In [46]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
```

In [47]:
```
data = pd.read_csv('lifesat.csv')
```

In [48]:
```
# Q1 (5 marks) Load the dataset lifesat.csv and display the first 5
data.head(5)
```

Out[48]:

	Country	GDP per capita (USD)	Life satisfaction
0	Russia	26456.387938	5.8
1	Greece	27287.083401	5.4
2	Turkey	28384.987785	5.5
3	Latvia	29932.493910	5.9
4	Hungary	31007.768407	5.6

In [49]:
```
# Q2 (5 marks) Print basic info and summary statistics .
data.info()
```

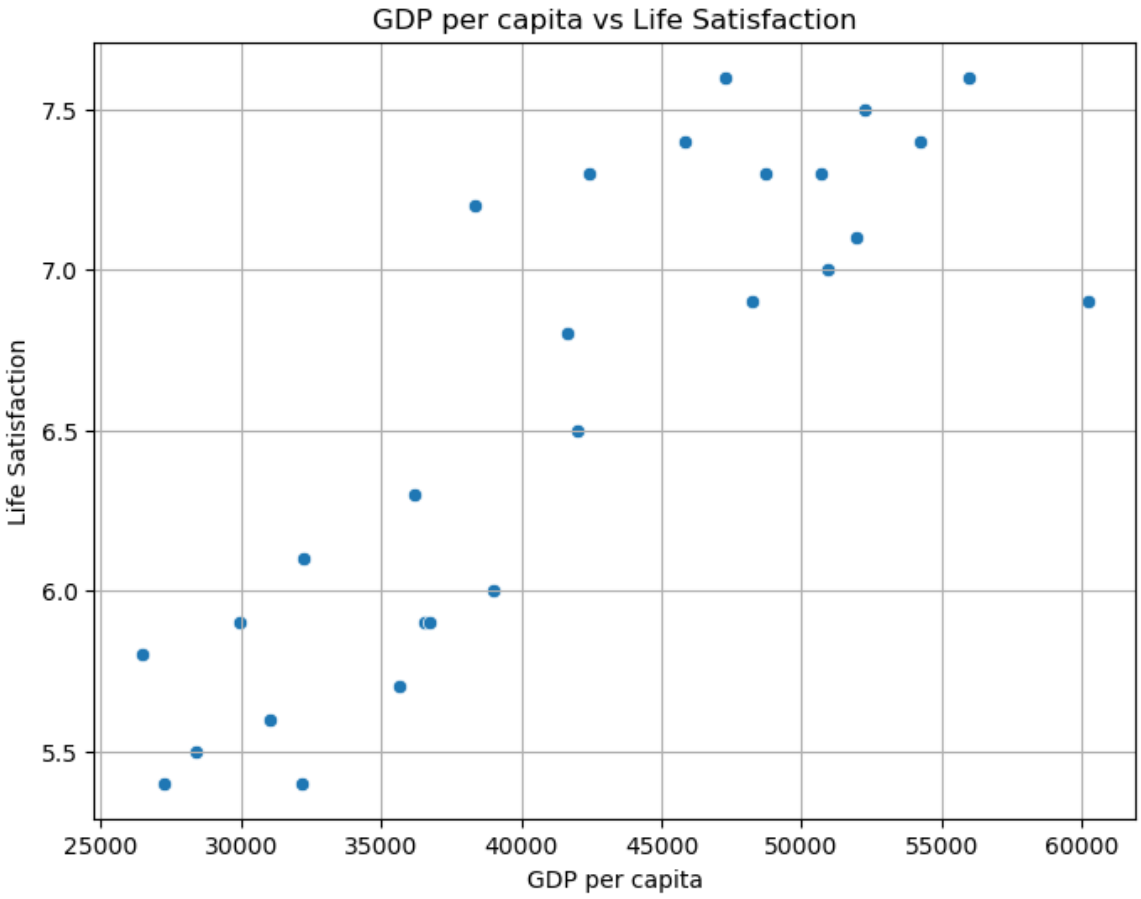
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 27 entries, 0 to 26
Data columns (total 3 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   Country               27 non-null     object 
 1   GDP per capita (USD)  27 non-null     float64
 2   Life satisfaction     27 non-null     float64
dtypes: float64(2), object(1)
memory usage: 780.0+ bytes
```

In [50]:
```
data.describe()
```

Out[50]:

	GDP per capita (USD)	Life satisfaction
count	27.000000	27.000000
mean	41564.521771	6.566667
std	9631.452319	0.765607
min	26456.387938	5.400000
25%	33938.289305	5.900000
50%	41627.129269	6.800000
75%	49690.580269	7.300000
max	60235.728492	7.600000

In [51]:
```
# Q3 (10 marks) Display a scatter plot for GDP per capita vs Life S
plt.figure(figsize=(8,6))
sns.scatterplot(data=data, x = 'GDP per capita (USD)', y = 'Life sa
plt.xlabel('GDP per capita')
plt.ylabel('Life Satisfaction')
plt.title('GDP per capita vs Life Satisfaction')
plt.grid(True)
plt.show()
```



Discuss the observed relationship:

In the plot, we can see that GDP per capita is an important factor influencing life satisfaction. However, GDP alone is not enough to fully explain life satisfaction, because in some countries other factors, such as culture, healthcare, and social support, can play a more significant role.

In [52]:
```
# Q4 (5 marks) Extract input (X) and target (y). Print their shape
X = data[['GDP per capita (USD)']] # [[]] -> DataFrame
y = data['Life satisfaction']

print("Shape of X:", X.shape)
print("Shape of y:", y.shape)
```

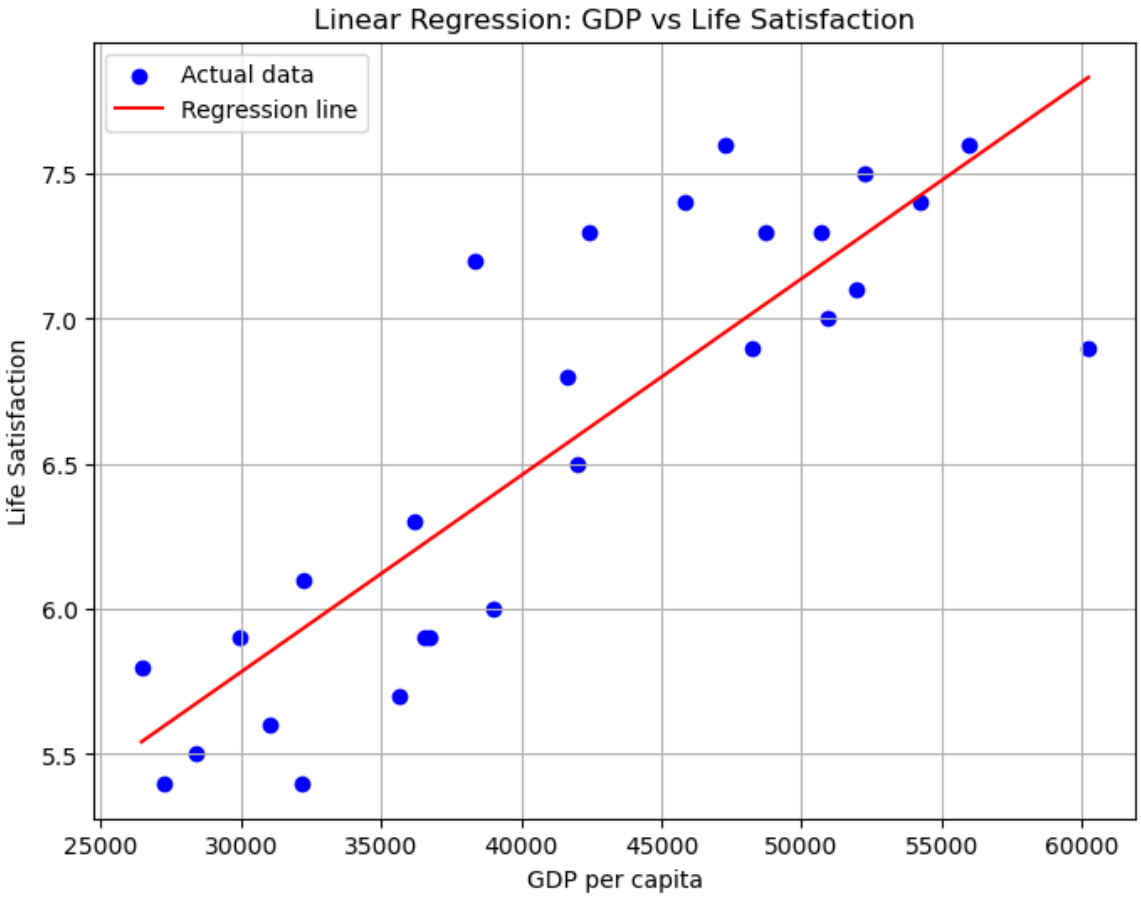
```
Shape of X: (27, 1)
Shape of y: (27,)
```

In [53]:
```
# Q5 (10 marks) Train a Linear Regression model & Display coefficie
from sklearn.linear_model import LinearRegression
```

```
model = LinearRegression()
model.fit(X, y)

print("Coefficient (slope):", model.coef_[0])
print("Intercept:", model.intercept_)
```

```
Coefficient (slope): 6.778899694341222e-05
Intercept: 3.7490494273769093
```

In [54]:
```
# Q6 (10 marks) Plot the predicted regression line from the model a

y_pred = model.predict(X)  # prediction

plt.figure(figsize=(8,6))
plt.scatter(X, y, label='Actual data', color='blue')
plt.plot(X, y_pred, color='red', label='Regression line')
plt.xlabel('GDP per capita')
plt.ylabel('Life Satisfaction')
plt.title('Linear Regression: GDP vs Life Satisfaction')
plt.legend()
plt.grid(True)
plt.show()
```



In [55]:
```
# Q7 (5 marks) Predict Life Satisfaction for GDP = 37,655.2 USD. Co
gdp = 37655.2
life_satisfaction_pred = model.predict([[gdp]])
print("Predicted Life Satisfaction for GDP = 37,655.2 USD:", life_s
```

```
Predicted Life Satisfaction for GDP = 37,655.2 USD: 6.30165766508048
5
```

```
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

In [56]:
```
# Q8 (5 marks) Train a KNeighborsRegressor (n_neighbors=3).
from sklearn.neighbors import KNeighborsRegressor

knn_model = KNeighborsRegressor(n_neighbors=3)
knn_model.fit(X, y)
```

Out[56]:

▾ KNeighborsRegressor

▶ Parameters

In [57]:
```
# Q9 (10 marks) Predict Life Satisfaction for GDP = 37,655.2 USD an
gdp_value = 37655.2
life_satisfaction_knn = knn_model.predict([[gdp_value]])
print("Predicted Life Satisfaction (KNN) for GDP = 37,655.2 USD:",

print()

life_satisfaction_lr = model.predict(pd.DataFrame({'GDP per capita
print("Predicted Life Satisfaction (Linear Regression) for GDP = 37
```

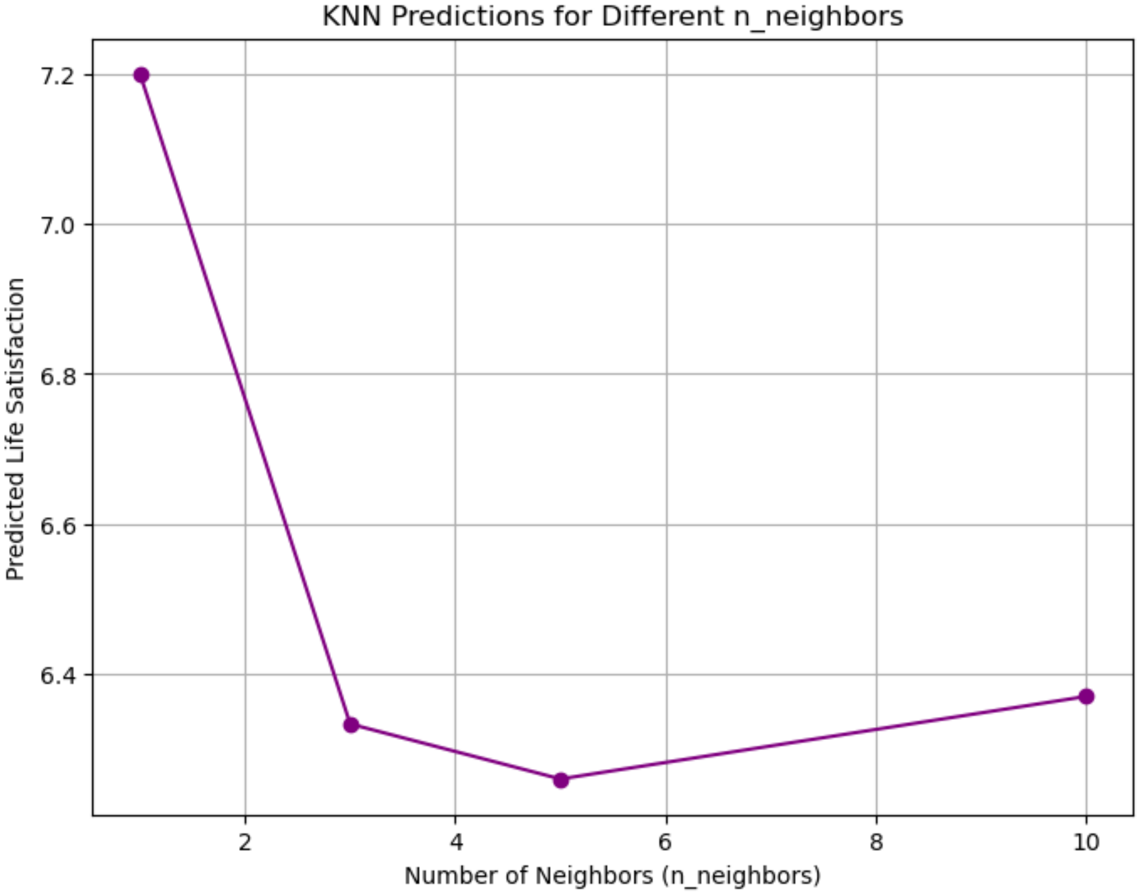
```
Predicted Life Satisfaction (KNN) for GDP = 37,655.2 USD: 6.33333333
3333333

Predicted Life Satisfaction (Linear Regression) for GDP = 37,655.2 U
SD: 6.301657665080485
```

```
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but KNeighborsRegressor was fitted with feature names
  warnings.warn(
```

In [58]:
```
# Q10 (10 marks)
# Use n_neighbors 1, 3, 5, and 10 and print the predicted values of
# Plot the results using a line plot.
gdp_value = 37655.2
neighbors_list = [1, 3, 5, 10]
predictions = {}

for k in neighbors_list:
    knn = KNeighborsRegressor(n_neighbors=k)
    knn.fit(X, y)
    pred = knn.predict([[gdp_value]])[0]
    predictions[k] = pred
    print(f"Predicted Life Satisfaction (KNN, n_neighbors={k}) = {p


plt.figure(figsize=(8,6))
plt.plot(list(predictions.keys()), list(predictions.values()), mark
plt.xlabel('Number of Neighbors (n_neighbors)')
plt.ylabel('Predicted Life Satisfaction')
```

```
plt.title('KNN Predictions for Different n_neighbors')
plt.grid(True)
plt.show()
```

```
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but KNeighborsRegressor was fitted with feature names
  warnings.warn(
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but KNeighborsRegressor was fitted with feature names
  warnings.warn(
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but KNeighborsRegressor was fitted with feature names
  warnings.warn(
/opt/conda/envs/anaconda-2025.12-py312/lib/python3.12/site-packages/
sklearn/utils/validation.py:2749: UserWarning: X does not have valid
feature names, but KNeighborsRegressor was fitted with feature names
  warnings.warn(
Predicted Life Satisfaction (KNN, n_neighbors=1) = 7.20
Predicted Life Satisfaction (KNN, n_neighbors=3) = 6.33
Predicted Life Satisfaction (KNN, n_neighbors=5) = 6.26
Predicted Life Satisfaction (KNN, n_neighbors=10) = 6.37
```




```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```

In [ ]:

In [ ]:

In [ ]: