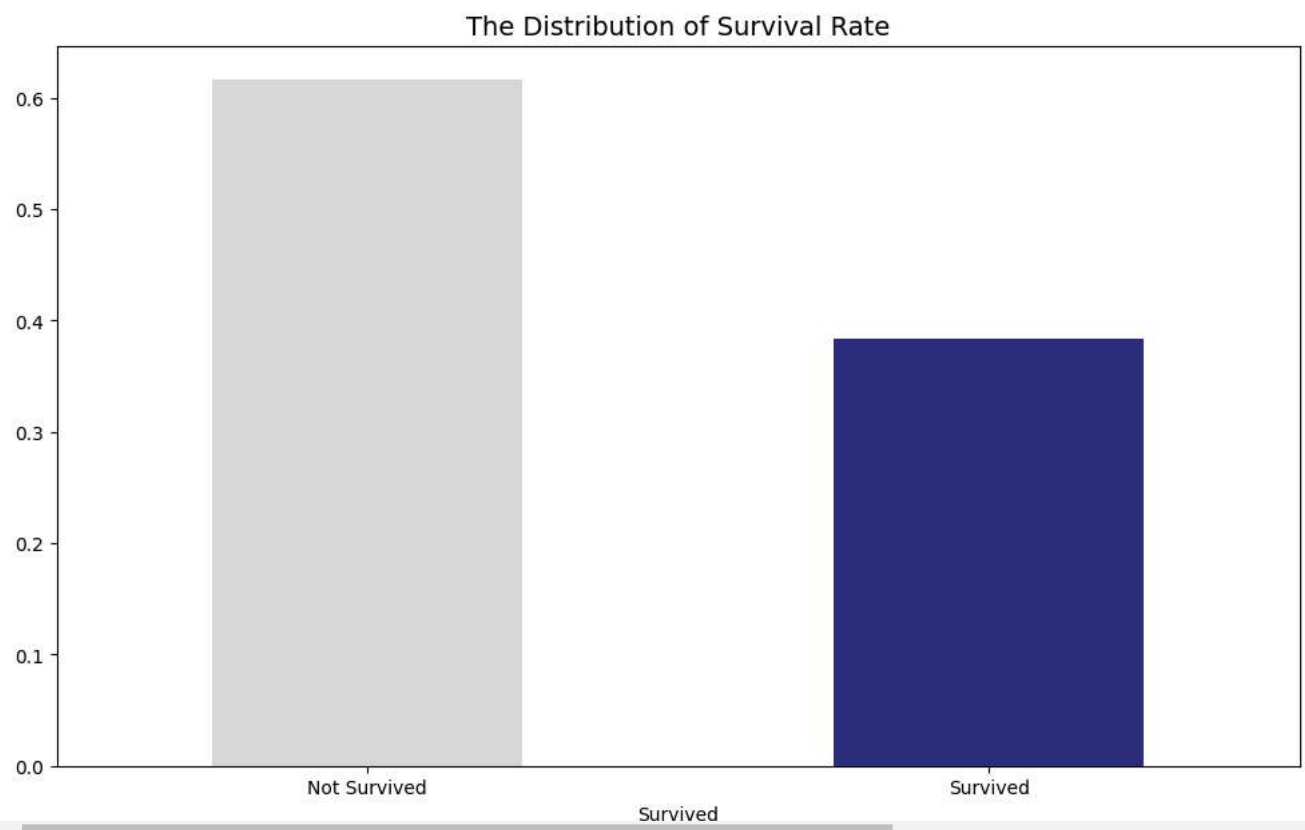
```
 decode_map = {0: "Not Survived", 1: "Survived"}
def decode_sentiment(label):
    return decode_map[int(label)]
train['Survived'] = train['Survived'].apply(lambda x: decode_sentiment(x))

target_grp = (train[['Survived']]
.groupby("Survived")
.agg(COUNT=("Survived","count"))
.sort_values(by=["COUNT"],ascending=False)
.reset_index()
)
target_grp.style.background_gradient(cmap='Blues')
```

	Survived	COUNT
0	Not Survived	549
1	Survived	342

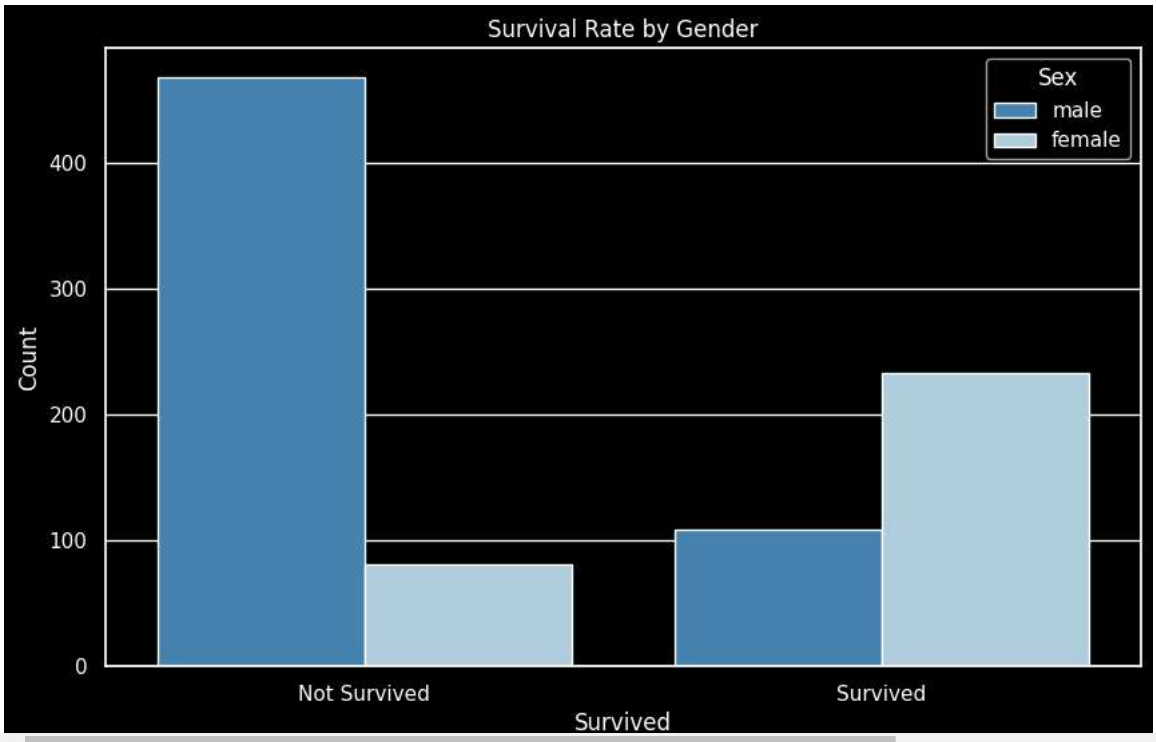
```
grp = train['Survived'].value_counts(normalize=True)
grp.reset_index().style.background_gradient(cmap='Blues')
```

	Survived	proportion
0	Not Survived	0.616162
1	Survived	0.383838

```
fig = plt.figure(figsize = (12,7))
grp.plot(kind='bar', color= ['lightgrey','midnightblue'], alpha = 0.9, rot=0)
plt.title('The Distribution of Survival Rate', fontsize=14)
plt.show()
```



```
sns.set(style='darkgrid')

plt.style.use('dark_background')
plt.figure(figsize=(10, 6))
sns.countplot(x='Survived', hue='Sex', data=train, palette='Blues_r')
plt.title('Survival Rate by Gender')
plt.xlabel('Survived')
plt.ylabel('Count')
plt.legend(title='Sex', loc='upper right')
plt.show()
```

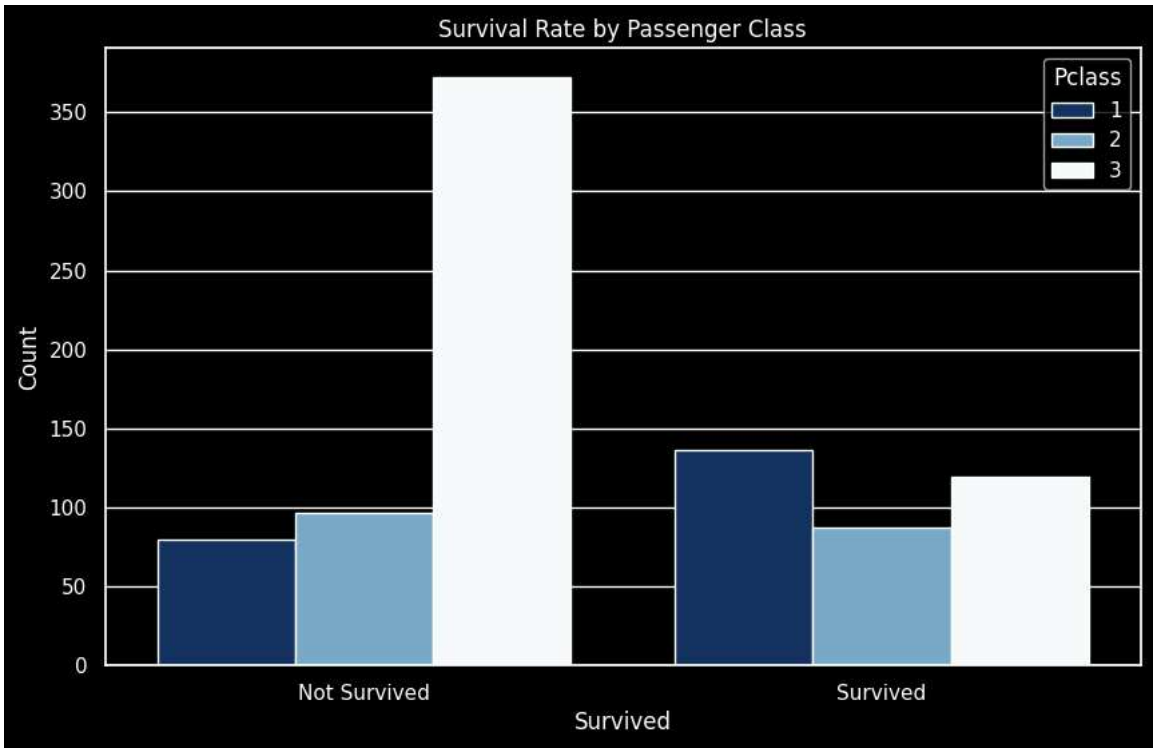



```
survival_by_gender = train.groupby(['Sex', 'Survived']).size().unstack(fill_value=0)
survival_by_gender.columns = ['Not Survived', 'Survived']
survival_by_gender
```

Sex	Not Survived	Survived
female	81	233
male	468	109

Next steps: Generate code with survival_by_gender | View recommended plots | New interactive sheet

```
plt.figure(figsize=(10, 6))
sns.countplot(x='Survived', hue='Pclass', data=train, palette='Blues_r')
plt.title('Survival Rate by Passenger Class')
plt.xlabel('Survived')

plt.ylabel('Count')
plt.legend(title='Pclass', loc='upper right')
plt.show()
```

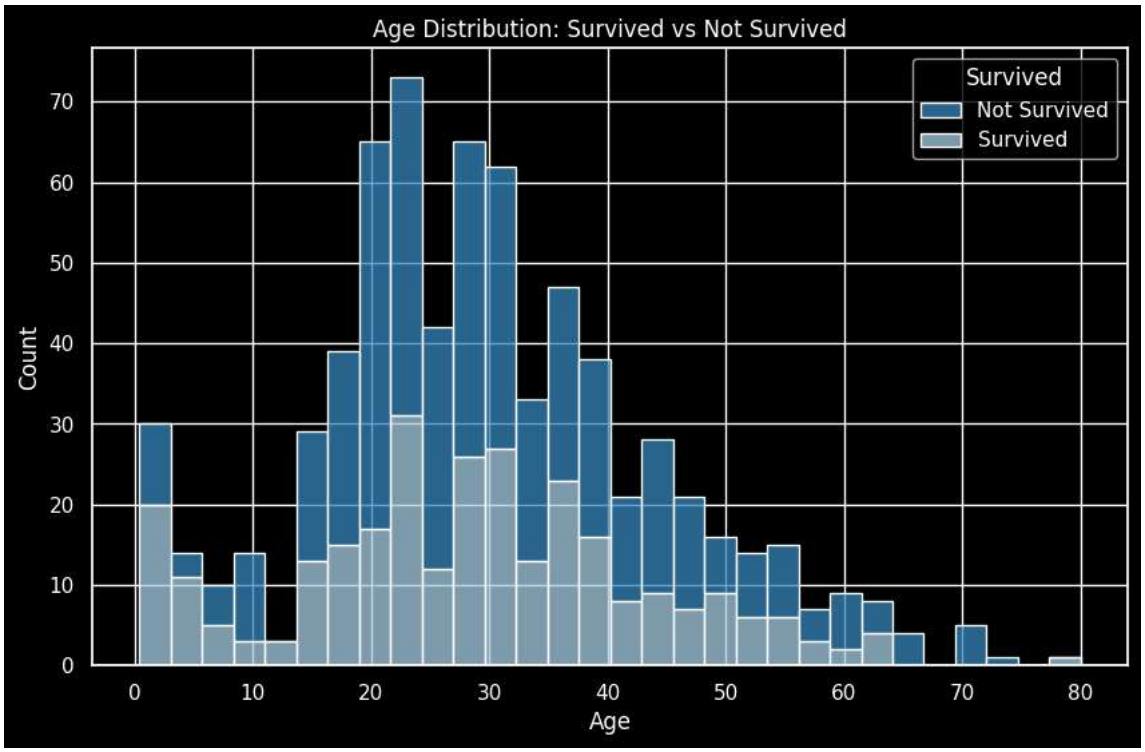



```
survival_by_class = train.groupby(['Pclass', 'Survived']).size().unstack(fill_value=0)
survival_by_class.columns = ['Not Survived', 'Survived']
survival_by_class
```

Pclass	Not Survived	Survived
1	80	136
2	97	87
3	372	119

Next steps: Generate code with survival_by_class | View recommended plots | New interactive sheet

```
plt.figure(figsize=(10, 6))
sns.histplot(data=train, x='Age', hue='Survived', multiple='stack',palette='Blues_r', bins=30)
plt.title('Age Distribution: Survived vs Not Survived')
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```



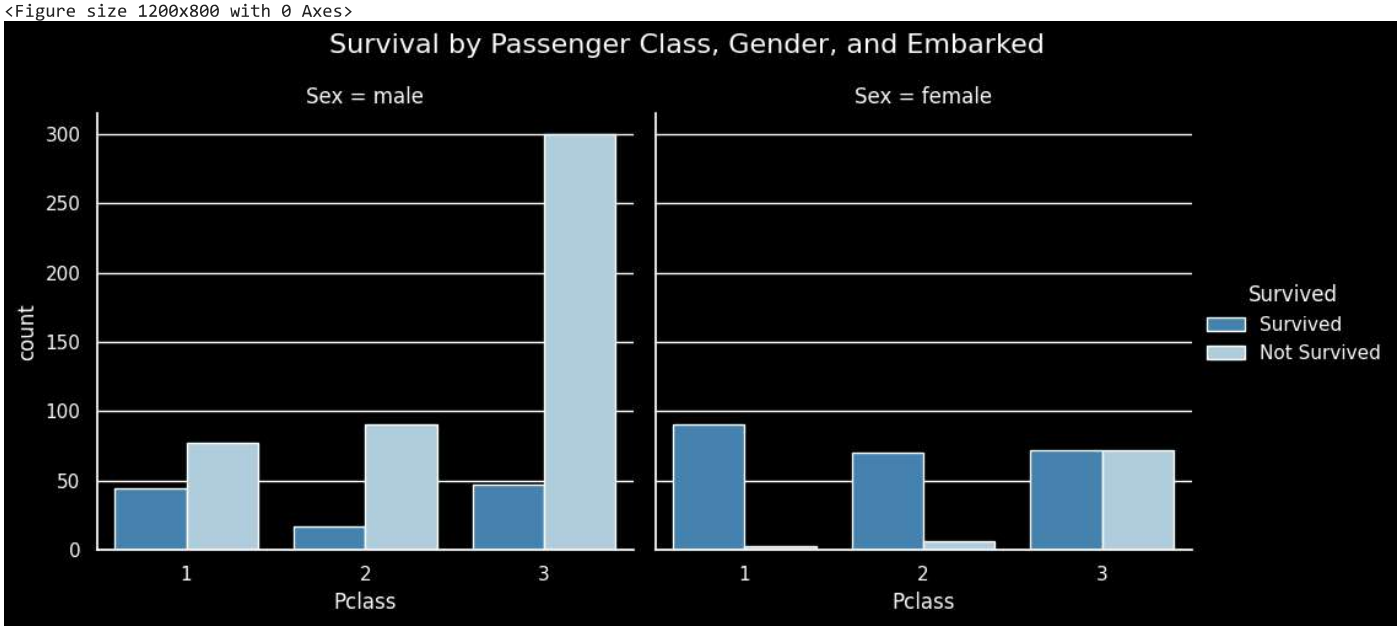

```
bins = [0, 12, 18, 25, 35, 60, 120]
labels = ['0-12', '13-18', '19-25', '26-35', '36-60', '61+']

train['AgeGroup'] = pd.cut(train['Age'], bins=bins, labels=labels, right=False)

age_distribution = train.groupby(['AgeGroup', 'Survived']).size().unstack(fill_value=0)

age_distribution.columns = ['Not Survived', 'Survived']
age_distribution
```

AgeGroup	Not Survived	Survived
0-12	29	39
13-18	23	22
19-25	108	57
26-35	123	78
36-60	122	87
61+	19	7

Next steps: Generate code with `age_distribution` View recommended plots New interactive sheet

```
plt.figure(figsize=(12, 8))
sns.catplot(x='Pclass', hue='Survived', col='Sex', kind='count', data=train,palette='Blues_r', dodge=True)
plt.subplots_adjust(top=0.85)
plt.suptitle('Survival by Passenger Class, Gender, and Embarked', fontsize=16)
plt.show()
```

```
<Figure size 1200x800 with 0 Axes>
```



Data Cleaning and Preprocessing

```
df_train.isnull().sum()
```

```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
```

```
print('Missing values:', df_train.isnull().values.any())
nvc = pd.DataFrame(df_train.isnull().sum(), columns=['Total Null Values'])
nvc['Percentage'] = (nvc['Total Null Values']/df_train.shape[0])*100
nvc.sort_values(by=['Percentage'], ascending=False).reset_index()
```

```
Missing values: True
```

	index	Total Null Values	Percentage
0	Cabin	687	77.104377
1	Age	177	19.865320
2	Embarked	2	0.224467
3	PassengerId	0	0.000000
4	Survived	0	0.000000
5	Pclass	0	0.000000
6	Name	0	0.000000
7	Sex	0	0.000000
8	SibSp	0	0.000000
9	Parch	0	0.000000
10	Ticket	0	0.000000
11	Fare	0	0.000000

```
df_train.drop(columns=['Cabin'], inplace=True)
```

```
mean_age = df_train['Age'].mean()
df_train['Age'].fillna(mean_age, inplace=True)
```

```
df_train.isnull().sum()
```

```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Embarked       2
dtype: int64
```

```
df_train.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	S

Next steps: Generate code with df_train | View recommended plots | New interactive sheet

```
df_train['Sex'] = df_train['Sex'].map({'male': 0, 'female': 1})
df_train = pd.get_dummies(df_train, columns=['Embarked'], drop_first=True)
```

```
df_train.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked_Q	Embarked_S
0	1	0	3	Braund, Mr. Owen Harris	0	22.0	1	0	A/5 21171	7.2500	False	True
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	1	38.0	1	0	PC 17599	71.2833	False	False
2	3	1	3	Heikkinen, Miss. Laina	1	26.0	0	0	STON/O2. 3101282	7.9250	False	True
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	1	35.0	1	0	113803	53.1000	False	True

Next steps: Generate code with df_train | View recommended plots | New interactive sheet

```
df_test.isnull().sum()
```

```
PassengerId      0
Pclass           0
Name             0
Sex              0
Age             86
SibSp            0
Parch            0
Ticket           0
Fare             1
Cabin          327
Embarked         0
dtype: int64
```

```
df_test.drop(columns=['Cabin'], inplace=True)
```

```
df_test['Age'].fillna(mean_age, inplace=True)

mean_fare = df_test['Fare'].mean()
df_test['Fare'].fillna(mean_fare, inplace=True)


df_test['Sex'] = df_test['Sex'].map({'male': 0, 'female': 1})
df_test = pd.get_dummies(df_test, columns=['Embarked'], drop_first=True)


print(df_test.isnull().sum())
```

```
PassengerId    0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Embarked_Q     0
Embarked_S     0
dtype: int64
```

```
df_test.head()
```

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked_Q	Embarked_S
0	892	3	Kelly, Mr. James	0	34.5	0	0	330911	7.8292	True	False
1	893	3	Wilkes, Mrs. James (Ellen Needs)	1	47.0	1	0	363272	7.0000	False	True
2	894	2	Myles, Mr. Thomas Francis	0	62.0	0	0	240276	9.6875	True	False
3	895	3	Wirz, Mr. Albert	0	27.0	0	0	315154	8.6625	False	True
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	1	22.0	1	1	3101298	12.2875	False	True

Next steps: Generate code with df_test | View recommended plots | New interactive sheet

Modeling

```
X = df_train.drop(columns=['PassengerId', 'Name', 'Ticket', 'Survived'])
y = df_train['Survived']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,random_state=42)
print(X_train.shape, X_test.shape)
```

```
(712, 8) (179, 8)
```

```
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

Logistic Regression

```
log_model = LogisticRegression(max_iter=200).fit(X_train_scaled, y_train)
print(log_model)
```

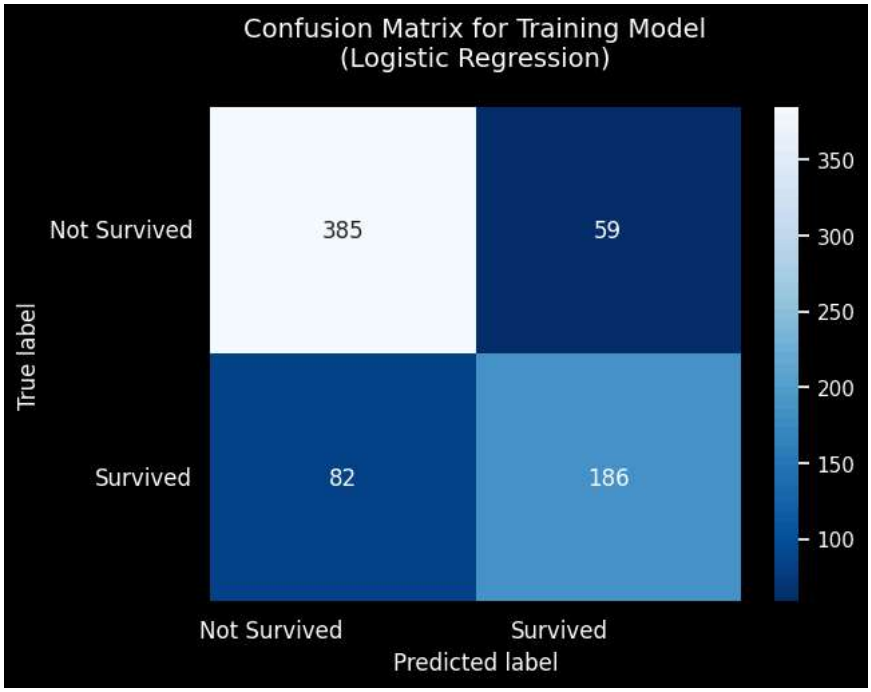
```
LogisticRegression(max_iter=200)
```

```
y_train_pred_log = log_model.predict(X_train_scaled)

print('Classification Report Training Model (Logistic Regression):')
print(classification_report(y_train, y_train_pred_log))
```

```
Classification Report Training Model (Logistic Regression):
              precision    recall  f1-score   support

           0       0.82      0.87      0.85       444
           1       0.76      0.69      0.73       268

    accuracy                           0.80       712
```

```
       macro avg       0.79      0.78      0.79       712
    weighted avg       0.80      0.80      0.80       712
```

```
confusion_matrix_log_train = pd.DataFrame((confusion_matrix(y_train,y_train_pred_log)),
('Not Survived', 'Survived'),
('Not Survived', 'Survived'))

plt.figure()
heatmap = sns.heatmap(confusion_matrix_log_train, annot=True, annot_kws={'size': 12}, fmt='d', cmap='Blues_r')
heatmap.yaxis.set_ticklabels(heatmap.yaxis.get_ticklabels(), rotation=0,ha='right', fontsize=12)
heatmap.xaxis.set_ticklabels(heatmap.xaxis.get_ticklabels(), rotation=0,ha='right', fontsize=12)
plt.title('Confusion Matrix for Training Model\n(Logistic Regression)\n',fontsize=14, color='white')
plt.ylabel('True label', fontsize=12)
plt.xlabel('Predicted label', fontsize=12)
plt.show()
```




```
y_test_pred_log = log_model.predict(X_test_scaled)

print('Classification Report Testing Model (Logistic Regression):')
print(classification_report(y_test, y_test_pred_log))
```

```
Classification Report Testing Model (Logistic Regression):
              precision    recall  f1-score   support

           0       0.83      0.86      0.84       105
           1       0.79      0.74      0.76        74

    accuracy                           0.81       179
   macro avg       0.81      0.80      0.80       179
weighted avg       0.81      0.81      0.81       179
```

```
confusion_matrix_log_test = pd.DataFrame((confusion_matrix(y_test,y_test_pred_log)),
('Not Survived', 'Survived'),
('Not Survived', 'Survived'))

plt.figure()
heatmap = sns.heatmap(confusion_matrix_log_test, annot=True, annot_kws={'size':12}, fmt='d', cmap='Blues_r')
heatmap.yaxis.set_ticklabels(heatmap.yaxis.get_ticklabels(), rotation=0,ha='right', fontsize=12)
heatmap.xaxis.set_ticklabels(heatmap.xaxis.get_ticklabels(), rotation=0,ha='right', fontsize=12)
plt.title('Confusion Matrix for Testing Model\n(Logistic Regression)\n',fontsize=14, color='white')
plt.ylabel('True label', fontsize=12)
plt.xlabel('Predicted label', fontsize=14)
```