In [1]:

```python
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```python
df = pd.read_csv("C:/Users/LEGION/Desktop/Python Project/Ecommerce Customers")
```

In [3]:

```python
df.head()
```

Out[3]:

	Email	Address	Avatar	Avg. Session Length	Time on App	Time on Website	Length of Membership	Yearly Amount Spent
0	mstephenson@fernandez.com	835 Frank Tunnel\nWrightmouth, MI 82180-9605	Violet	34.497268	12.655651	39.577668	4.082621	587.951054
1	hduke@hotmail.com	4547 Archer Common\nDiazchester, CA 06566-8576	DarkGreen	31.926272	11.109461	37.268959	2.664034	392.204933
2	pallen@yahoo.com	24645 Valerie Unions Suite 582\nCobbborough, D...	Bisque	33.000915	11.330278	37.110597	4.104543	487.547505
3	riverarebecca@gmail.com	1414 David Throughway\nPort Jason, OH 22070-1220	SaddleBrown	34.305557	13.717514	36.721283	3.120179	581.852344
4	mstephens@davidson-herman.com	14023 Rodriguez Passage\nPort Jacobville, PR 3...	MediumAquaMarine	33.330673	12.795189	37.536653	4.446308	599.406092

In [4]:

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 8 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   Email                 500 non-null    object 
 1   Address               500 non-null    object 
 2   Avatar                500 non-null    object 
 3   Avg. Session Length   500 non-null    float64
 4   Time on App           500 non-null    float64
 5   Time on Website       500 non-null    float64
 6   Length of Membership  500 non-null    float64
 7   Yearly Amount Spent   500 non-null    float64
dtypes: float64(5), object(3)
memory usage: 31.4+ KB
```

In [5]:

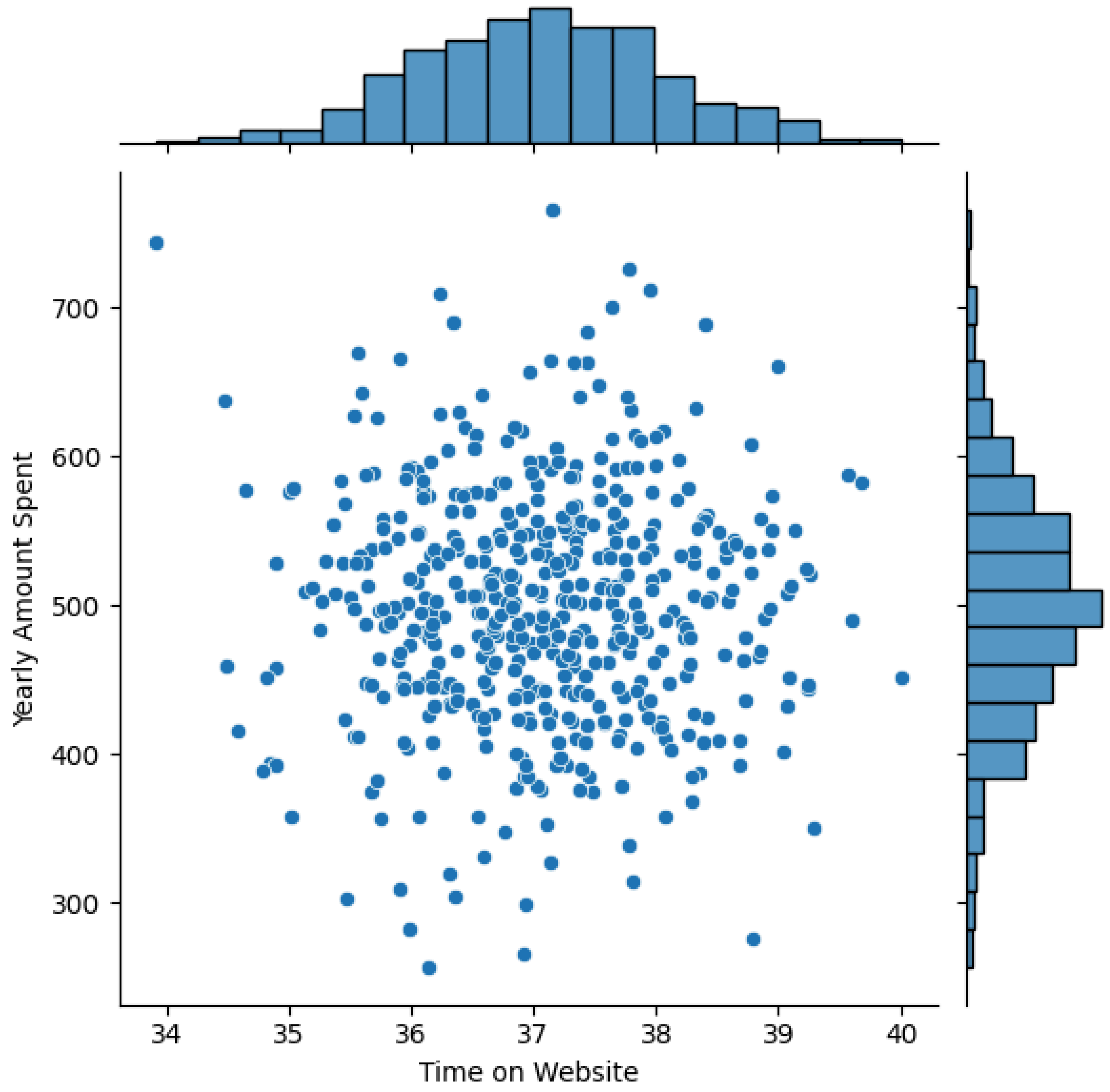
```python
df.describe()
```

Out[5]:

	Avg. Session Length	Time on App	Time on Website	Length of Membership	Yearly Amount Spent
count	500.000000	500.000000	500.000000	500.000000	500.000000
mean	33.053194	12.052488	37.060445	3.533462	499.314038
std	0.992563	0.994216	1.010489	0.999278	79.314782
min	29.532429	8.508152	33.913847	0.269901	256.670582
25%	32.341822	11.388153	36.349257	2.930450	445.038277
50%	33.082008	11.983231	37.069367	3.533975	498.887875
75%	33.711985	12.753850	37.716432	4.126502	549.313828
max	36.139662	15.126994	40.005182	6.922689	765.518462

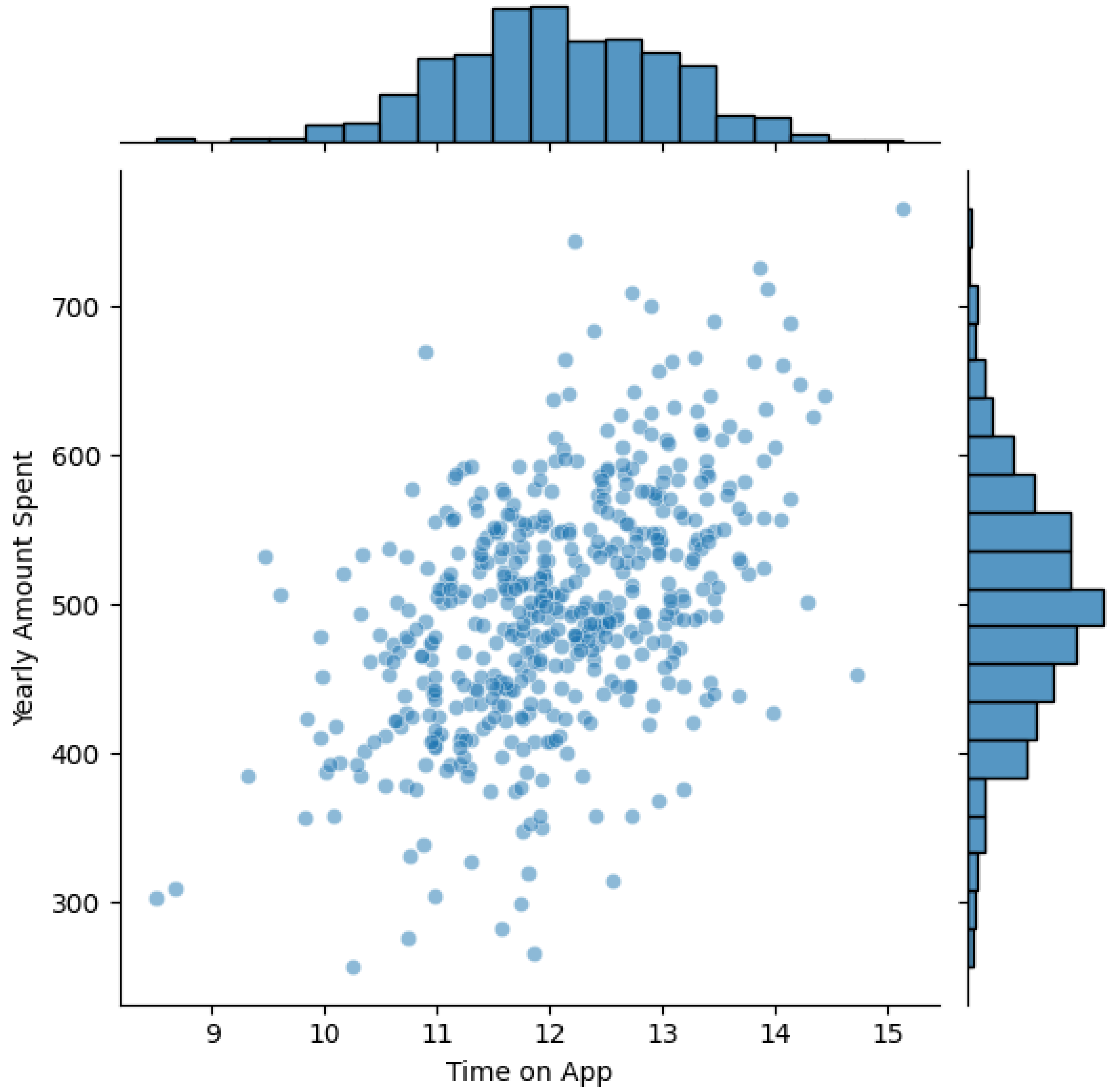
```
In [6]: sns.jointplot(x="Time on Website", y="Yearly Amount Spent", data=df)

Out[6]: <seaborn.axisgrid.JointGrid at 0x25a74c7c470>
```



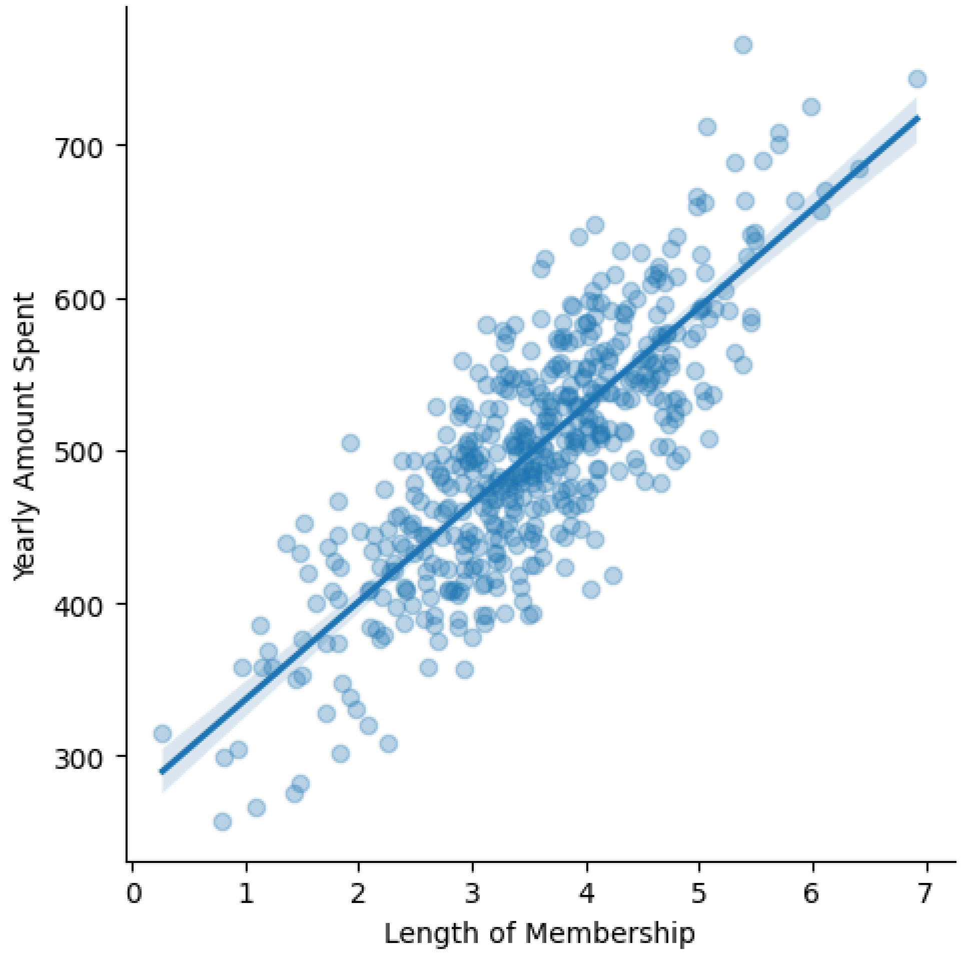
```
In [7]: sns.jointplot(x="Time on App", y="Yearly Amount Spent", data=df, alpha=0.5)

Out[7]: <seaborn.axisgrid.JointGrid at 0x25a74c987d0>
```



```
In [8]: sns.lmplot(x= 'Length of Membership',
                   y= 'Yearly Amount Spent',
                    data = df,
                   scatter_kws={'alpha':0.3})
```

```
Out[8]: <seaborn.axisgrid.FacetGrid at 0x25a2a038890>
```



In [9]:
```
from sklearn.model_selection import train_test_split
```

In [10]:
```
X = df[['Time on App', 'Time on Website','Length of Membership']]
y = df['Yearly Amount Spent']
```

In [11]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size =0.3, random_state= 42 )
```

In [12]:
```
X_test
```

Out[12]:

	Time on App	Time on Website	Length of Membership
361	10.347877	39.045156	3.434560
73	12.817113	37.031539	3.851579
374	10.101632	38.043453	4.238296
155	13.457725	37.238806	2.941411
104	10.994224	38.074452	3.428860
...	...	...	...
266	11.777772	37.979827	3.784273
23	11.657576	36.772604	3.919302
222	11.109456	38.585855	3.892891
261	13.041245	36.655208	3.456234
426	13.271475	37.239847	4.022103

150 rows × 3 columns

In [13]:
```
from sklearn.linear_model import LinearRegression
```

In [15]:
```
lm = LinearRegression()
```

In [16]:
```
lm.fit(X_train, y_train)
```

Out[16]:

▾ LinearRegression

```
LinearRegression()
```

In [17]:
```
lm.coef_
```

Out[17]:
```
array([38.60854346,  0.78562369, 62.55928792])
```

In [18]:
```
cdf = pd.DataFrame(lm.coef_, X.columns, columns=['coef'])
print(cdf)
```

```
                           coef
Time on App           38.608543
Time on Website        0.785624
Length of Membership  62.559288
```

In [19]:
```
predictions = lm.predict(X_test)
```

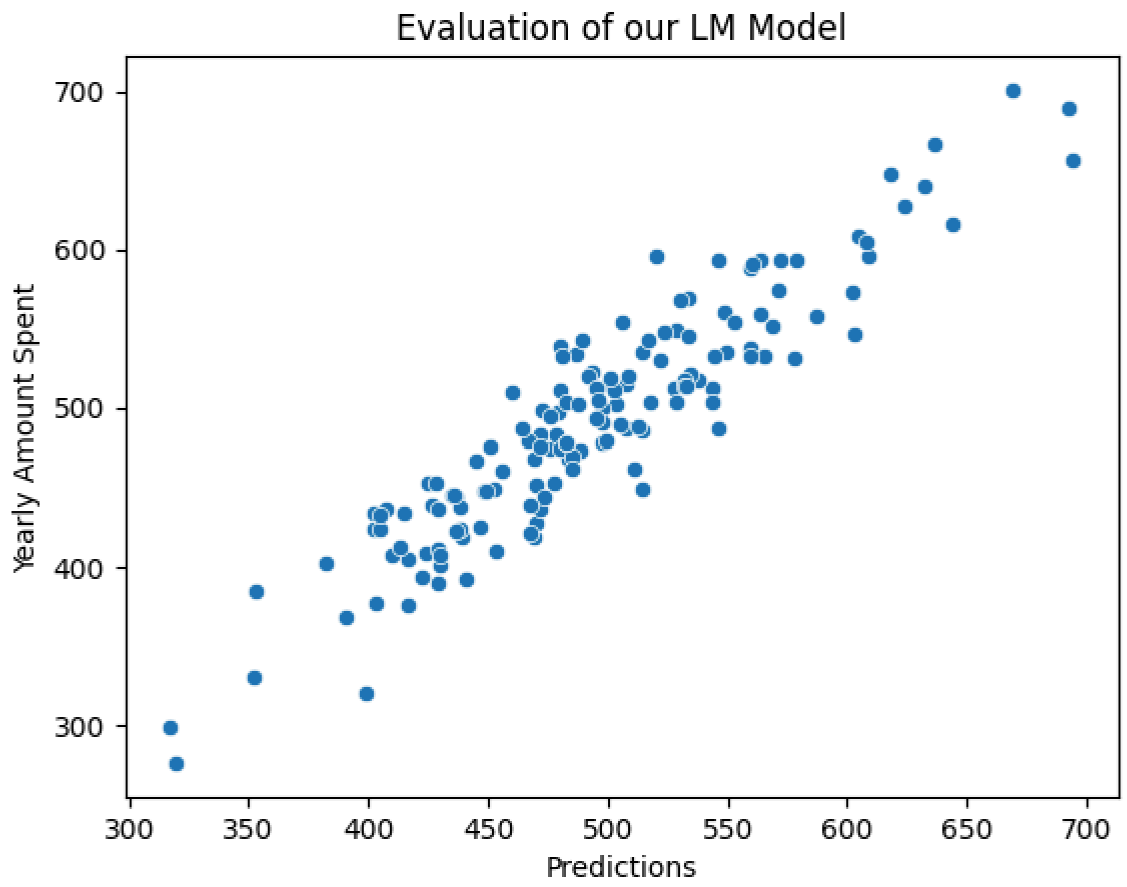
In [20]:
```
predictions
```

Out[20]:

```
array([429.47210171, 549.31218446, 469.45917026, 517.26864352,
       453.30743285, 586.77274082, 480.43964578, 507.87790281,
       424.42185231, 475.98961873, 470.09091211, 414.46445873,
       428.63754654, 487.01257302, 448.1500256 , 409.45375361,
       571.18066702, 479.50208277, 444.50723503, 483.66493466,
       460.11061419, 480.43797079, 527.63371392, 632.16176969,
       436.73240808, 503.55520124, 568.69314436, 528.72859582,
       429.36409196, 352.16513089, 513.97073363, 497.9897364 ,
       497.36719991, 317.14314417, 507.79503236, 472.15712634,
       543.92620023, 434.66394134, 469.50780249, 477.9911575 ,
       480.42766939, 426.87833886, 500.51404989, 514.65248448,
       497.32995695, 533.69902098, 559.53248572, 493.12170996,
       319.13483159, 471.82925757, 439.20574544, 495.41794949,
       602.50554948, 604.97133051, 602.81708635, 471.73760128,
       402.42393424, 477.47828545, 533.93141144, 512.76000721,
       502.91005133, 403.13108398, 488.30266824, 466.95844138,
       471.97010658, 559.32674432, 407.04309906, 563.85259862,
       467.51059071, 482.61642469, 480.87249518, 546.37856347,
       643.79924619, 528.87273585, 416.44323311, 475.88970084,
       498.86611121, 470.03207542, 438.208469  , 489.20375257,
       520.47980833, 608.52136562, 545.76616758, 636.30641467,
       516.4892317 , 452.85724749, 537.72208218, 565.13485183,
       399.0057803 , 521.79589862, 523.93028207, 484.83760218,
       352.55367666, 563.59471274, 450.46440537, 572.00748093,
       463.92317376, 482.55925587, 422.69266329, 510.81308662,
       500.88866708, 401.8620988 , 608.02803112, 482.81886479,
       404.3831717 , 533.9806929 , 504.76271246, 429.15859838,
       544.57575736, 424.54662907, 404.52546243, 456.17334969,
       473.12596335, 438.59626874, 692.63294587, 548.5217562 ,
       618.05034366, 416.18707903, 578.51730143, 560.15069587,
       491.74473117, 559.23166905, 390.29314482, 694.19919606,
       495.11569482, 484.862025  , 467.20484236, 440.44547222,
       531.7481646 , 435.78154748, 449.2148069 , 436.19220503,
       446.62245893, 623.56592692, 513.91095924, 428.26026409,
       496.05816633, 668.70094577, 429.82936678, 530.58520163,
       552.71052106, 412.79215141, 382.38814996, 532.27705535,
       543.99374472, 505.71914007, 508.57745193, 487.18764328,
       532.93742025, 577.68595571])
```

In [24]:

```
sns.scatterplot(x=predictions, y=y_test)
plt.xlabel("Predictions")
plt.ylabel("Yearly Amount Spent")  # Adding a label for the y-axis
plt.title("Evaluation of our LM Model")
plt.show()
```



In [26]:
```
from sklearn.metrics import mean_squared_error, mean_absolute_error
import math
```

In [27]:
```
print("Mean Absloute Error: ", mean_absolute_error(y_test, predictions))
print("Mean Squared Error: ", mean_squared_error(y_test, predictions))
print("RMSE: ", math.sqrt(mean_squared_error(y_test, predictions)))
```

```
Mean Absloute Error:  22.57620980116825
Mean Squared Error:  758.6208936474467
RMSE:  27.543073424137813
```

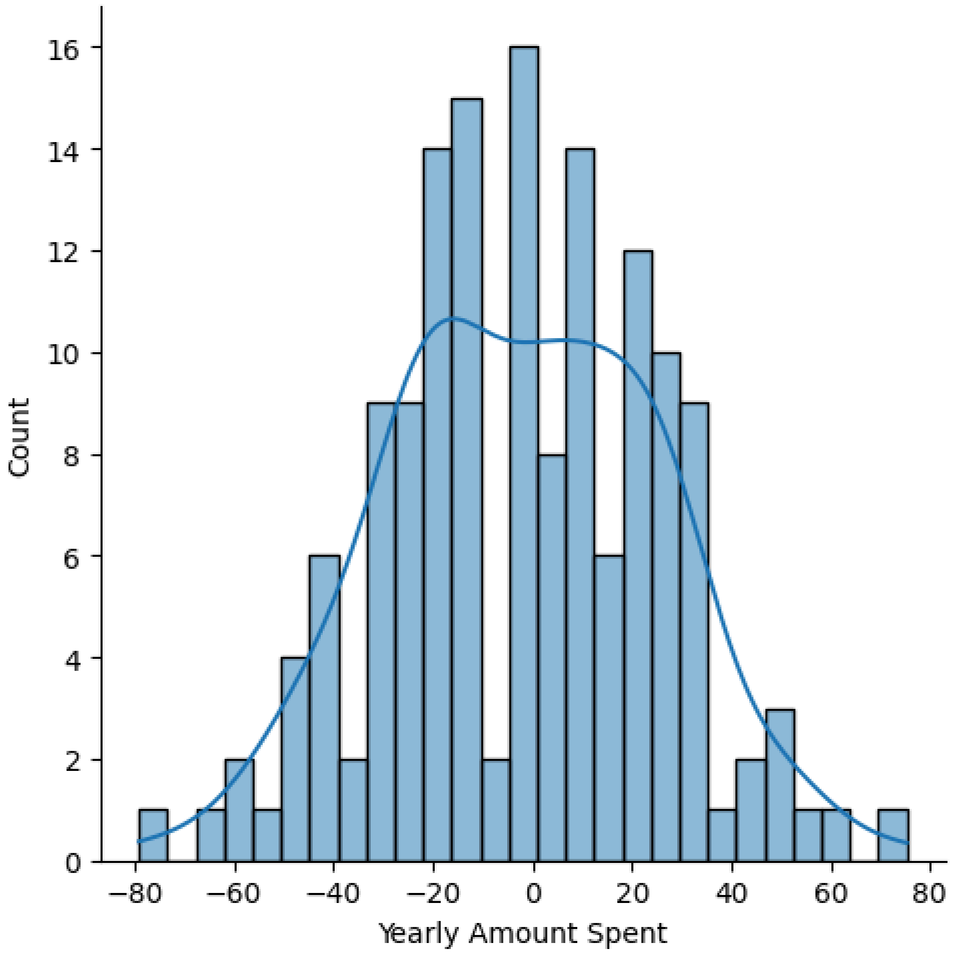
In [28]:
```
residual = y_test - predictions
```

In [29]:
```
residual
```

Out[29]:
```
361   -28.438966
73    -14.534996
374   -50.856428
155   -13.290264
104   -43.237822
         ...    
266    48.283953
23     10.763537
222    15.222142
261   -18.927602
426   -46.919237
Name: Yearly Amount Spent, Length: 150, dtype: float64
```

In [37]:
```
sns.displot(residual, bins = 27, kde = True)
```

Out[37]:
```
<seaborn.axisgrid.FacetGrid at 0x25a2f8516a0>
```

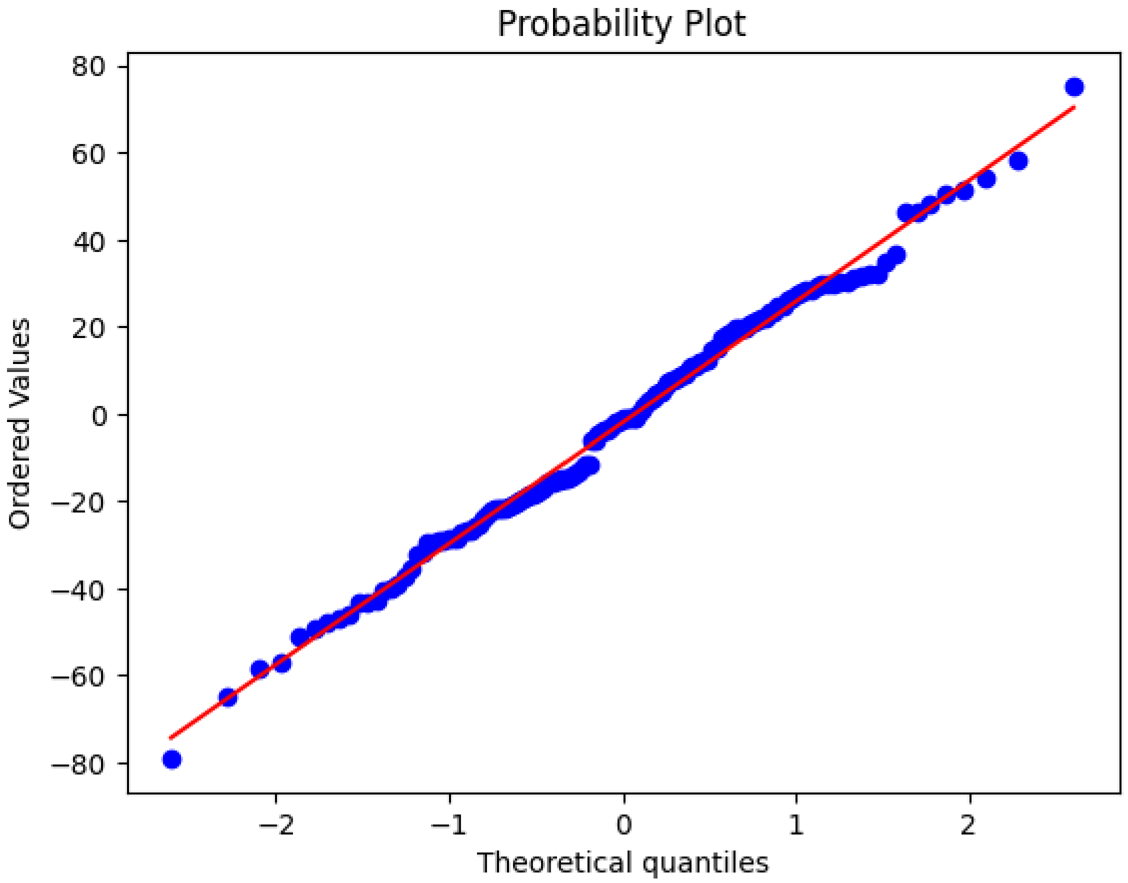


In [41]:

```
residuals = y_test - predictions

import pylab
import scipy.stats as stats

stats.probplot(residuals, dist="norm", plot=pylab)
pylab.show()
```


Probability Plot
80
60
40
20
0
−20
−40
−60
−80
Ordered Values
−2
−1
0
1
2
Theoretical quantiles

```
In [ ]:
```