In [1]:
```python
import pandas as pd
```

In [2]:
```python
df = pd.read_csv("clean_superstore_sales.csv")
```

In [3]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4441 entries, 0 to 4440
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Row ID         4441 non-null   int64
 1   Order ID       4441 non-null   object
 2   Order Date     4441 non-null   object
 3   Ship Date      4441 non-null   object
 4   Ship Mode      4441 non-null   object
 5   Customer ID    4441 non-null   object
 6   Customer Name  4441 non-null   object
 7   Segment        4441 non-null   object
 8   Country        4441 non-null   object
 9   City           4441 non-null   object
 10  State          4441 non-null   object
 11  Postal Code    4441 non-null   int64
 12  Region         4441 non-null   object
 13  Product ID     4441 non-null   object
 14  Category       4441 non-null   object
 15  Sub-Category   4441 non-null   object
 16  Product Name   4441 non-null   object
 17  Sales          4441 non-null   float64
 18  Order_Year     4441 non-null   int64
 19  Order_Month    4441 non-null   int64
 20  Shipping_Days  4441 non-null   int64
dtypes: float64(1), int64(5), object(15)
memory usage: 728.7+ KB
```

In [4]:
```python
df.head()
```

Out[4]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Product Name	Sales	Order_Year	Order_Month	Shipping_Days
0	1	CA-2017-152156	2017-08-11	2017-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798	furniture	Bookcases	Bush Somerset Collection Bookcase	261.960	2017	8	92
1	3	CA-2017-138688	2017-12-06	2017-12-09	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	90036	West	OFF-LA-10000240	office supplies	Labels	Self-Adhesive Address Labels for Typewriters b...	14.620	2017	12	3
2	5	US-2016-108966	2016-11-10	2016-11-13	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	OFF-ST-10000760	office supplies	Storage	Eldon Fold 'N Roll Cart System	22.368	2016	11	3
3	6	CA-2015-115812	2015-09-06	2015-09-09	Standard Class	BH-11710	Brosina Hoffman	Consumer	United States	Los Angeles	...	90032	West	FUR-FU-10001487	furniture	Furnishings	Eldon Expressions Wood and Plastic Desk Access...	48.860	2015	9	3
4	7	CA-2015-115812	2015-09-06	2015-09-09	Standard Class	BH-11710	Brosina Hoffman	Consumer	United States	Los Angeles	...	90032	West	OFF-AR-10002833	office supplies	Art	Newell 322	54.900	2015	9	3

5 rows × 21 columns

In [5]:
```python
df["Order Date"] = pd.to_datetime(df["Order Date"])
```

In [6]:
```python
df["Order_Year"] = df["Order Date"].dt.year
```

In [7]:
```python
df["Order_Month"] = df["Order Date"].dt.month
```

In [8]:
```python
df["Order_Month_Name"] = df["Order Date"].dt.month_name()
```

In [9]:
```python
# Yearly Sales
yearly_sales = df.groupby("Order_Year")["Sales"].sum().reset_index()
yearly_sales
```

Out[9]:

	Order_Year	Sales
0	2015	69721.7442
1	2016	79428.6157
2	2017	98305.7755
3	2018	116962.4186
4	2019	2078.5720

In [10]:
```python
import matplotlib.pyplot as plt
```

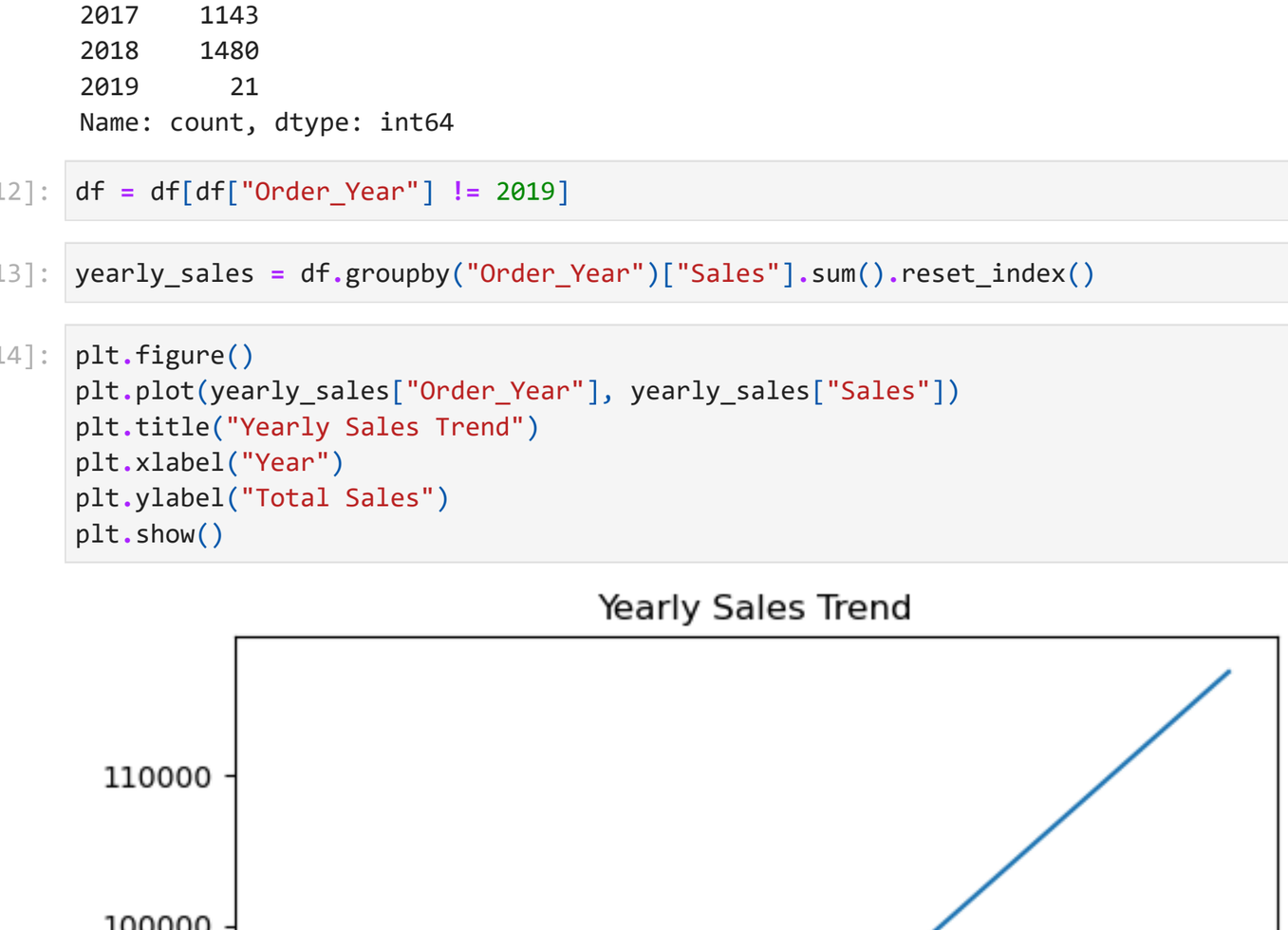
In [11]:
```python
df["Order_Year"].value_counts().sort_index()
```

Out[11]:
```
Order_Year
2015     852
2016     945
2017    1143
2018    1480
2019      21
Name: count, dtype: int64
```

In [12]:
```python
df = df[df["Order_Year"] != 2019]
```

In [13]:
```python
yearly_sales = df.groupby("Order_Year")["Sales"].sum().reset_index()
```

In [14]:
```python
plt.figure()
plt.plot(yearly_sales["Order_Year"], yearly_sales["Sales"])
plt.title("Yearly Sales Trend")
plt.xlabel("Year")
plt.ylabel("Total Sales")
plt.show()
```



Insight

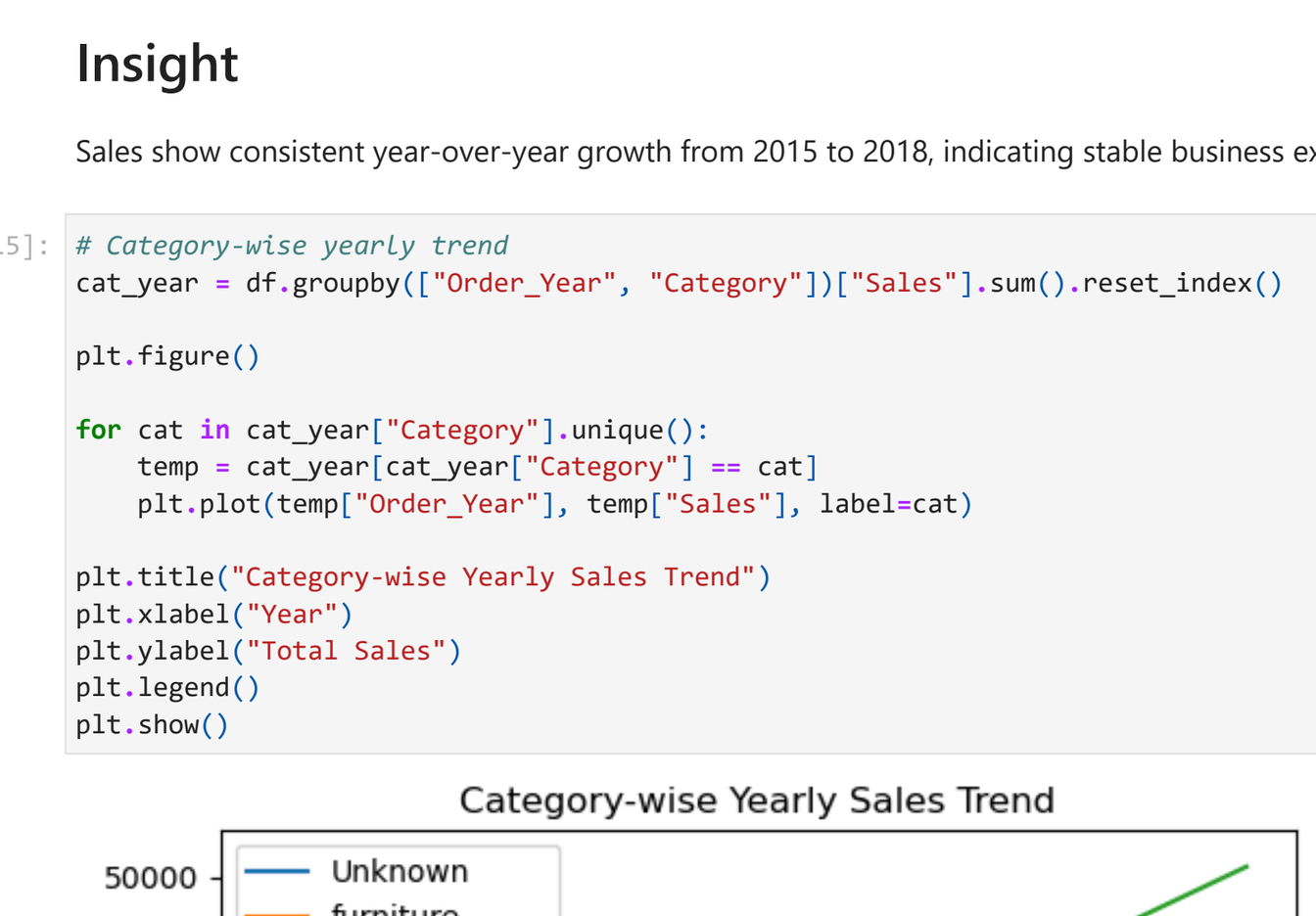
Sales show consistent year-over-year growth from 2015 to 2018, indicating stable business expansion. 2019 was removed due to incomplete data and would have distorted the trend.

In [15]:
```python
# Category-wise yearly trend
cat_year = df.groupby(["Order_Year", "Category"])["Sales"].sum().reset_index()

plt.figure()

for cat in cat_year["Category"].unique():
    temp = cat_year[cat_year["Category"] == cat]
    plt.plot(temp["Order_Year"], temp["Sales"], label=cat)

plt.title("Category-wise Yearly Sales Trend")
plt.xlabel("Year")
plt.ylabel("Total Sales")
plt.legend()
plt.show()
```



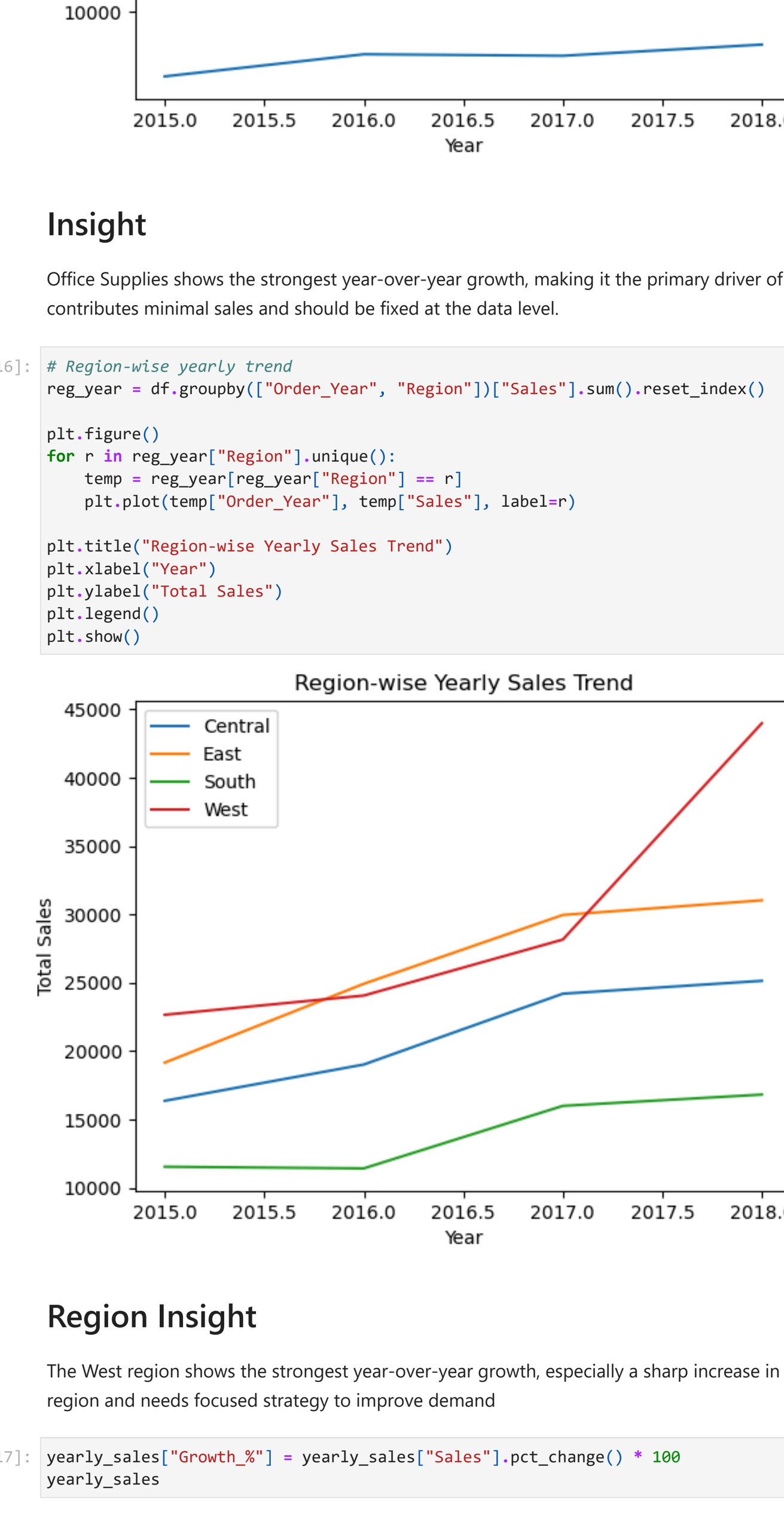
Insight

Office Supplies shows the strongest year-over-year growth, making it the primary driver of sales expansion. Technology also shows healthy growth, while Furniture grows slowly and may need pricing or product strategy review. The "Unknown" category contributes minimal sales and should be fixed at the data level.

In [16]:
```python
# Region-wise yearly trend
reg_year = df.groupby(["Order_Year", "Region"])["Sales"].sum().reset_index()

plt.figure()
for r in reg_year["Region"].unique():
    temp = reg_year[reg_year["Region"] == r]
    plt.plot(temp["Order_Year"], temp["Sales"], label=r)

plt.title("Region-wise Yearly Sales Trend")
plt.xlabel("Year")
plt.ylabel("Total Sales")
plt.legend()
plt.show()
```



Region Insight

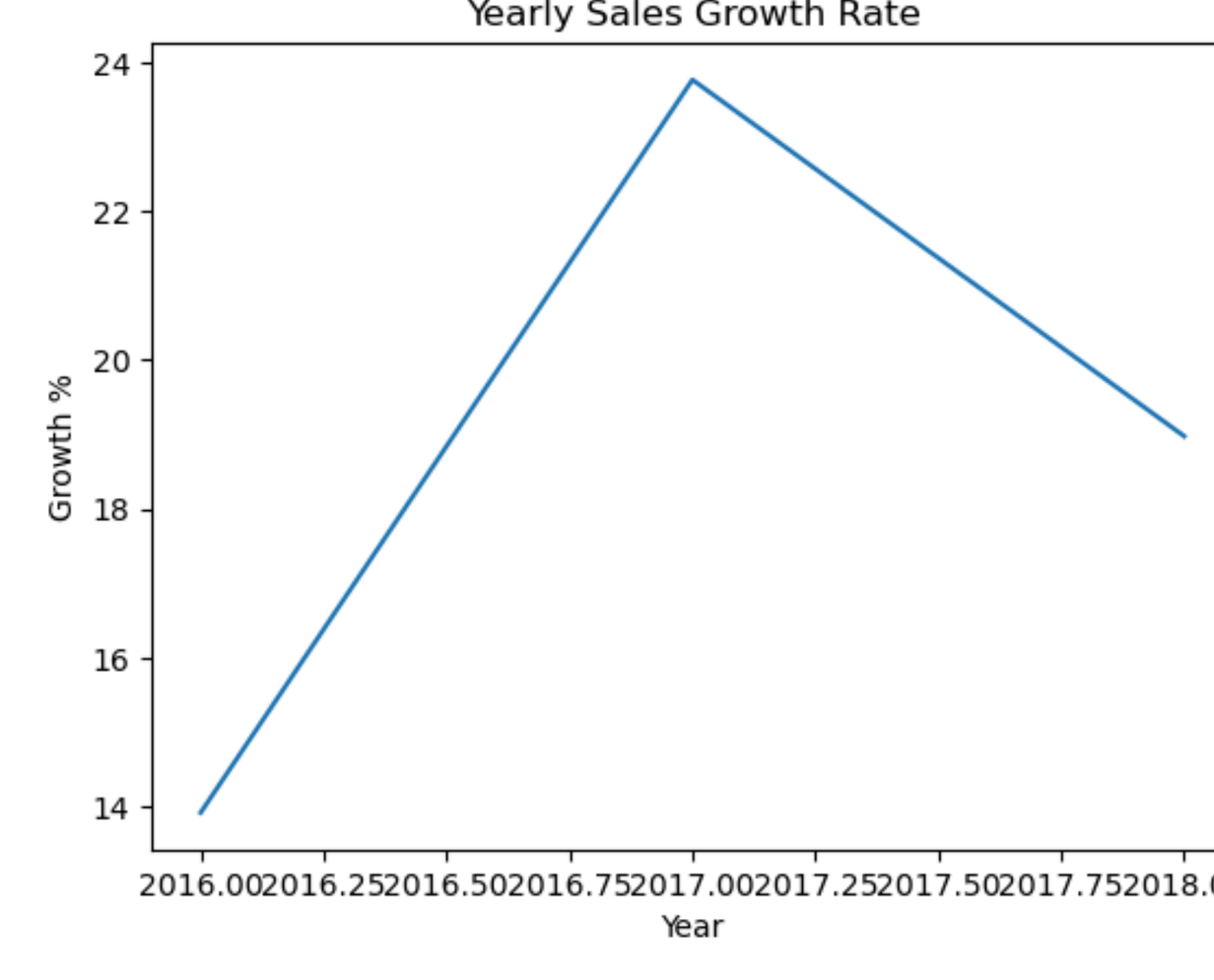
The West region shows the strongest year-over-year growth, especially a sharp increase in 2018, making it the top-performing growth region. East shows steady but slower growth. Central grows gradually without acceleration. South remains the weakest region and needs focused strategy to improve demand

In [17]:
```python
yearly_sales["Growth_%"] = yearly_sales["Sales"].pct_change() * 100
yearly_sales
```

Out[17]:

	Order_Year	Sales	Growth_%
0	2015	69721.7442	NaN
1	2016	79428.6157	13.922302
2	2017	98305.7755	23.766195
3	2018	116962.4186	18.978176

In [18]:
```python
plt.figure()
plt.plot(yearly_sales["Order_Year"], yearly_sales["Growth_%"])
plt.title("Yearly Sales Growth Rate")
plt.xlabel("Year")
plt.ylabel("Growth %")
plt.show()
```



Insight

Sales growth peaked in 2017, showing the strongest expansion phase. Growth slowed in 2018, meaning the market started stabilizing or competition increased. The company should identify what worked in 2017 (products, regions, marketing) and replicate that strategy, while fixing weak regions like South to avoid future slowdown.

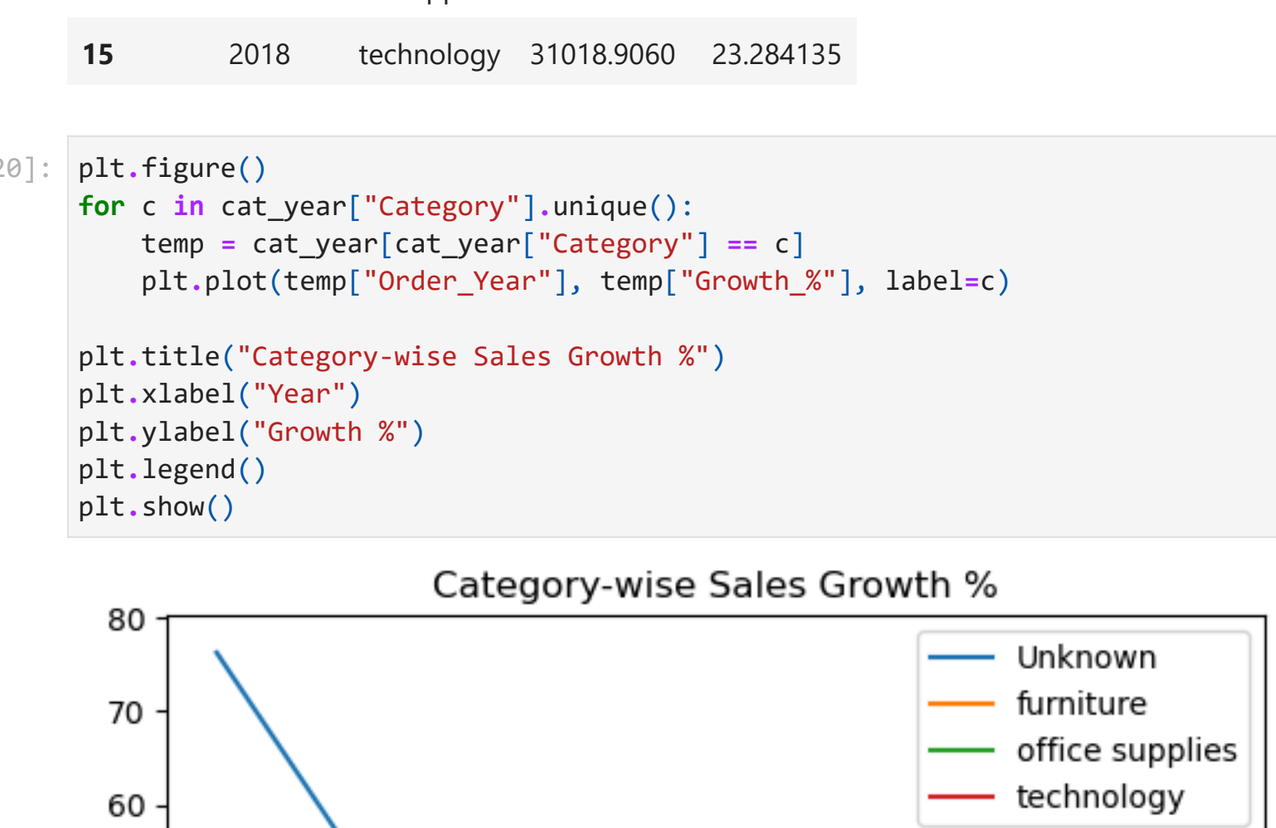
In [19]:
```python
# Category-wise Growth %
cat_year = df.groupby(["Order_Year","Category"])["Sales"].sum().reset_index()
cat_year["Growth_%"] = cat_year.groupby("Category")["Sales"].pct_change() * 100
cat_year
```

Out[19]:

	Order_Year	Category	Sales	Growth_%
0	2015	Unknown	3104.6750	NaN
1	2015	furniture	17771.8282	NaN
2	2015	office supplies	31703.4930	NaN
3	2015	technology	17141.7480	NaN
4	2016	Unknown	5470.6540	76.206978
5	2016	furniture	24579.5977	38.306523
6	2016	office supplies	31495.4580	-0.656190
7	2016	technology	17882.9060	4.323701
8	2017	Unknown	5308.2160	-2.969261
9	2017	furniture	27240.2225	10.824525
10	2017	office supplies	40596.8360	28.897430
11	2017	technology	25160.5010	40.695819
12	2018	Unknown	6504.3660	22.533936
13	2018	furniture	28770.3516	5.617168
14	2018	office supplies	50668.7950	24.809714
15	2018	technology	31018.9060	23.284135

In [20]:
```python
plt.figure()
for c in cat_year["Category"].unique():
    temp = cat_year[cat_year["Category"] == c]
    plt.plot(temp["Order_Year"], temp["Growth_%"], label=c)

plt.title("Category-wise Sales Growth %")
plt.xlabel("Year")
plt.ylabel("Growth %")
plt.legend()
plt.show()
```



Insight

- Technology shows the strongest momentum

Growth spikes around 2017 (~40%), then cools down in 2018. This means tech products drive big jumps but are volatile. → Strategy: push tech during high-demand periods, but don't depend on it alone.

- Office Supplies is the most stable category

Growth is positive every year and fairly consistent (roughly 0% → 29% → 25%). → Strategy: this is your "safe engine" — steady revenue, low risk. Invest consistently.

- Furniture is slowing down

Growth drops every year (around 38% → 11% → 6%). → Strategy: furniture is losing momentum. Needs redesign, pricing changes, or better marketing.

- "Unknown" category is unreliable

Huge spike, then negative, then recovery. That's messy data + unstable category. → Strategy: clean or eliminate "Unknown" from serious business decisions

In [21]:
```python
# Region-wise Growth %
reg_year = df.groupby(["Order_Year","Region"])["Sales"].sum().reset_index()
reg_year["Growth_%"] = reg_year.groupby("Region")["Sales"].pct_change() * 100
reg_year
```

Out[21]:

	Order_Year	Region	Sales	Growth_%
0	2015	Central	16364.3602	NaN
1	2015	East	19157.8230	NaN
2	2015	South	11543.1995	NaN
3	2015	West	22656.3615	NaN
4	2016	Central	19019.3252	16.224068
5	2016	East	24922.9090	30.092595
6	2016	South	11422.6095	-1.044684
7	2016	West	24063.7720	6.211988
8	2017	Central	24196.3270	27.219692
9	2017	East	29957.6330	20.201189
10	2017	South	15994.7780	40.027355
11	2017	West	28157.0375	17.010074
12	2018	Central	25138.5976	3.894271
13	2018	East	31028.8140	3.575653
14	2018	South	16819.4100	5.155633
15	2018	West	43975.5970	56.179772

In [22]:
```python
plt.figure()
for r in reg_year["Region"].unique():
    temp = reg_year[reg_year["Region"] == r]
    plt.plot(temp["Order_Year"], temp["Growth_%"], label=r)

plt.title("Region-wise Sales Growth %")
plt.xlabel("Year")
plt.ylabel("Growth %")
plt.legend()
plt.show()
```

Insight

West region shows the fastest growth beacuse it has higher technology category sales and a growing customer base that prefers high value tech product.

Final Business Recommendations

Double Down on West Region

- West has the highest growth rate and strongest upward trend.
- Likely driven by high Technology sales and strong customer demand.

Action:

- Increase marketing budget in West.
- Push premium/tech products harder here.
- Improve delivery speed and stock availability for West.

Fix South Region – It's Underperforming

- South shows weak or unstable growth.

Action:

- Analyze product mix: what sells in other regions but not in South?
- Run discounts or bundles in South.
- Improve distribution and delivery time.

Technology = Growth Engine

- Tech category shows big growth spikes.
- High reward but unstable.

Action:

- Launch new tech products regularly.
- Target tech buyers with ads and offers.
- Track tech demand monthly, not yearly.

Office Supplies = Stability Engine

- Most consistent growth.

Action:

- Keep steady investment.
- Use office supplies for repeat customers and subscriptions.

Furniture Is Losing Speed

- Growth is dropping every year.

Action:

- Refresh designs or drop low-selling items.
- Test price cuts or combo offers.
- If it doesn't recover, reduce focus.

Clean "Unknown" Category

- Too unstable to trust.

Action:

- Fix data source so category is always known.
- Never use "Unknown" for business decisions.