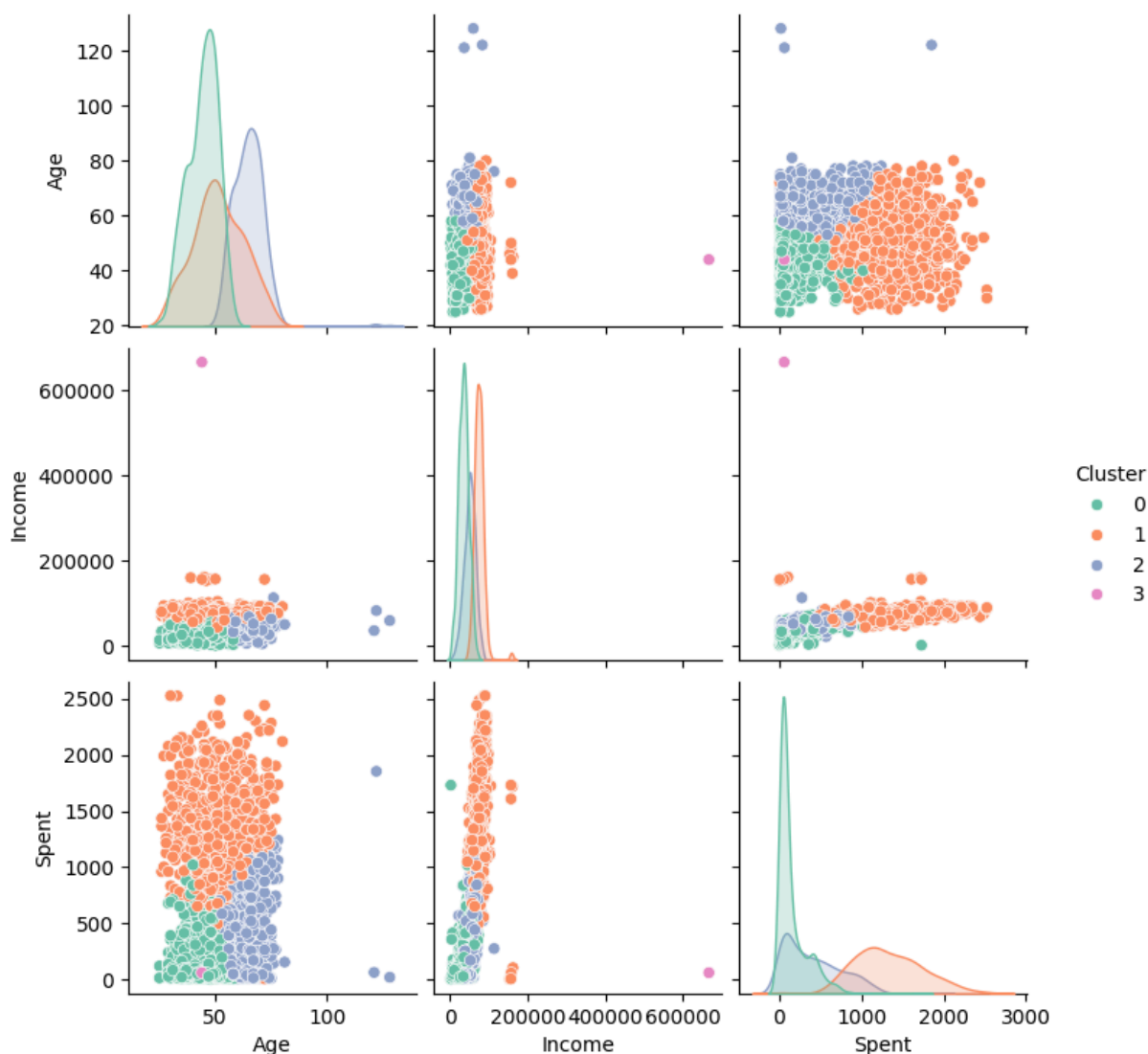




```
In [ ]: ## pair plots
```

```
In [35]: sns.pairplot(sales[['Age', 'Income', 'Spent', 'Cluster']], hue='Cluster', palette='  
plt.show()
```



```
In [36]: ## Centroid Visualization
centroids = kmeans.cluster_centers_
centroids_df = pd.DataFrame(centroids, columns=features.columns)

print("\nCentroids of clusters:")
print(centroids_df)
```

Centroids of clusters:

	Age	Income	Spent
0	-0.664558	-0.696772	-0.754073
1	-0.064854	0.875130	1.193879
2	1.050829	-0.076586	-0.335088
3	-0.682609	24.413282	-0.904293

```
In [47]: # Analyze clusters for actionable insights
for cluster in sales['Cluster'].unique():
    cluster_data = sales[sales['Cluster'] == cluster]
    print(f"\nCluster {cluster} Analysis:")
    print(cluster_data.describe())

print("\nRecommendations:")
print("- Target customers in high-income, high-spending clusters for premium product")
```

```
print("- Introduce loyalty programs for high-spending customers.")  
print("- Design tailored promotions for age-specific or income-specific segments.")
```

Cluster 1 Analysis:

	Income	Kidhome	Teenhome	Recency	MntWines	\
count	728.000000	728.000000	728.000000	728.000000	728.000000	
mean	74271.984890	0.089286	0.395604	49.696429	661.876374	
std	13150.391059	0.290132	0.529807	29.026476	310.165477	
min	44802.000000	0.000000	0.000000	0.000000	1.000000	
25%	66326.250000	0.000000	0.000000	25.000000	423.000000	
50%	73452.000000	0.000000	0.000000	51.500000	626.000000	
75%	80881.500000	0.000000	1.000000	74.000000	896.250000	
max	162397.000000	2.000000	2.000000	99.000000	1493.000000	

	MntFruits	MntMeatProducts	MntFishProducts	MntSweetProducts	\
count	728.000000	728.000000	728.000000	728.000000	
mean	58.048077	390.817308	82.188187	59.170330	
std	49.773536	248.609566	67.634844	50.875429	
min	0.000000	1.000000	0.000000	0.000000	
25%	20.000000	184.000000	28.000000	19.000000	
50%	43.000000	352.000000	64.000000	43.000000	
75%	86.000000	541.250000	127.000000	92.000000	
max	199.000000	1725.000000	259.000000	198.000000	

	MntGoldProds	...	AcceptedCmp4	AcceptedCmp5	AcceptedCmp1	\
count	728.000000	...	728.000000	728.000000	728.000000	
mean	74.603022	...	0.145604	0.214286	0.171703	
std	59.844207	...	0.352952	0.410608	0.377382	
min	0.000000	...	0.000000	0.000000	0.000000	
25%	29.750000	...	0.000000	0.000000	0.000000	
50%	54.000000	...	0.000000	0.000000	0.000000	
75%	108.000000	...	0.000000	0.000000	0.000000	
max	249.000000	...	1.000000	1.000000	1.000000	

	AcceptedCmp2	Complain	Response	Customer_For	Age	\
count	728.000000	728.000000	728.000000	7.280000e+02	728.000000	
mean	0.034341	0.004121	0.251374	3.275628e+16	51.402473	
std	0.182228	0.064106	0.434101	1.786404e+16	11.341096	
min	0.000000	0.000000	0.000000	8.640000e+13	26.000000	
25%	0.000000	0.000000	0.000000	1.678320e+16	44.000000	
50%	0.000000	0.000000	0.000000	3.490560e+16	51.000000	
75%	0.000000	0.000000	1.000000	4.918320e+16	60.000000	
max	1.000000	1.000000	1.000000	6.022080e+16	80.000000	

	Spent	Cluster
count	728.000000	728.0
mean	1326.703297	1.0
std	414.958426	0.0
min	6.000000	1.0
25%	1026.250000	1.0
50%	1284.500000	1.0
75%	1609.000000	1.0
max	2525.000000	1.0

[8 rows x 26 columns]

Cluster 2 Analysis:

	Income	Kidhome	Teenhome	Recency	MntWines	\
count	604.000000	604.000000	604.000000	604.000000	604.000000	

mean	50319.774834	0.344371	0.847682	49.223510	223.642384
std	14567.776051	0.528415	0.467850	29.001425	209.520746
min	5648.000000	0.000000	0.000000	0.000000	0.000000
25%	40754.250000	0.000000	1.000000	24.000000	45.000000
50%	50884.000000	0.000000	1.000000	51.000000	172.000000
75%	60544.000000	1.000000	1.000000	74.000000	356.750000
max	113734.000000	2.000000	2.000000	99.000000	1099.000000

	MntFruits	MntMeatProducts	MntFishProducts	MntSweetProducts	\
count	604.000000	604.000000	604.000000	604.000000	
mean	15.546358	88.228477	22.56457	16.922185	
std	26.657079	106.129747	35.07411	30.163219	
min	0.000000	1.000000	0.000000	0.000000	
25%	1.000000	16.000000	2.000000	0.000000	
50%	5.000000	49.500000	7.500000	5.000000	
75%	17.000000	115.750000	28.000000	19.000000	
max	178.000000	818.000000	199.000000	262.000000	

	MntGoldProds	...	AcceptedCmp4	AcceptedCmp5	AcceptedCmp1	\
count	604.000000	...	604.000000	604.000000	604.000000	
mean	38.192053	...	0.076159	0.009934	0.021523	
std	45.375780	...	0.265472	0.099254	0.145241	
min	0.000000	...	0.000000	0.000000	0.000000	
25%	7.000000	...	0.000000	0.000000	0.000000	
50%	22.500000	...	0.000000	0.000000	0.000000	
75%	48.000000	...	0.000000	0.000000	0.000000	
max	229.000000	...	1.000000	1.000000	1.000000	

	AcceptedCmp2	Complain	Response	Customer_For	Age	\
count	604.000000	604.000000	604.000000	6.040000e+02	604.000000	
mean	0.008278	0.016556	0.086093	2.930033e+16	64.771523	
std	0.090682	0.127707	0.280733	1.702079e+16	7.328410	
min	0.000000	0.000000	0.000000	0.000000e+00	51.000000	
25%	0.000000	0.000000	0.000000	1.466640e+16	60.000000	
50%	0.000000	0.000000	0.000000	2.959200e+16	65.000000	
75%	0.000000	0.000000	0.000000	4.328640e+16	69.000000	
max	1.000000	1.000000	1.000000	6.030720e+16	128.000000	

	Spent	Cluster
count	604.000000	604.0
mean	405.096026	2.0
std	334.790671	0.0
min	9.000000	2.0
25%	93.750000	2.0
50%	319.500000	2.0
75%	637.000000	2.0
max	1853.000000	2.0

[8 rows x 26 columns]

Cluster 0 Analysis:

	Income	Kidhome	Teenhome	Recency	MntWines	\
count	883.000000	883.000000	883.000000	883.000000	883.000000	
mean	34711.318233	0.798414	0.362401	48.334088	66.985277	
std	12843.434724	0.476331	0.501734	28.868268	99.930729	
min	1730.000000	0.000000	0.000000	0.000000	0.000000	

25%	25293.000000	1.000000	0.000000	24.000000	8.000000
50%	34600.000000	1.000000	0.000000	47.000000	23.000000
75%	42801.000000	1.000000	1.000000	74.000000	80.000000
max	73395.000000	2.000000	2.000000	99.000000	728.000000

	MntFruits	MntMeatProducts	MntFishProducts	MntSweetProducts	\
count	883.000000	883.000000	883.000000	883.000000	
mean	7.635334	36.511891	11.251416	7.472254	
std	13.744864	70.808392	20.616358	13.214868	
min	0.000000	0.000000	0.000000	0.000000	
25%	1.000000	8.000000	2.000000	1.000000	
50%	3.000000	17.000000	4.000000	3.000000	
75%	7.000000	46.000000	12.000000	8.000000	
max	122.000000	1725.000000	208.000000	129.000000	

	MntGoldProds	...	AcceptedCmp4	AcceptedCmp5	AcceptedCmp1	\
count	883.000000	...	883.000000	883.0	883.000000	
mean	22.690827	...	0.013590	0.0	0.004530	
std	33.630994	...	0.115847	0.0	0.067191	
min	0.000000	...	0.000000	0.0	0.000000	
25%	5.000000	...	0.000000	0.0	0.000000	
50%	12.000000	...	0.000000	0.0	0.000000	
75%	26.000000	...	0.000000	0.0	0.000000	
max	321.000000	...	1.000000	0.0	1.000000	

	AcceptedCmp2	Complain	Response	Customer_For	Age	\
count	883.0	883.000000	883.000000	8.830000e+02	883.000000	
mean	0.0	0.009060	0.110985	2.956759e+16	44.216308	
std	0.0	0.094806	0.314292	1.735155e+16	6.737017	
min	0.0	0.000000	0.000000	1.728000e+14	25.000000	
25%	0.0	0.000000	0.000000	1.442880e+16	39.000000	
50%	0.0	0.000000	0.000000	2.859840e+16	45.000000	
75%	0.0	0.000000	0.000000	4.458240e+16	49.000000	
max	0.0	1.000000	1.000000	6.039360e+16	60.000000	

	Spent	Cluster
count	883.000000	883.0
mean	152.546999	0.0
std	178.146303	0.0
min	5.000000	0.0
25%	41.000000	0.0
50%	72.000000	0.0
75%	198.500000	0.0
max	1730.000000	0.0

[8 rows x 26 columns]

Cluster 3 Analysis:

	Income	Kidhome	Teenhome	Recency	MntWines	MntFruits	\
count	1.0	1.0	1.0	1.0	1.0	1.0	
mean	666666.0	1.0	0.0	23.0	9.0	14.0	
std	NaN	NaN	NaN	NaN	NaN	NaN	
min	666666.0	1.0	0.0	23.0	9.0	14.0	
25%	666666.0	1.0	0.0	23.0	9.0	14.0	
50%	666666.0	1.0	0.0	23.0	9.0	14.0	
75%	666666.0	1.0	0.0	23.0	9.0	14.0	

max	666666.0	1.0	0.0	23.0	9.0	14.0	
	MntMeatProducts	MntFishProducts	MntSweetProducts	MntGoldProds	...	\	
count	1.0	1.0	1.0	1.0	1.0	...	
mean	18.0	8.0	1.0	12.0	...		
std	NaN	NaN	NaN	NaN	...		
min	18.0	8.0	1.0	12.0	...		
25%	18.0	8.0	1.0	12.0	...		
50%	18.0	8.0	1.0	12.0	...		
75%	18.0	8.0	1.0	12.0	...		
max	18.0	8.0	1.0	12.0	...		
	AcceptedCmp4	AcceptedCmp5	AcceptedCmp1	AcceptedCmp2	Complain	\	
count	1.0	1.0	1.0	1.0	1.0		
mean	0.0	0.0	0.0	0.0	0.0		
std	NaN	NaN	NaN	NaN	NaN		
min	0.0	0.0	0.0	0.0	0.0		
25%	0.0	0.0	0.0	0.0	0.0		
50%	0.0	0.0	0.0	0.0	0.0		
75%	0.0	0.0	0.0	0.0	0.0		
max	0.0	0.0	0.0	0.0	0.0		
	Response	Customer_For	Age	Spent	Cluster		
count	1.0	1.000000e+00	1.0	1.0	1.0		
mean	0.0	3.386880e+16	44.0	62.0	3.0		
std	NaN	NaN	NaN	NaN	NaN		
min	0.0	3.386880e+16	44.0	62.0	3.0		
25%	0.0	3.386880e+16	44.0	62.0	3.0		
50%	0.0	3.386880e+16	44.0	62.0	3.0		
75%	0.0	3.386880e+16	44.0	62.0	3.0		
max	0.0	3.386880e+16	44.0	62.0	3.0		

[8 rows x 26 columns]

- Recommendations:
- Target customers in high-income, high-spending clusters for premium products.
 - Introduce loyalty programs for high-spending customers.
 - Design tailored promotions for age-specific or income-specific segments.