

# IE 5390 – Assignment - 06

Name: Simran Abhay Sinha

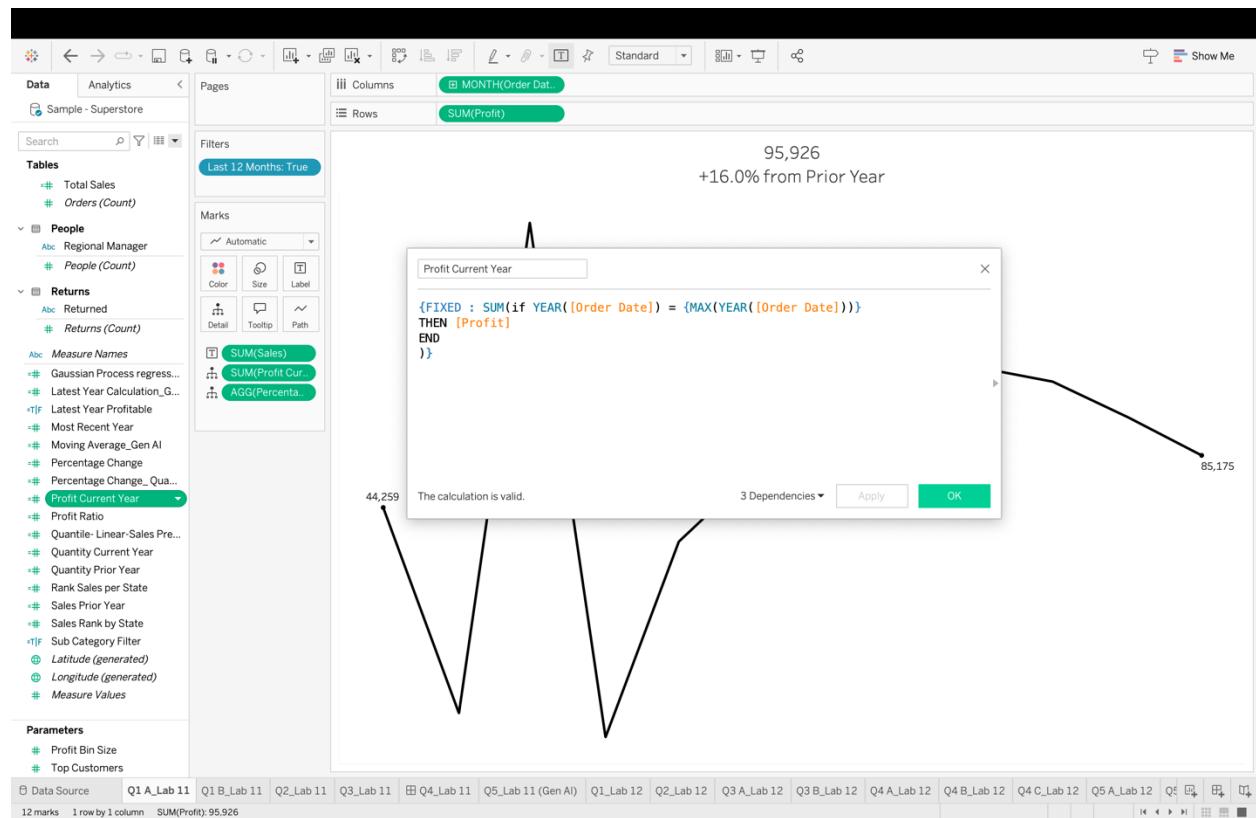
## Lab 11

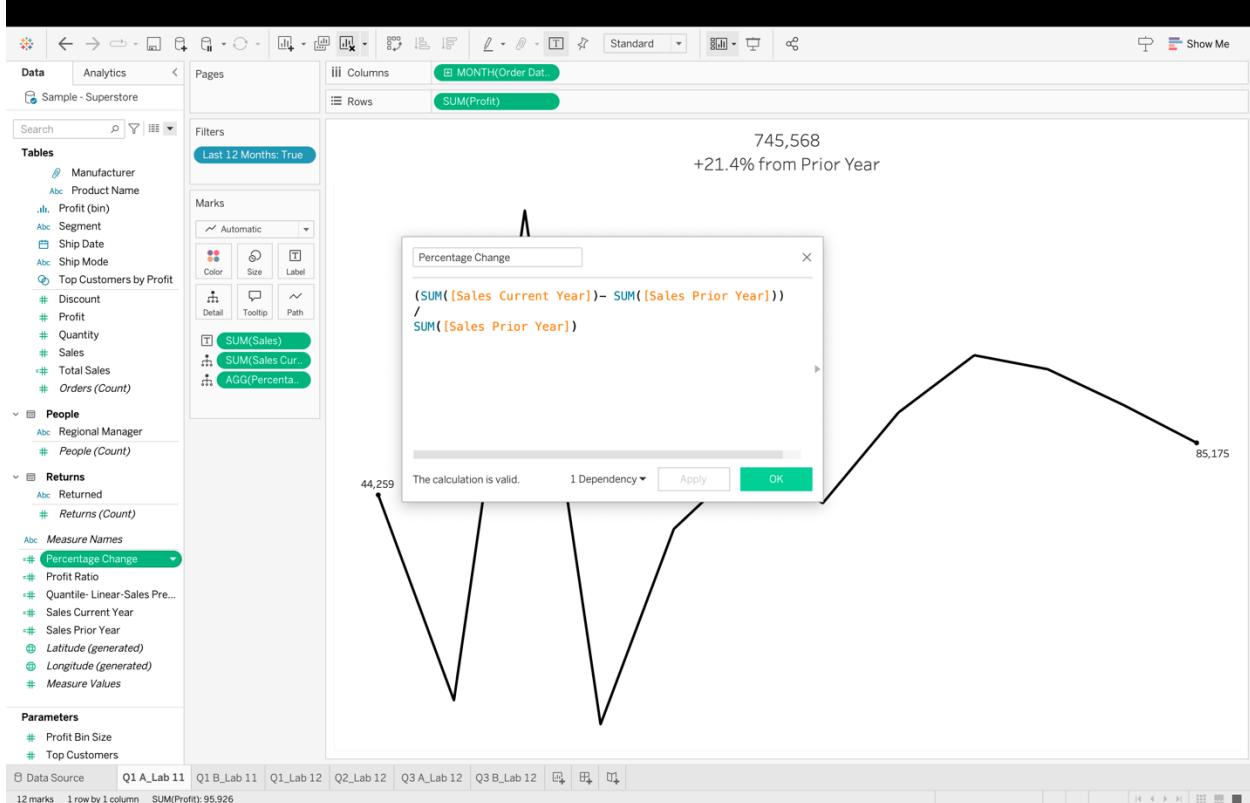
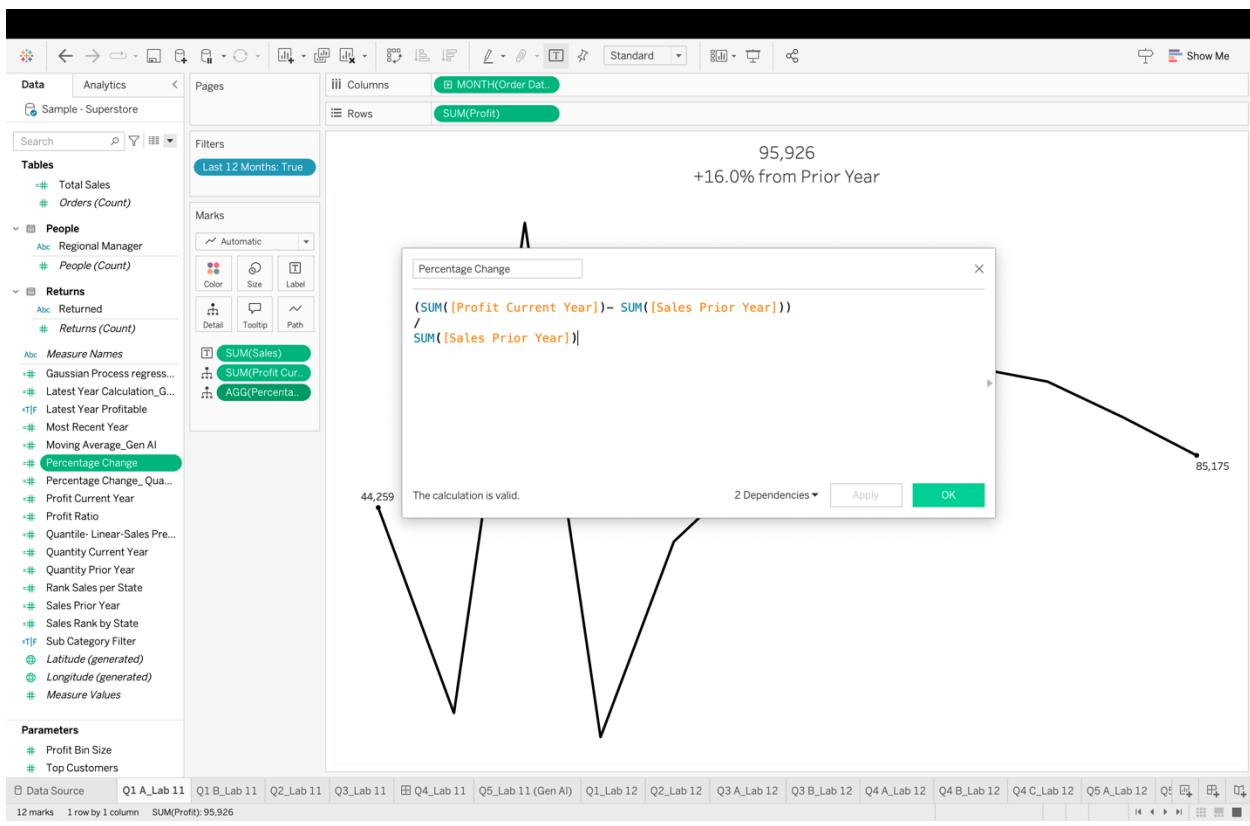
### Tableau Dashboards

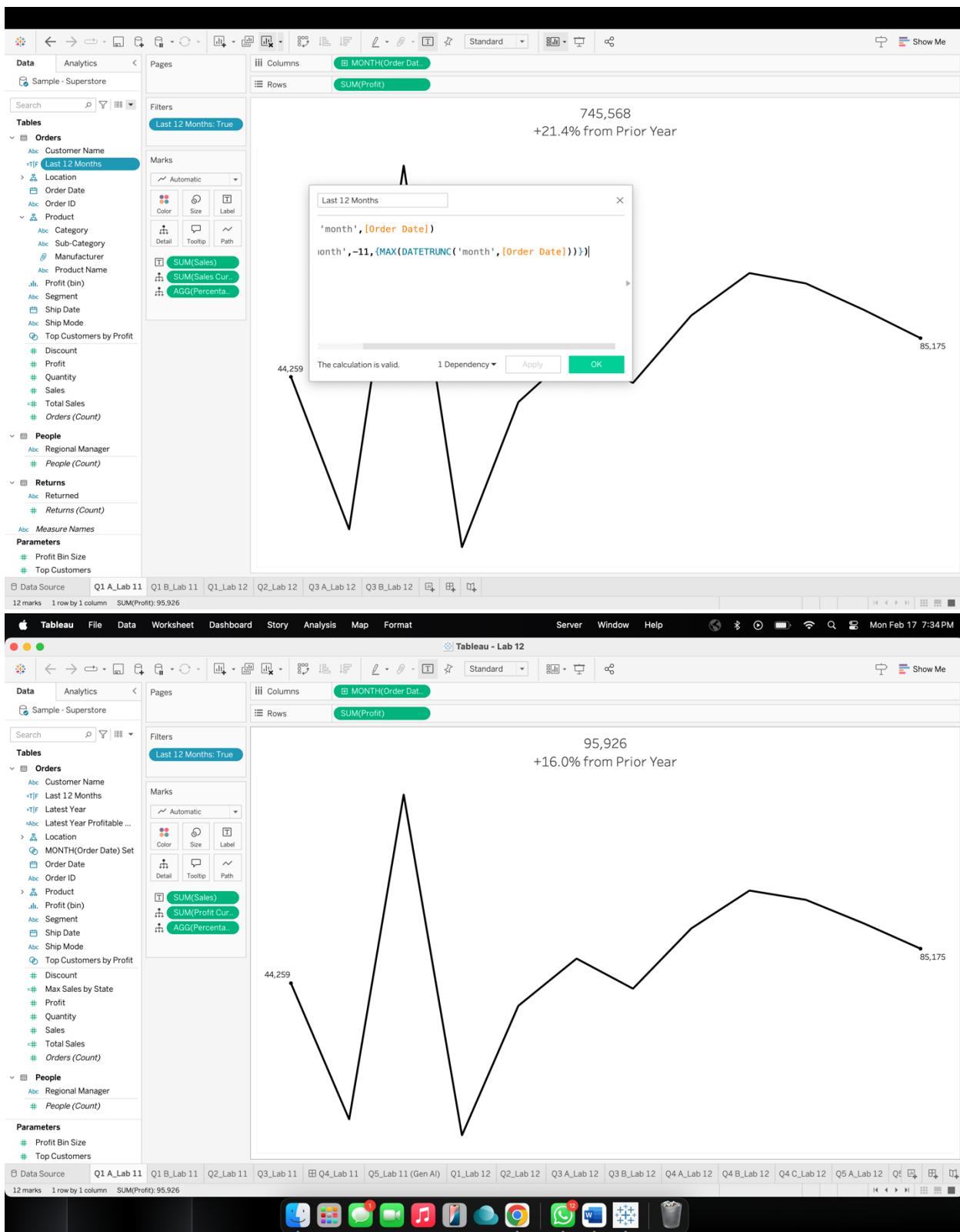
1. Using the Sample - Superstore dataset, complete the following questions with LOD expressions, KPI's and Sparklines:

a. Create calculated fields using LOD expressions for Profit Current Year and Profit Prior Year and calculate Percent Change in Profit from Prior Year to Current Year. Create a calculated field for most recent year – (see slide 17 from the lecture) Using these fields, create a Sparkline that shows change in Profit over the last year. The visualization should show the KPI's displayed on the title

Calculated Field:



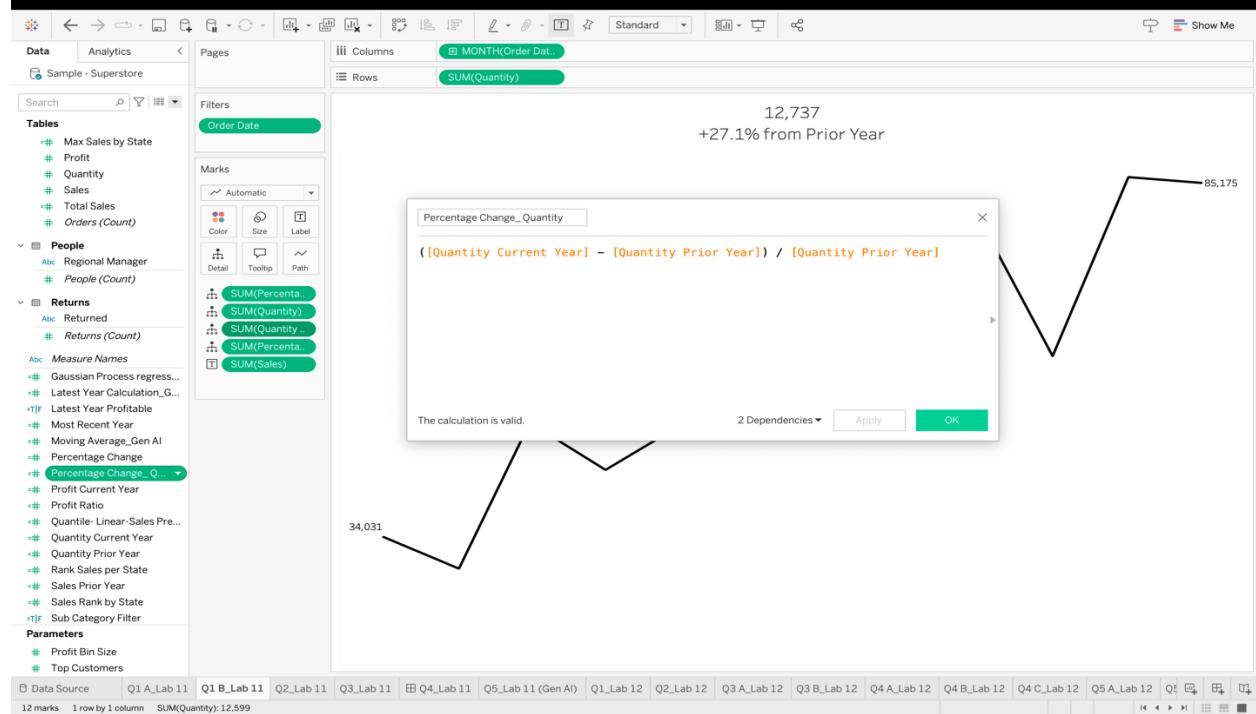
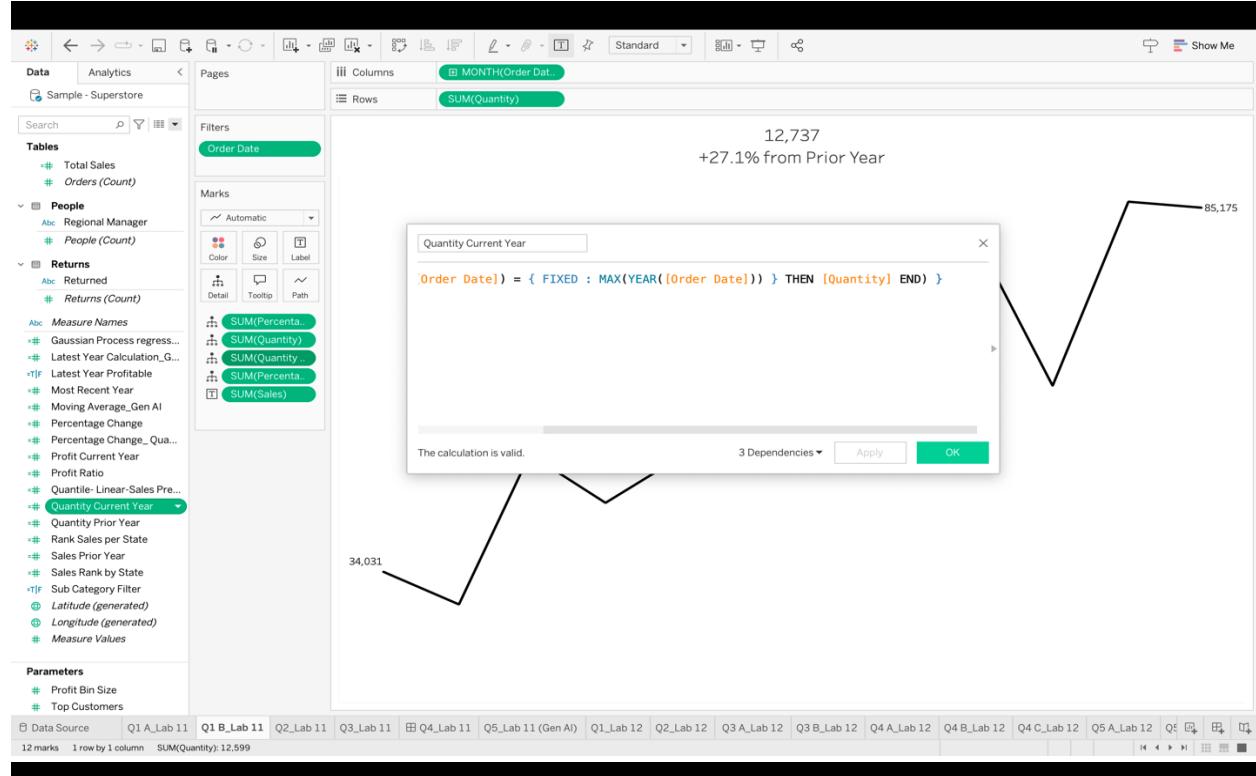


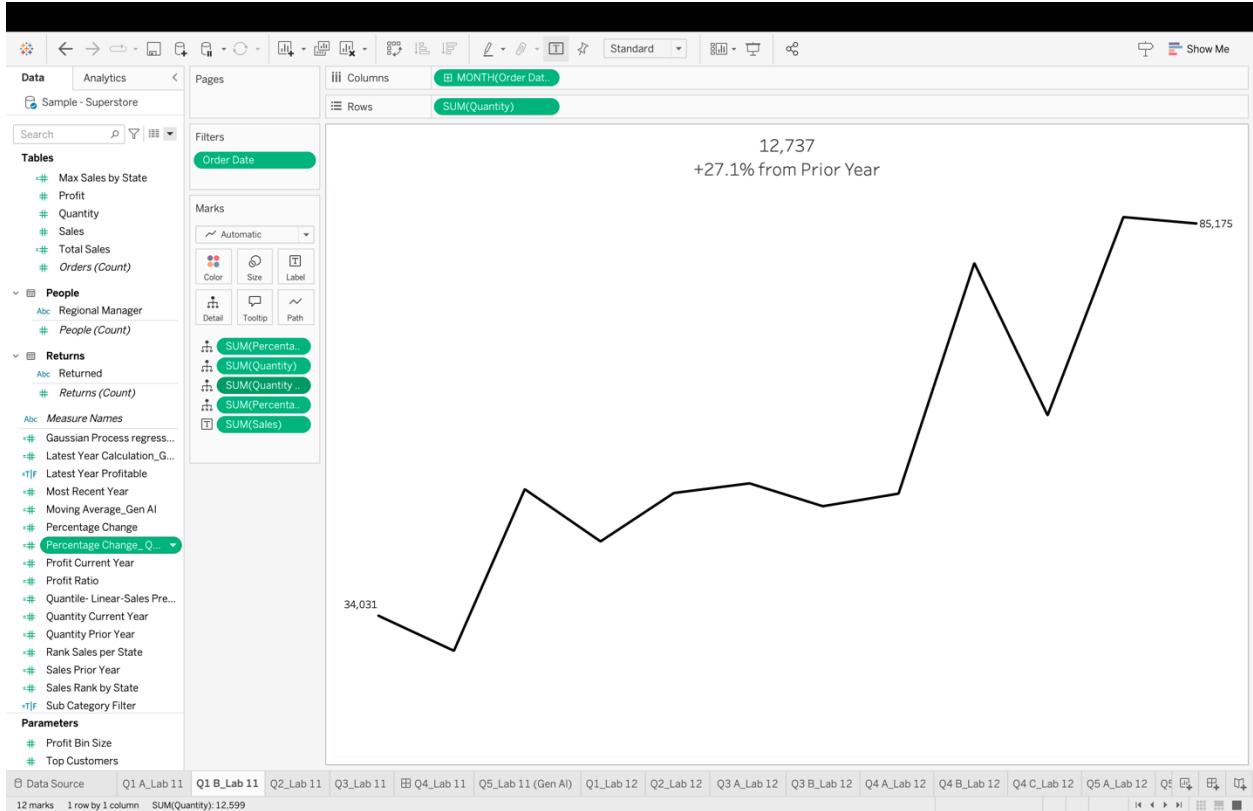


- b. Create calculated fields using LOD expressions for Quantity Current Year and Quantity Prior Year and calculate Percent Change in Quantity from Prior Year to Current Year. Create a calculated field

for most recent year – (see slide 17 from the lecture) Using these fields, create a Sparkline that shows change in Quantity over the last year. The visualization should show the KPI's displayed on the title.

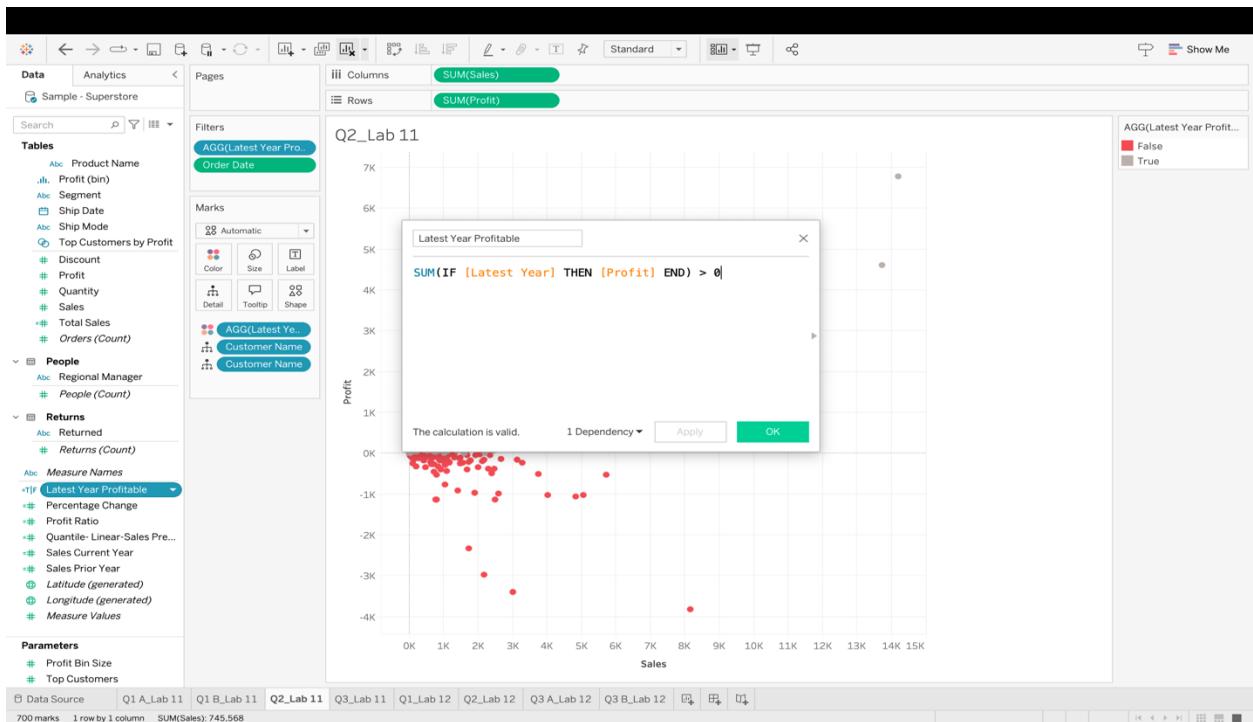
### Calculated Field:

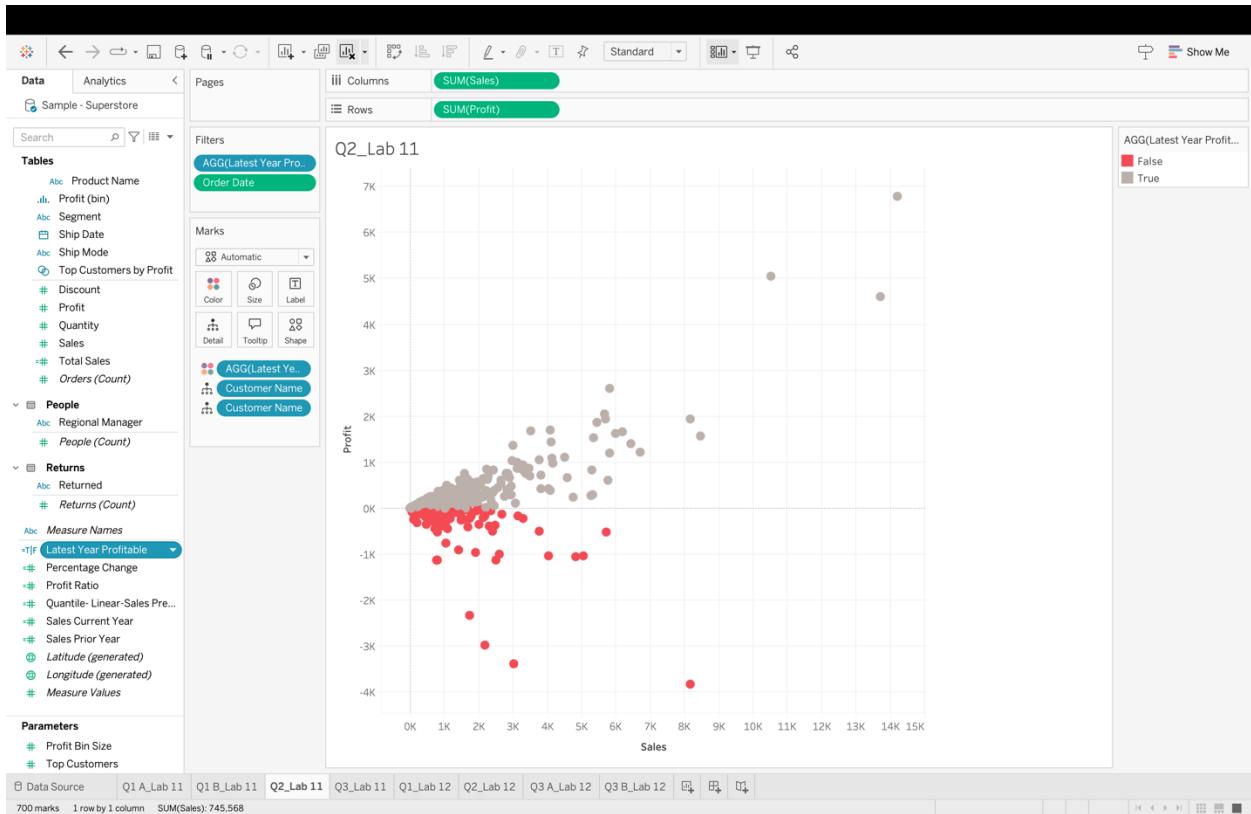




2. Create a scatterplot that displays Profit vs Sales by Customer for the latest year. Create the 'Latest Year Profitable' field from Slide 28 of the lecture and use it for Color. Filter by Latest Year and Latest Year Profitable field (exclude null values).

Calculated Field:

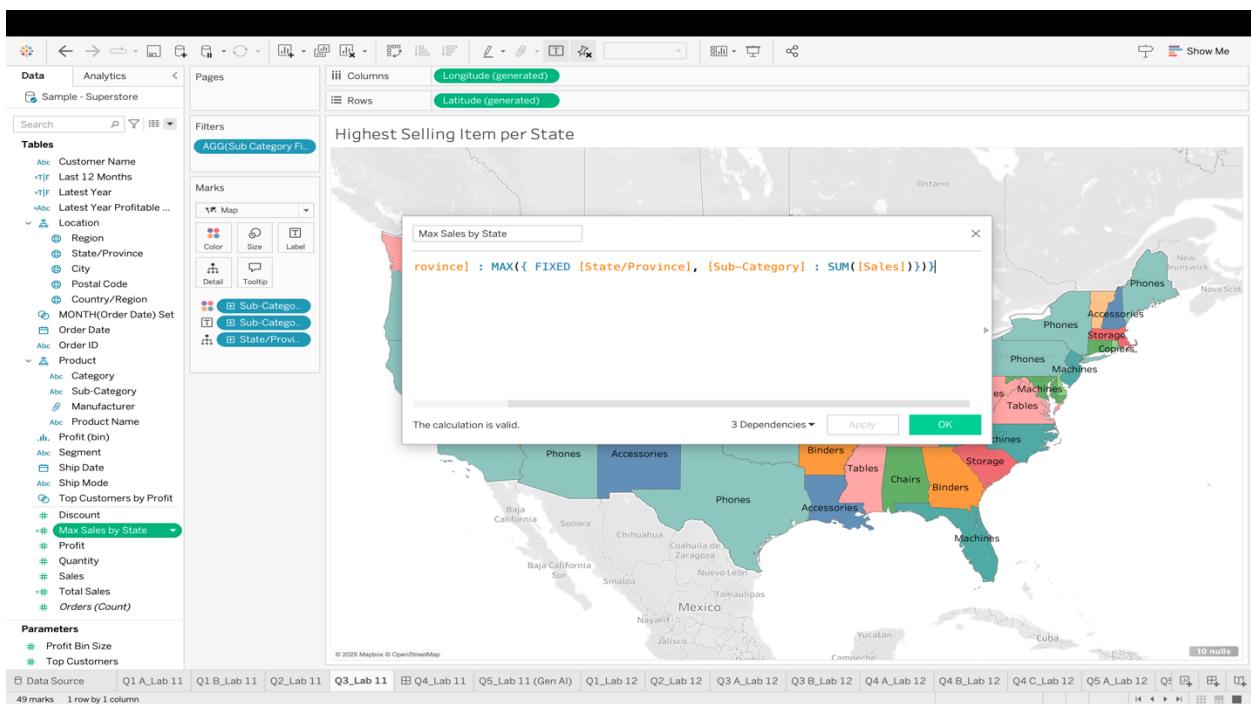


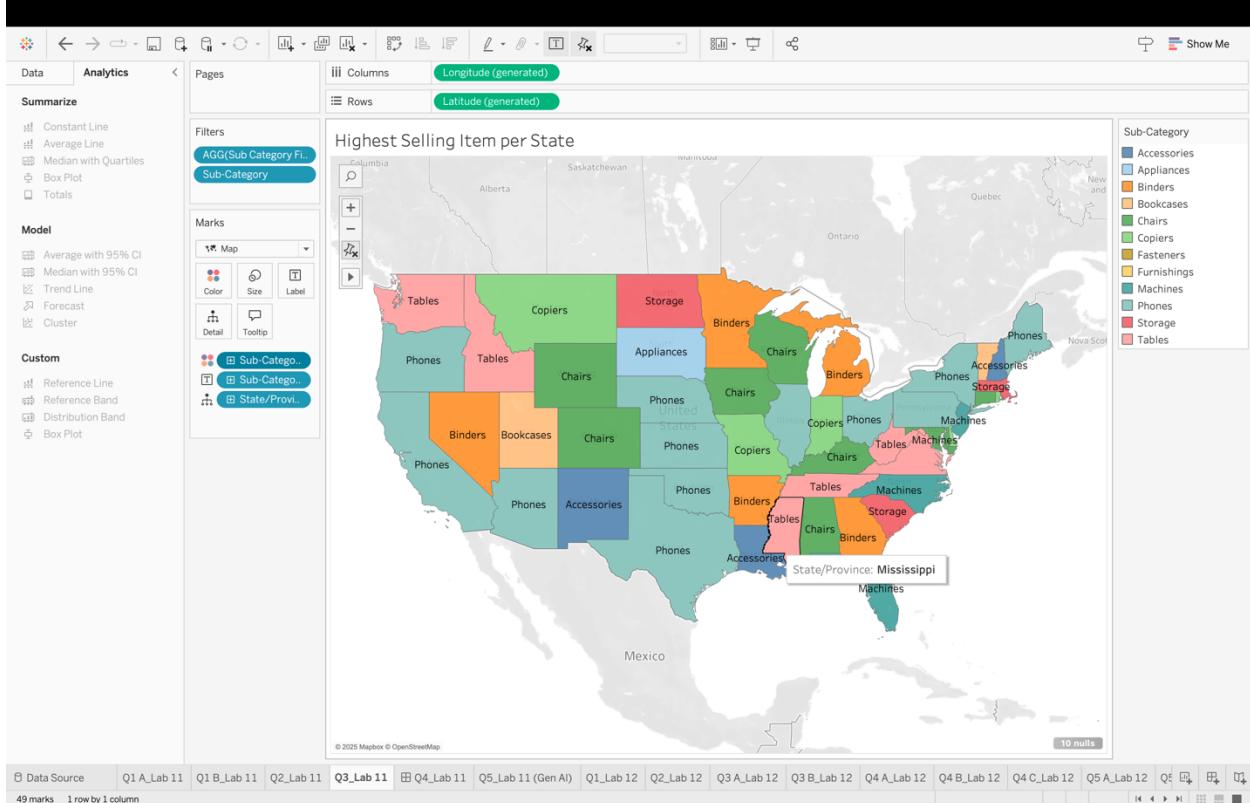
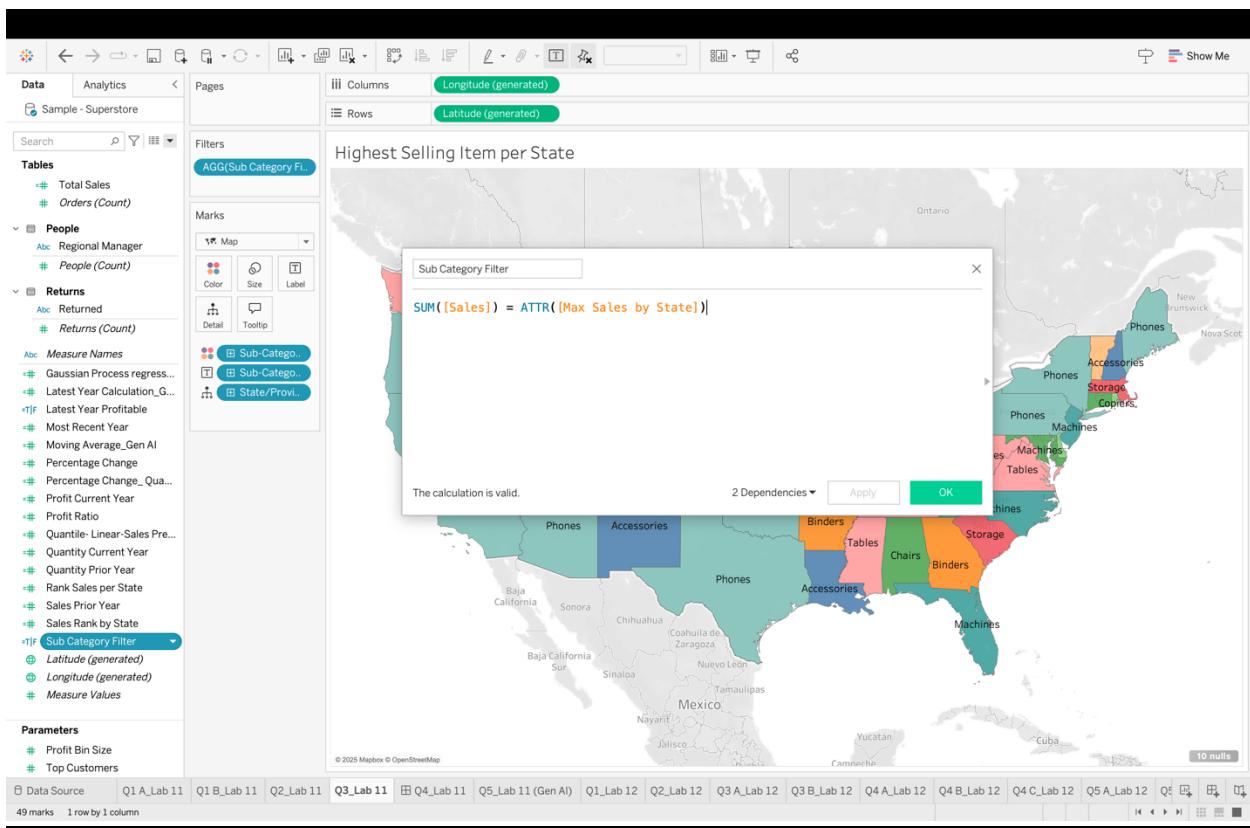


### 3. Find the Highest Selling Item per State with a Table Calculation.

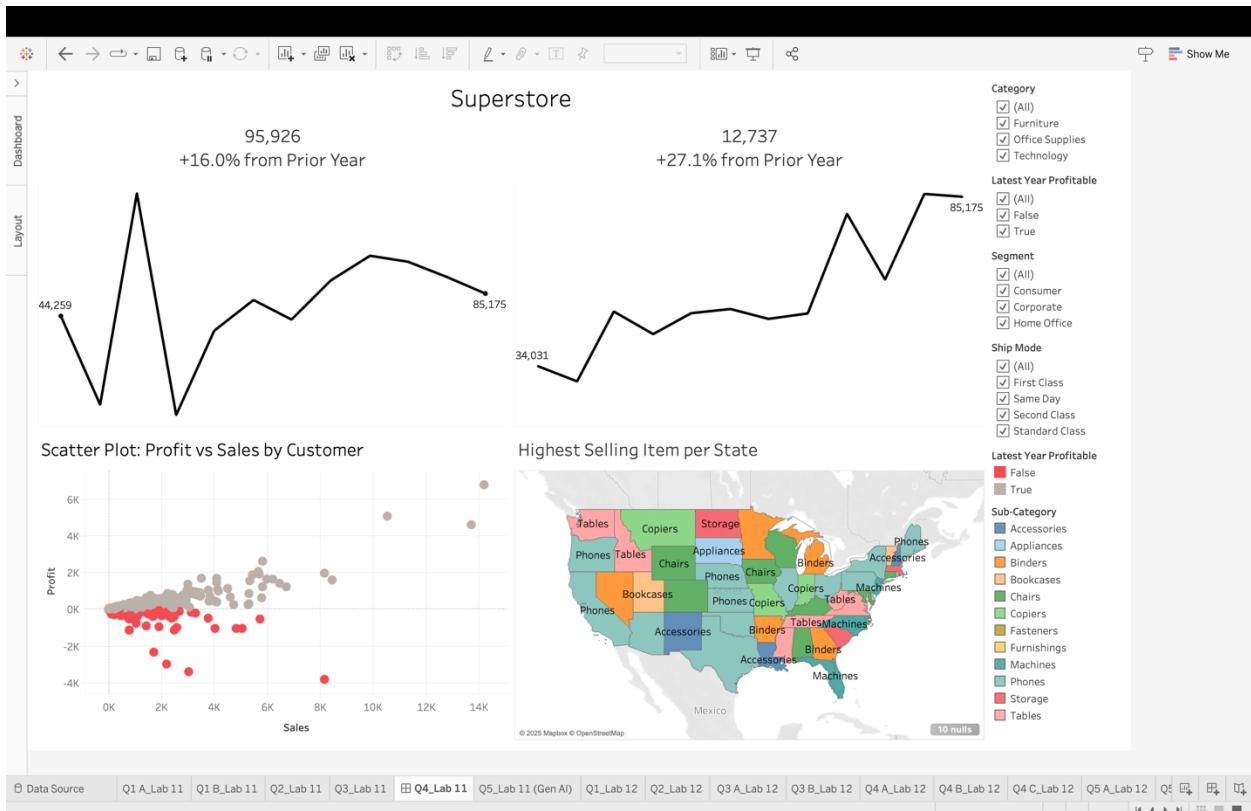
Hint: Create a Table with State, Subcategory and Sales. Then create a calculated field that ranks sales figures by sub-category per state. Select the highest selling item using a filter

Calculated Filter:





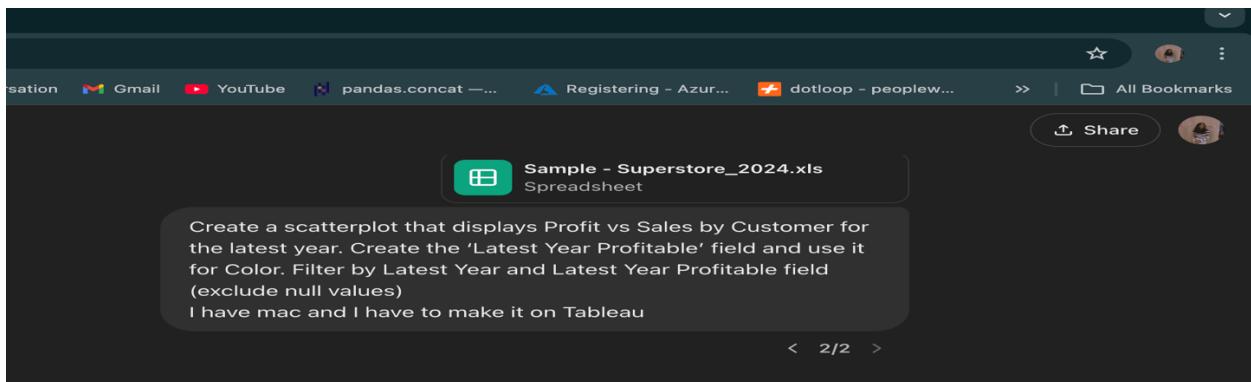
4. Create a dashboard with all the visualizations used in this Lab. Filter all the visualizations by Category, Segment and Ship Mode.



## 5. Gen AI and Prompt Engineering:

How do you think you can use AI bots to help with tableau tasks. Find one useful use case and document its solution.

Prompt:



Gen AI:

To create a scatterplot of Profit vs Sales by Customer for the Latest Year in Tableau, follow these steps:

**◆ Step 1: Create a Calculated Field for the Latest Year**

We need to determine the most recent year in the dataset.

**Latest Year Calculation**

```
sql
{ FIXED : MAX(YEAR([Order Date])) }
```

**◆ Step 2: Create a Field for Latest Year Profitability**

This field will determine if a customer was profitable in the latest year.

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If [Latest Year] is correctly computed, update your calculation for Latest Year Profitable as follows:

```
sql
IF YEAR([Order Date]) = { FIXED : MAX(YEAR([Order Date])) } THEN
    IF { FIXED [Customer Name]: SUM([Profit]) } > 0 THEN "Profitable"
    ELSE "Not Profitable"
END
ELSE
    NULL
END
```

**◆ Why This Fix Works**

1. `YEAR([Order Date]) = { FIXED : MAX(YEAR([Order Date])) }`
  - Ensures that only records from the latest year are considered.
2. `{ FIXED [Customer Name]: SUM([Profit]) }`
  - Aggregates profit per customer.

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**Final Steps in Tableau**

1. Drag `Customer Name` to Detail.
2. Drag `SUM(Sales)` to Columns.
3. Drag `SUM(Profit)` to Rows.
4. Drag `Latest Year Profitable` to Color.
5. Apply Filters:
  - Filter `YEAR([Order Date])` → Select { `FIXED : MAX(YEAR([Order Date]))` }.
  - Filter `Latest Year Profitable` → Exclude `NULL` values.

---

**Expected Outcome**

- The scatterplot should now display Profit vs Sales per customer, color-coded by "Profitable" and "Not Profitable".
- If the chart is still empty, check if your dataset actually contains sales and profit data for the latest year.

Try this and let me know if it works! 🚀

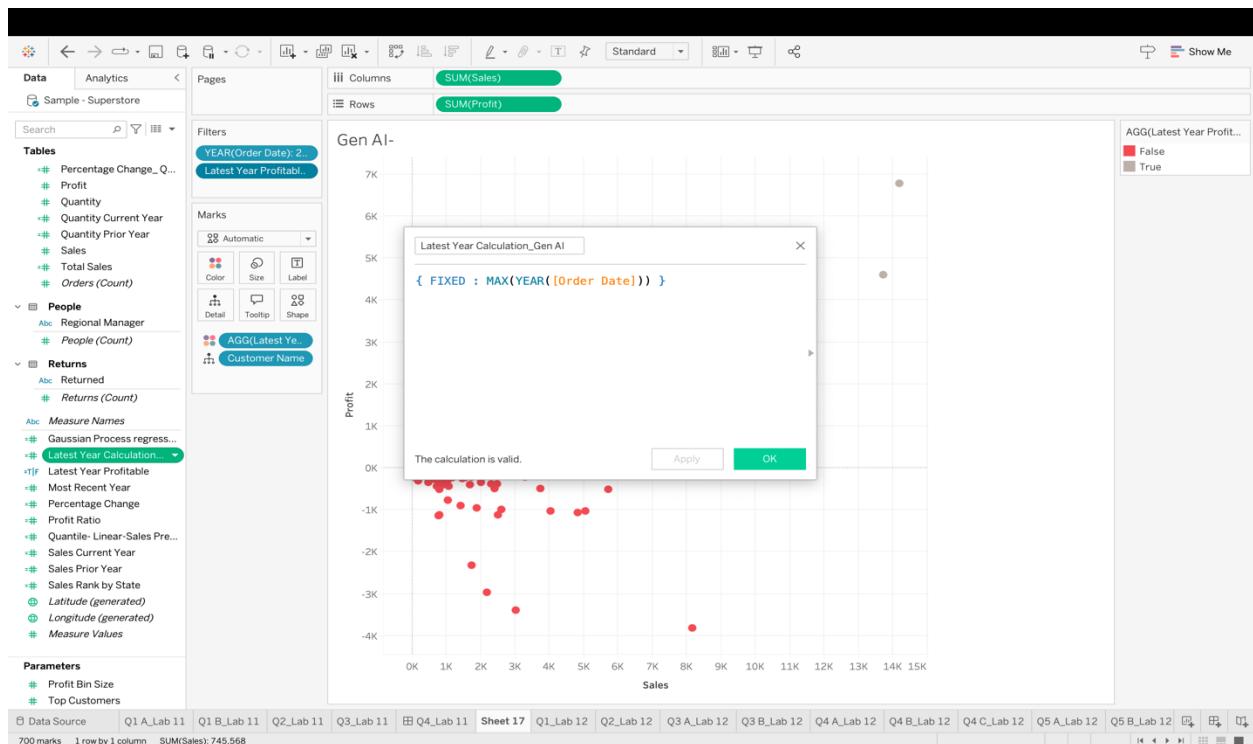
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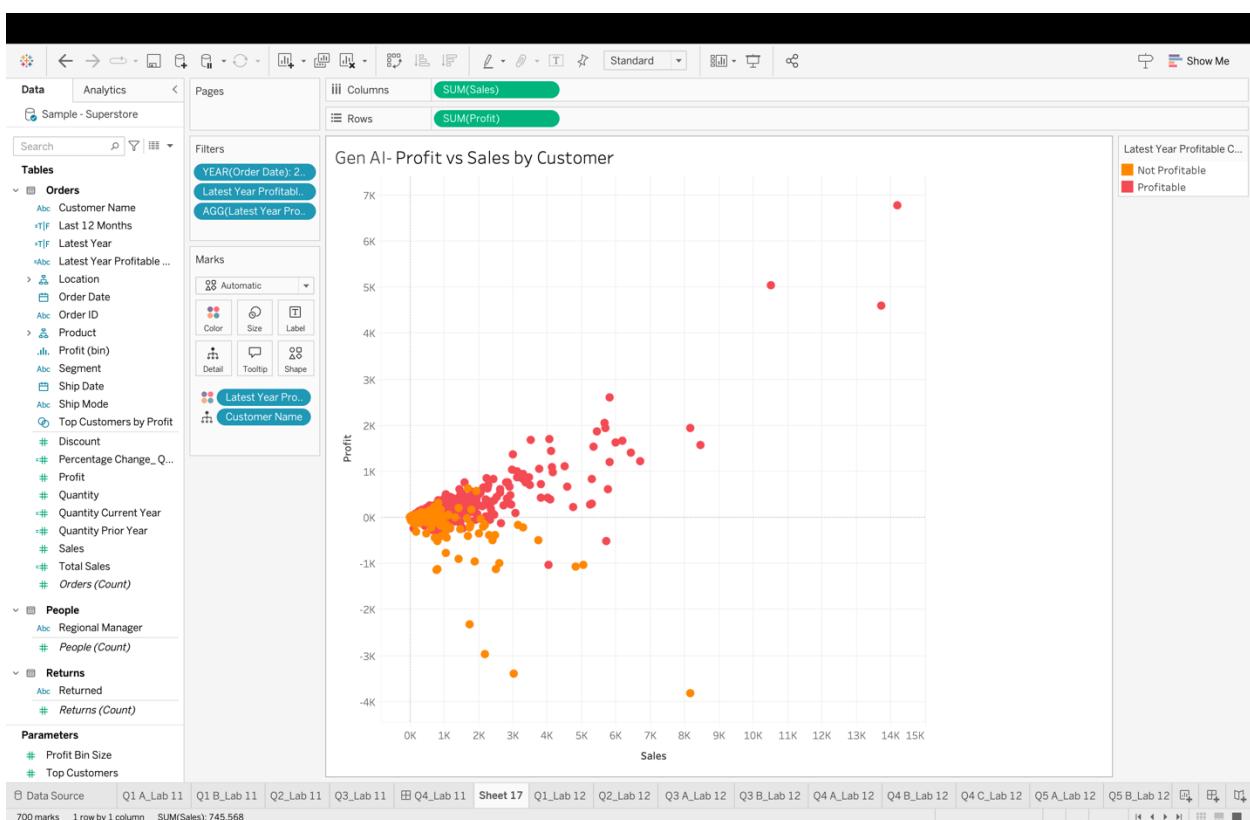
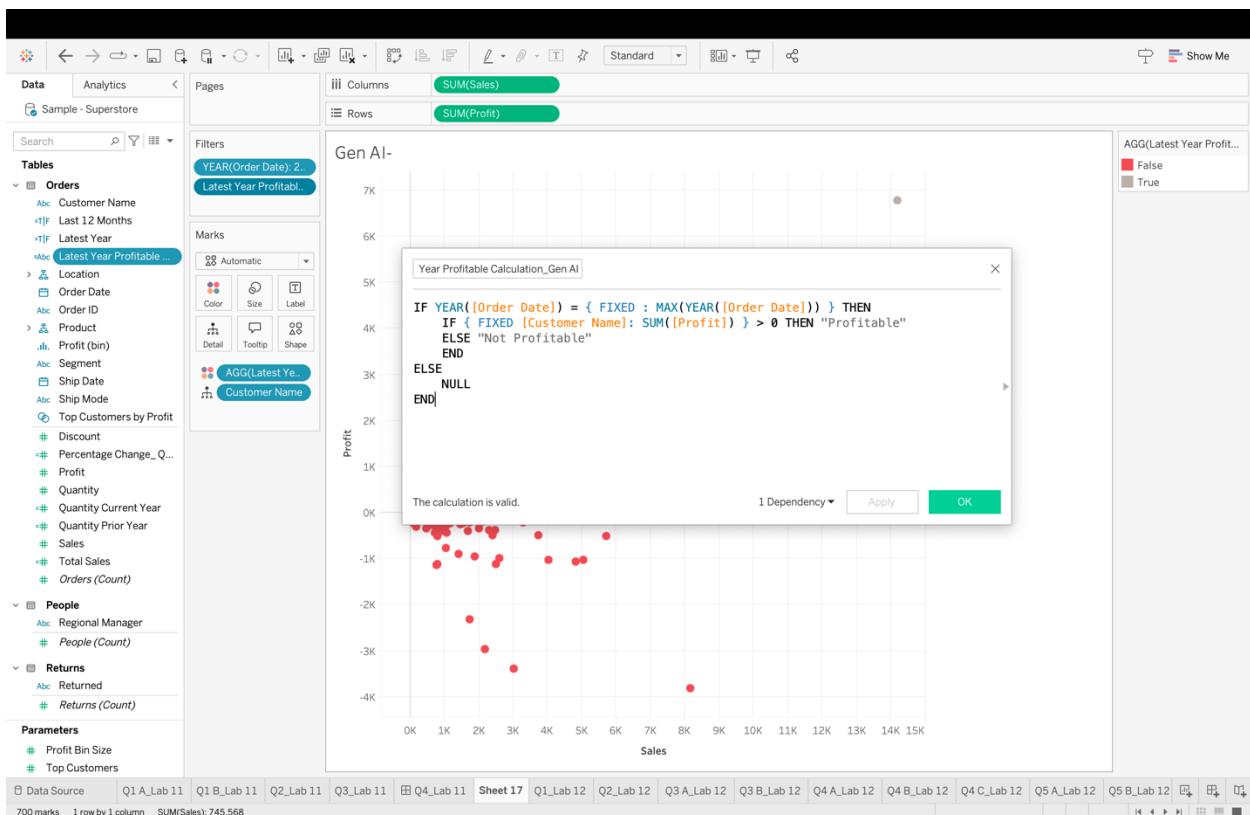
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## Tableau:

### Calculated Field:





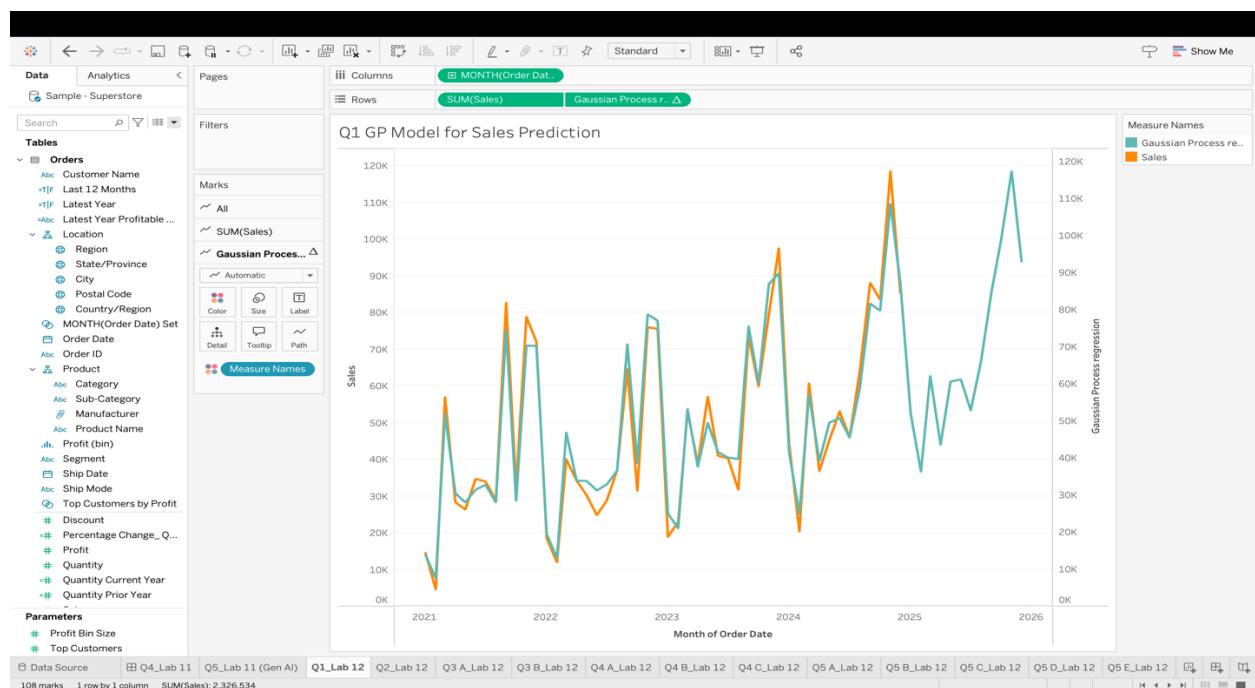
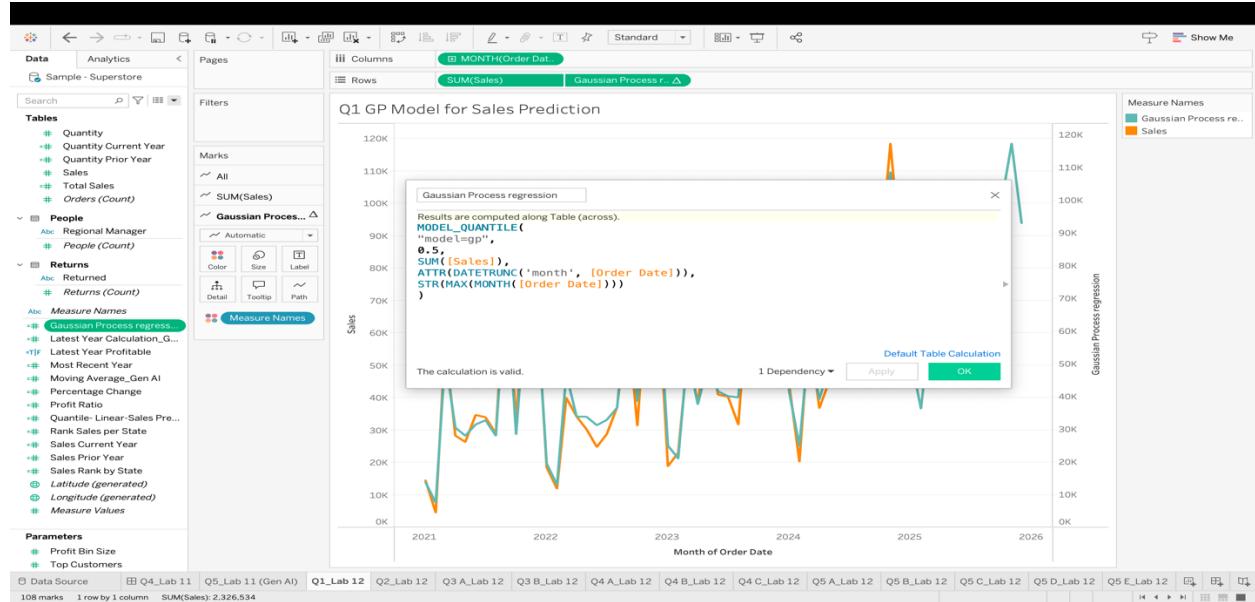
## Lab 12

Using the concepts from Regression and Forecasting in Tableau, answer the following questions:

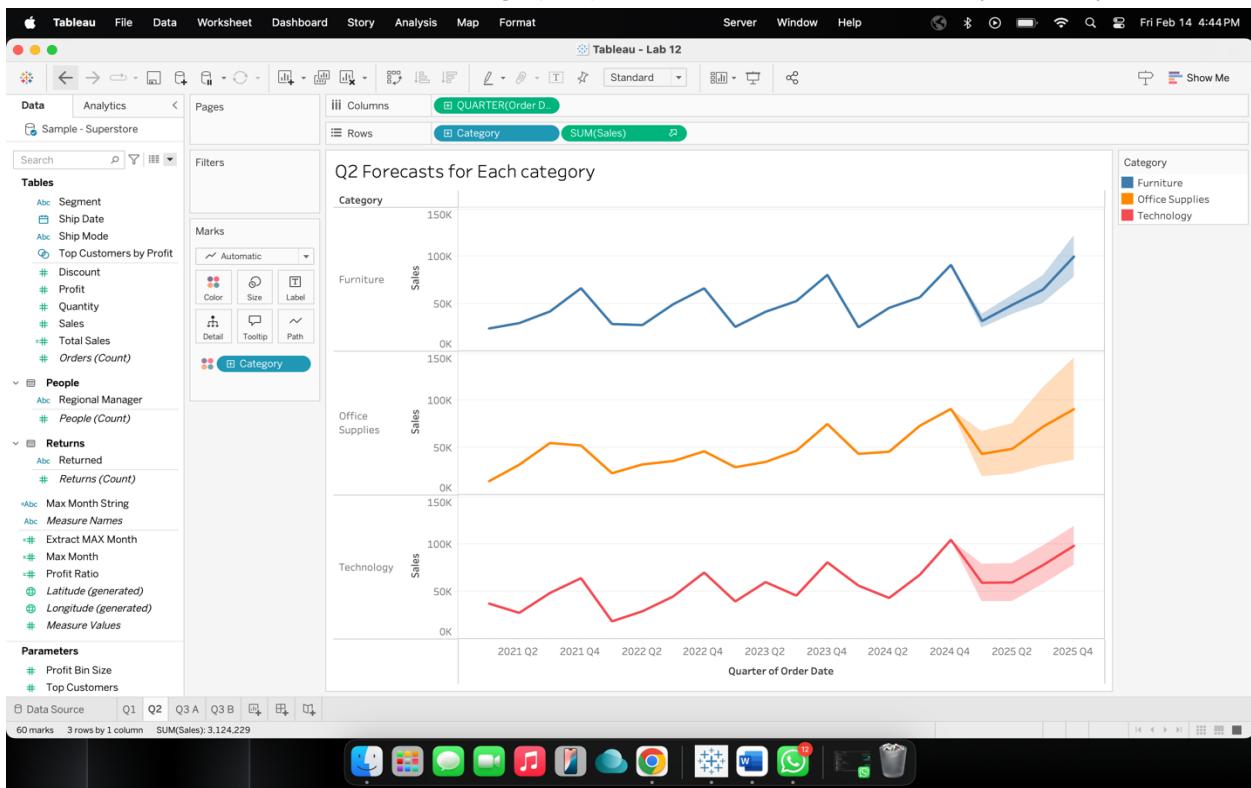
1. Create a Gaussian Process regression model to predict the Sales over the next 1 year. Your model should use the SUM of Sales as the target expression, and MAX MONTH of the Order Date along with the STRING of MAX MONTH of the Order Date as the predictor expressions.

What is the sales prediction for the next future 6 month from when the dataset ends? Your visualization should reflect your answer

Calculated Field:

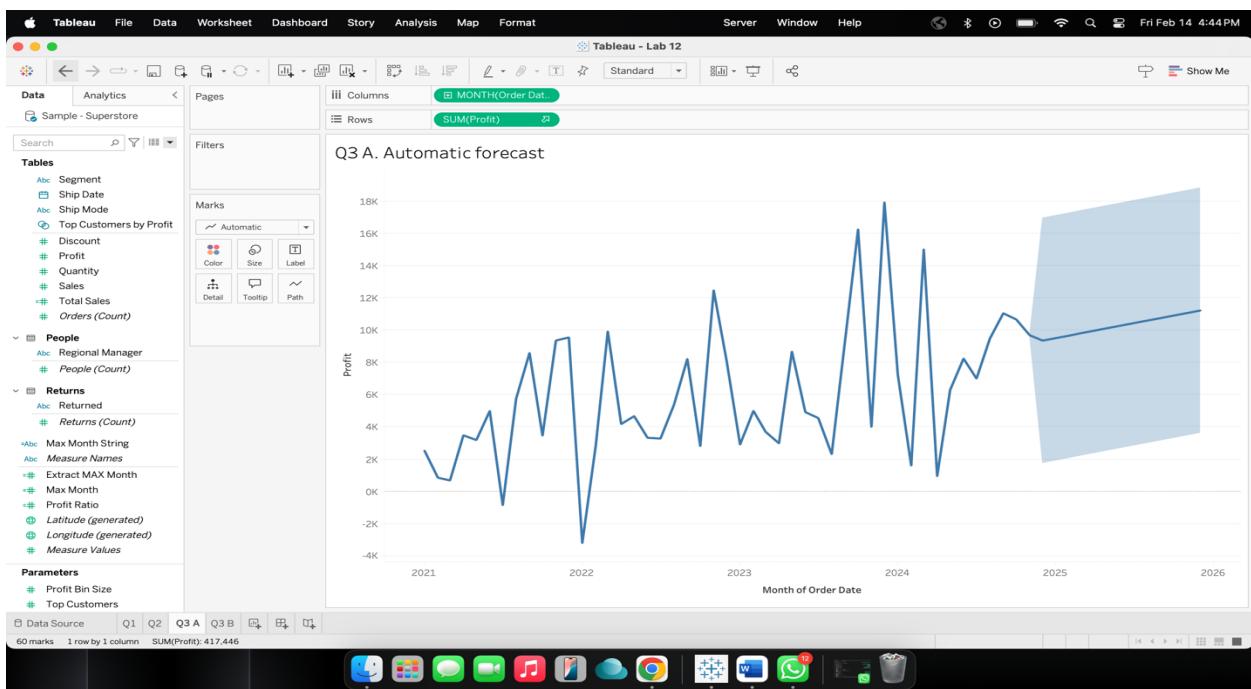


## 2. Create Sales Forecasts for Each category of products based on Order Date (Quarters).

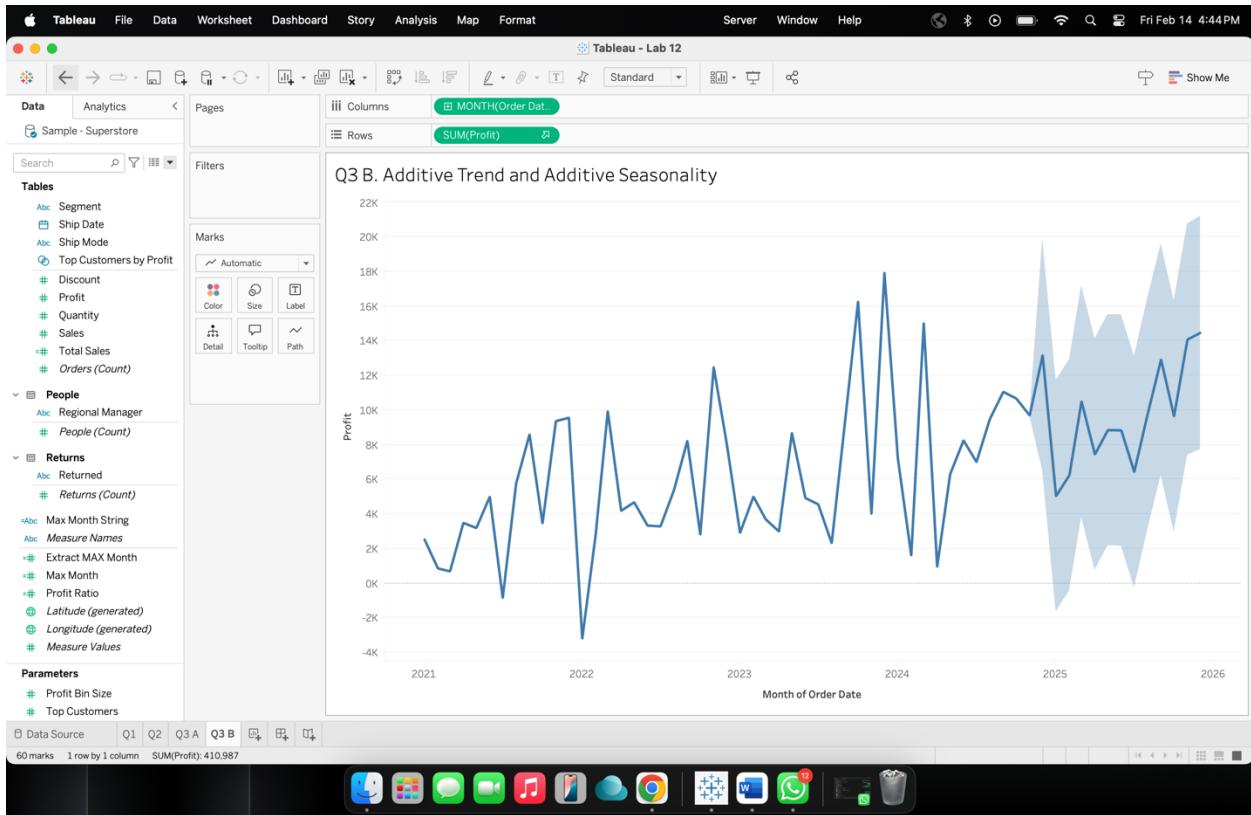


## 3. Create forecasts for Profits based on Order Date (Months). Show the results using the following models: automatic, and additive trend and additive seasons and answer these sub-questions:

- Automatic forecast



### - Additive Trend and Additive Seasonality



a) What is the forecasted profit for December 2026 used the two methods?

To determine the forecasted profit for December 2026 using the two methods:

#### **Automatic Model**

- This method automatically selects the best model for the given data.
- The forecasted profit for December 2026 can be found by hovering over the last predicted point in the chart.

#### **Additive Trend and Additive Seasonality Model**

- This model considers both a linear trend and repeating seasonal patterns.
- The forecasted profit for December 2026 is represented by the last prediction in the second chart.

b) Can you use the multiplicative trend and multiplicative seasonality method to forecast profits? Why or why not? You must answer this to some detail. Provide citations or hyperlinks you use to reach your conclusions.

Regarding using Multiplicative Trend and Multiplicative Seasonality:

This method would not be appropriate for this profit data for several key reasons:

#### **1. Negative Values:**

The profit data shows negative values (dips below 0 to -4K in early 2022). Multiplicative models cannot properly handle negative values because:

- Multiplicative decomposition assumes that seasonal variations are proportional to the level of the time series
- Negative values create mathematical issues when multiplying components
- The seasonal factor would not make logical sense with negative values

#### **2. Zero Values:**

The data appears to have values very close to zero, which also causes problems for multiplicative models because:

- Division by zero is undefined
- Very small values can create unstable seasonal factors

### 3. Pattern Characteristics:

- The data shows relatively constant variance
- The seasonal variations don't appear to increase with the level of the series
- These characteristics suggest additive models are more appropriate

#### Citation:

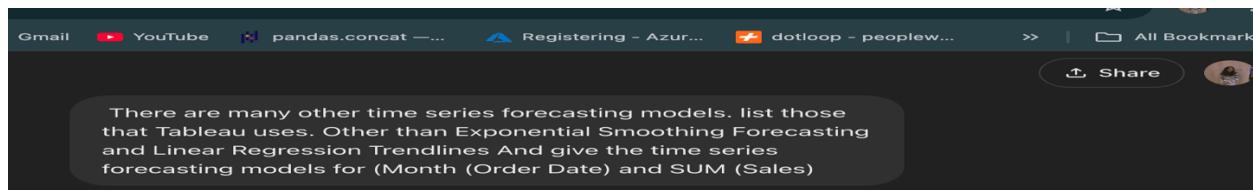
Tableau's official documentation: [https://help.tableau.com/current/pro/desktop/en-us/forecast\\_create.htm](https://help.tableau.com/current/pro/desktop/en-us/forecast_create.htm)

## 4. Gen AI and Prompt Engineering

There are many other time series forecasting models. Ask your AI bot to list those that Tableau uses. Use two new forecasting models from the list that AI bot provides. Ask AI bot to use the two and apply them to our time series we did in Sheet1: (Month (Order Date) and SUM (Sales)). Compare with the results we generated during the class lecture. Ask AI bot, if it can, to provide insight about the different forecasting models, which is better and why. If AI bot fails, generate the insight yourself as an intelligent Data Analytics expert.

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Prompt:



Gen AI:

**Other Time Series Forecasting Models in Tableau**

Apart from Exponential Smoothing Forecasting and Linear Regression Trendlines, Tableau also supports:

1. **ARIMA (AutoRegressive Integrated Moving Average)** – Used for advanced time series forecasting with trends and seasonality.
2. **Moving Average Forecasting** – Uses the average of past values to predict future data points.
3. **Seasonal Naïve Forecasting** – Assumes that future values will follow the same seasonal pattern as past data.
4. **Median Forecasting** – Predicts future values based on the median of historical data.

**Time Series Forecasting for (Month (Order Date) and SUM(Sales))**

To apply forecasting in Tableau for Month (Order Date) and SUM(Sales):

Steps to Apply Forecasting in Tableau:

1. Create a Time Series Line Chart
  - Drag Month(Order Date) to the Columns shelf.

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**Time Series Forecasting for (Month (Order Date) and SUM(Sales))**

To apply forecasting in Tableau for Month (Order Date) and SUM(Sales):

Steps to Apply Forecasting in Tableau:

1. Create a Time Series Line Chart
  - Drag Month(Order Date) to the Columns shelf.
  - Drag SUM(Sales) to the Rows shelf.
2. Enable Forecasting
  - Click on the Analytics Pane → Drag Forecast into the view.
3. Customize Forecasting Model
  - Click on the forecast → Edit Forecast → Choose Custom.
  - Try different models like:
    - **Automatic (Best Fit)** – Tableau selects the best model.
    - **Moving Average** – Smooths fluctuations and detects trends.
    - **ARIMA (if available)** – For advanced forecasting.

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## How to Try Different Forecasting Models in Tableau?

To apply and experiment with different forecasting models in Tableau for Month(Order Date) and SUM(Sales):

---

**1 Create the Time Series Visualization**

1. Open Tableau and connect to your dataset (*Sample-Superstore* in your case).
2. Drag "Order Date" to Columns → Right-click it and choose Month (Continuous).
3. Drag "Sales" to Rows → Tableau will create a line chart.
4. Ensure that the aggregation for Sales is SUM (Tableau does this by default).

---

**2 Add a Forecast in Tableau**

1. Go to the Analytics Pane (found on the left side next to the Data Pane).
2. Drag "Forecast" onto the View → This will automatically generate a forecast line in your graph.

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## 3 Customize the Forecast Model

1. Right-click on the Forecast line and select Edit Forecast.
2. In the Forecast Options Window, you can modify:
  - Forecast Length → Choose how many future months you want to predict.
  - Forecast Model → Select one of the following:
    - Automatic (Best Fit) → Tableau picks the best model.
    - Custom → Allows you to try different models manually.
3. If you choose Custom, select:
  - Trend Models:
    - None (No trend)
    - Additive Trend (Linear Growth)
    - Multiplicative Trend (Exponential Growth)
  - Seasonal Models:
    - None (No seasonality)
    - Additive or Multiplicative Seasonality (Based on recurring patterns).

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## 4 Try Different Forecasting Methods

Automatic (Best Fit)

- How?
  - Set the model to **Automatic** and let Tableau choose the best forecasting approach based on your data.

Moving Average (Manual Workaround)

- How?
  - Instead of a forecast, create a **Moving Average Calculation** using a calculated field:

```
plaintext
```

```
WINDOW_AVG(SUM([Sales]), -3, 0) // 3-month moving average
```

ARIMA (If Available)

- How?
  - Tableau does not provide ARIMA directly, but you can integrate it via R or Python (TabPy) for advanced time series forecasting.

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Drag this calculated field to your visualization.

ARIMA (If Available)

- How?
  - Tableau does not provide ARIMA directly, but you can integrate it via R or Python (TabPy) for advanced time series forecasting.
  - Use Python (TabPy) to apply ARIMA if needed.

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**5 Interpret the Forecast**

- Hover over the forecast line to see Predicted Values, Confidence Intervals, and Model Type.
- Adjust the **forecast length** to see how predictions change.

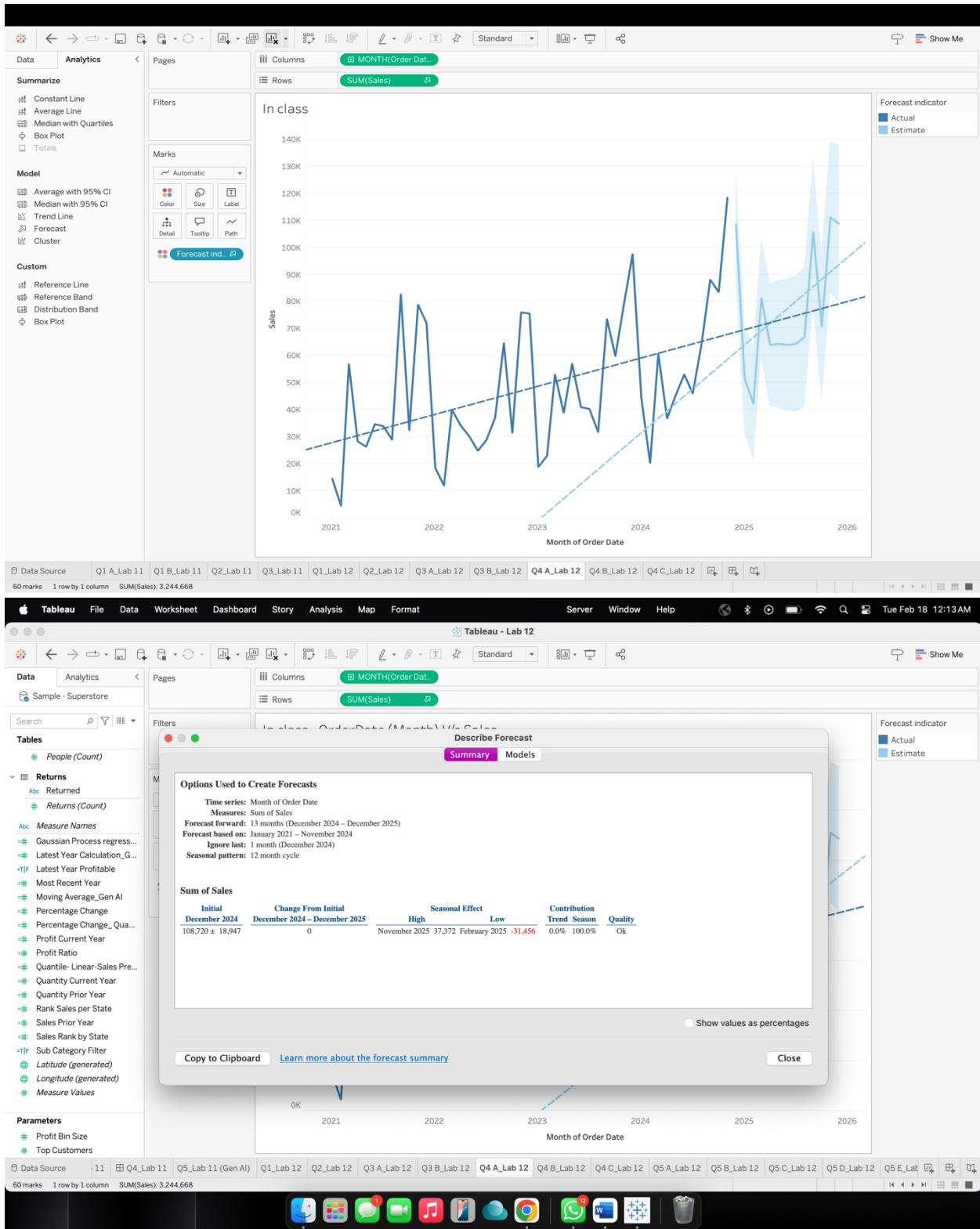
Try these steps and let me know if you need fine-tuning!

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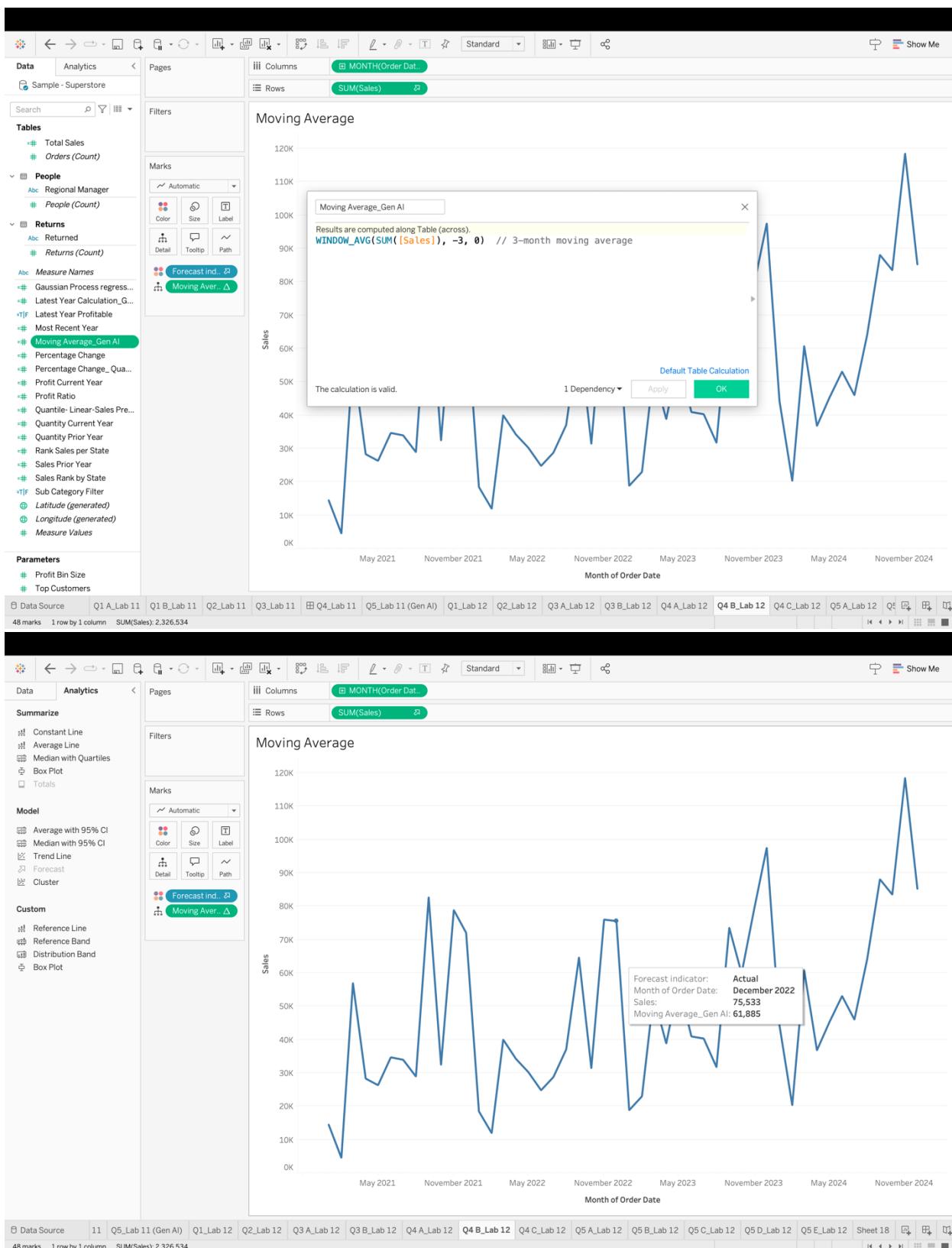
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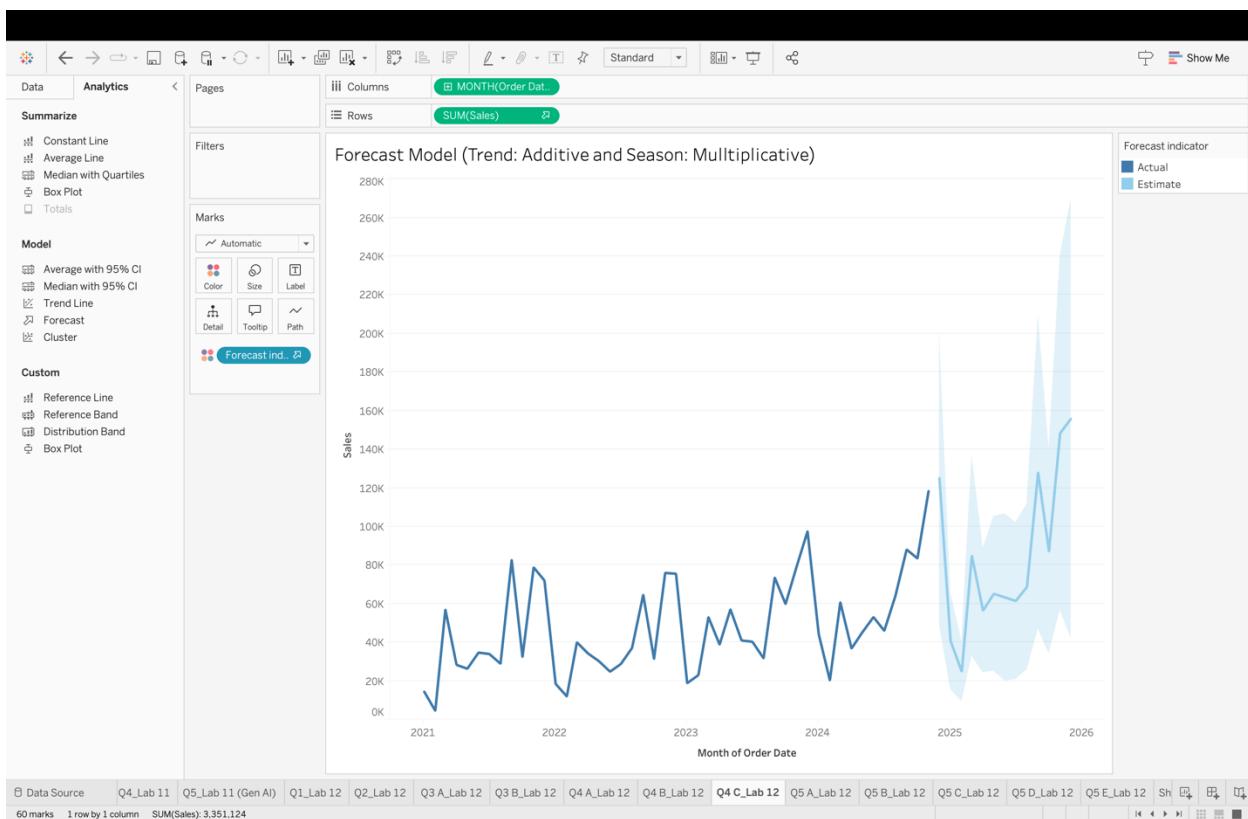
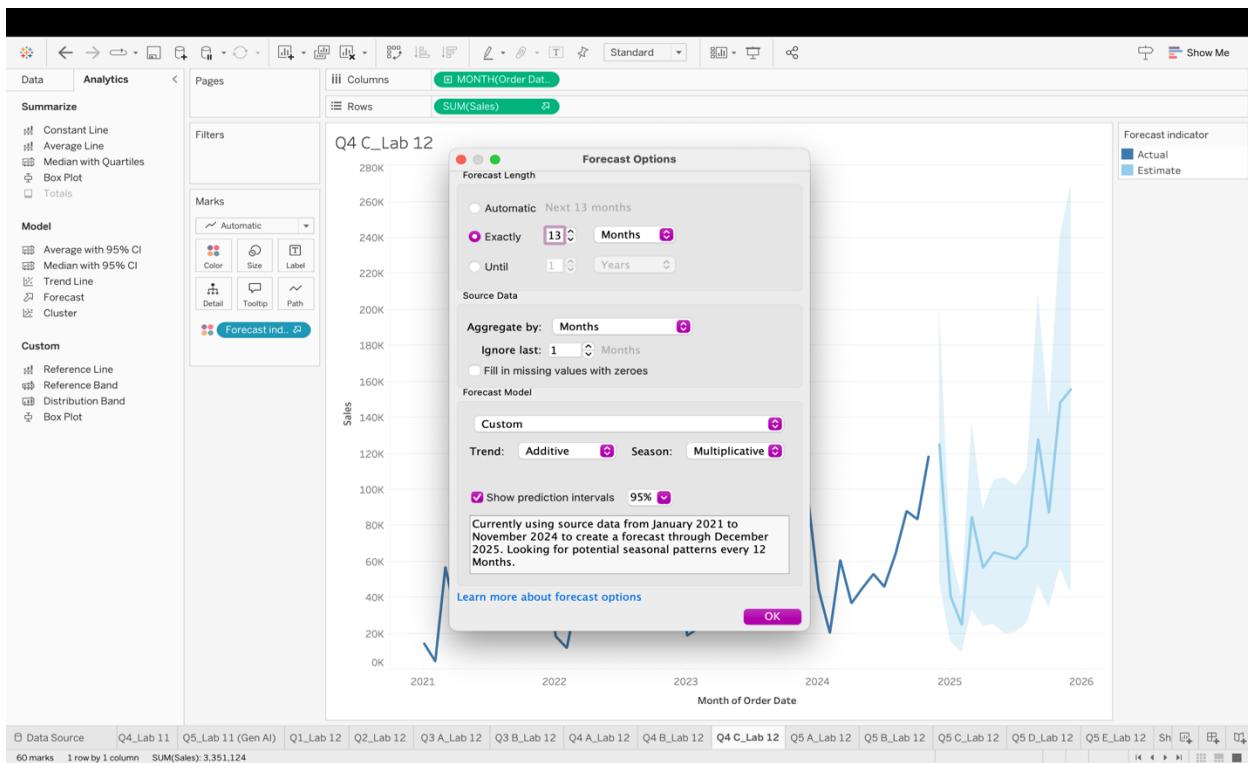
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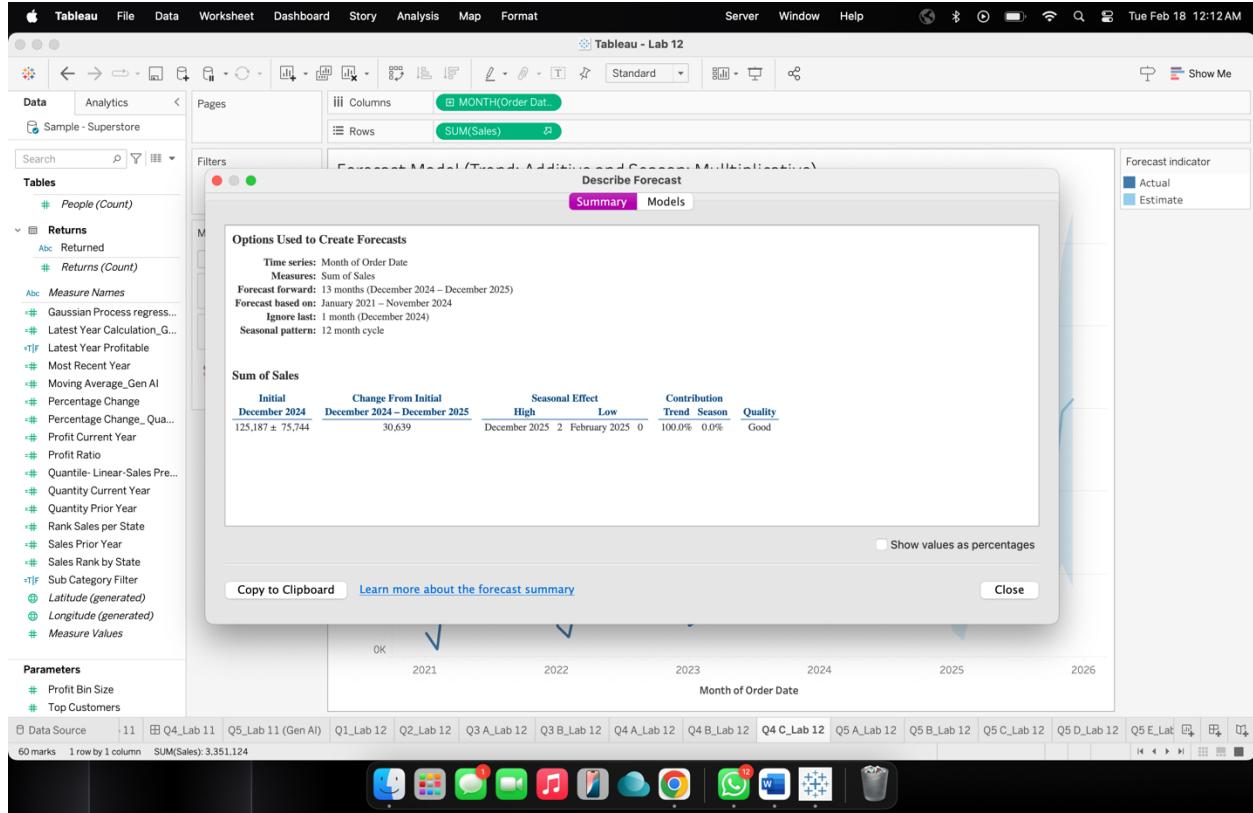
## In-Class – Exponential Smoothing Forecasting and Linear Regression Trendlines



## ChatGPT Solution:



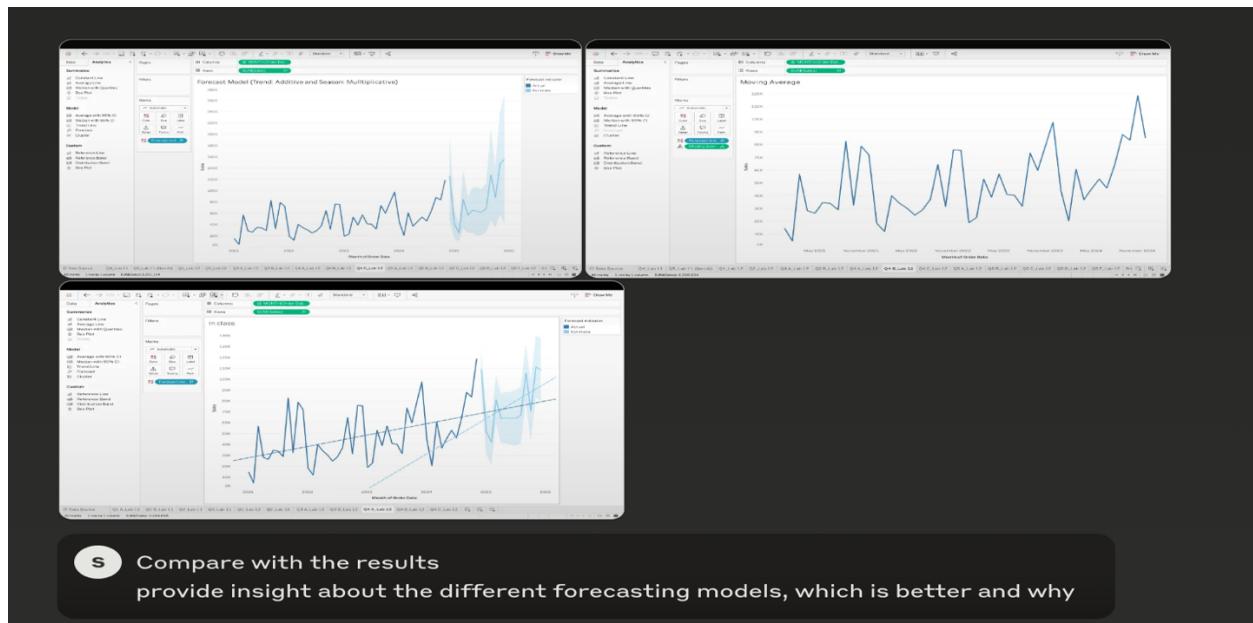




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Insights

Prompt:



Claude Q Compare with the results provi... ▾

Let me analyze the three different forecasting visualizations shown:

1. Forecast Model (Trend: Additive and Season: Multiplicative):
  - Shows both historical data (solid blue line) and forecasted values (light blue with confidence interval)
  - Captures both the upward trend and seasonal patterns
  - The confidence interval widens as it projects further into the future, indicating increasing uncertainty
  - Predicts continued growth while maintaining seasonal fluctuations
2. Moving Average:
  - Smooths out the historical data to show the general trend
  - Helps reduce noise in the data and makes the pattern more visible
  - Shows clear cyclical peaks and troughs
  - Doesn't provide future predictions
3. In Class (Linear Trend):
  - Shows historical data with two trend lines
  - The dashed lines represent linear trends fitted to the data
  - Suggests a steady upward trend over time
  - Includes forecasted values with confidence intervals
  - Simpler model that may miss seasonal patterns

Reply to Claude...

Claude 3.5 Sonnet Choose style ▾

Claude Q Compare with the results provi... ▾

Among these models, the Additive-Multiplicative model (first image) appears to be the most appropriate because:

1. It accounts for both trend and seasonality:
  - Captures the overall upward trend in the data
  - Preserves the seasonal patterns visible in the historical data
  - The multiplicative seasonal component allows for increasing amplitude of seasonal variations as the trend grows
2. More realistic uncertainty representation:
  - Shows widening confidence intervals for future predictions
  - Acknowledges that uncertainty increases as we forecast further into the future
3. Better fit to historical patterns:
  - The forecast appears to follow the historical patterns more closely
  - Maintains the characteristic peaks and troughs seen in the data

The Moving Average is useful for understanding historical patterns but doesn't provide forecasts. The linear trend model is too simplistic as it assumes a constant rate of growth and doesn't capture the seasonal variations effectively.

For this dataset, which shows clear seasonality and an upward trend with varying amplitudes, the Additive-Multiplicative model would be the most reliable for forecasting future values while accounting for the complex patterns in the data.

Would you like me to elaborate on any specific aspect of these models or their comparisons?

Reply to Claude...

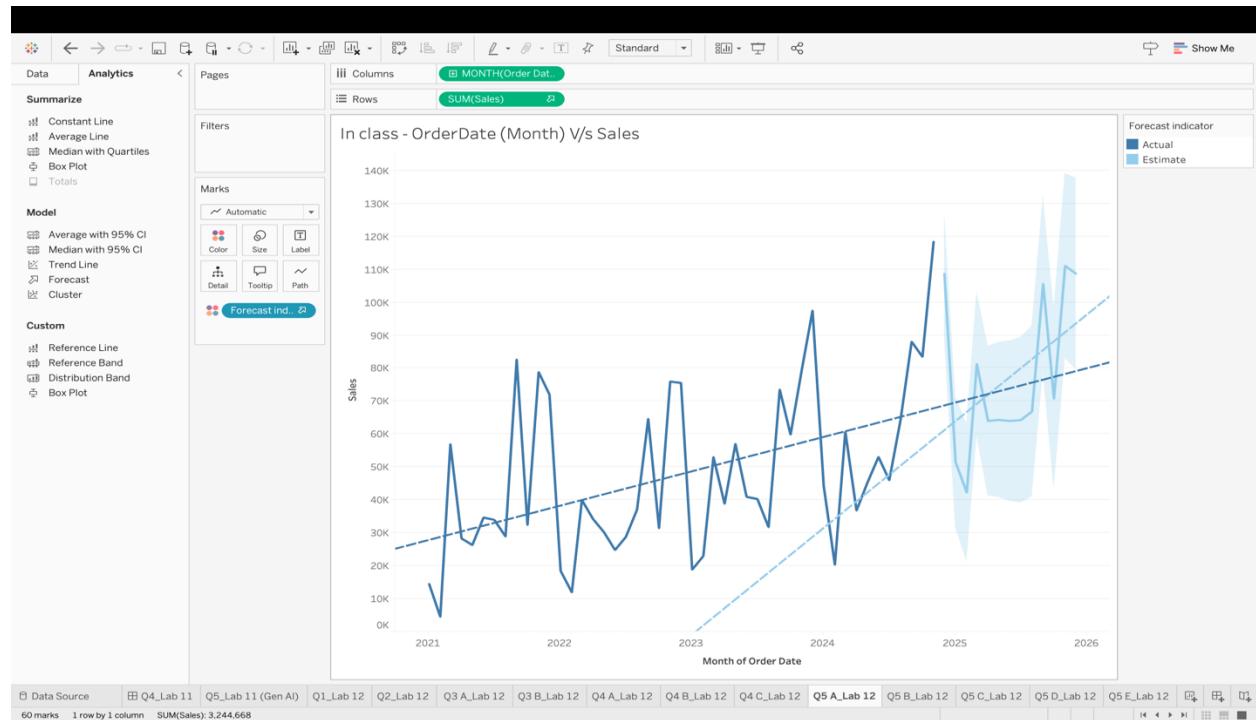
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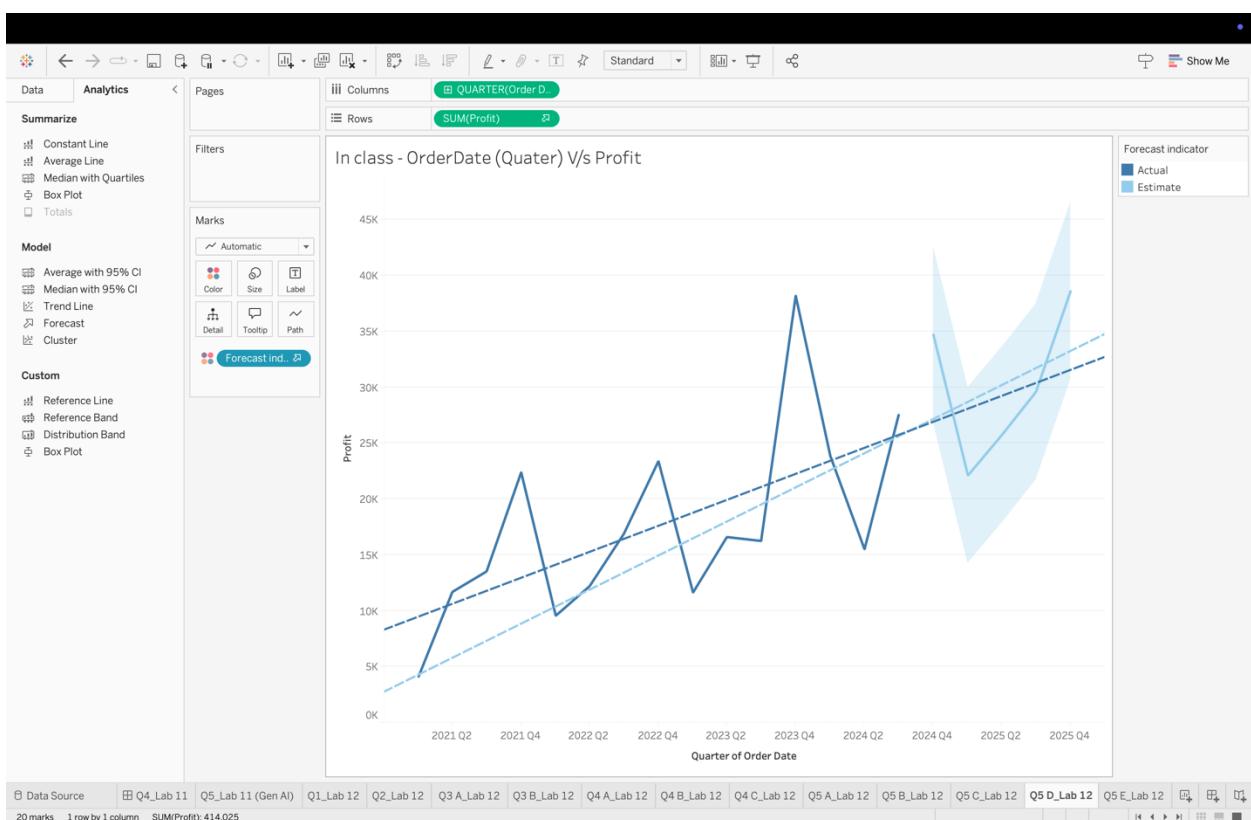
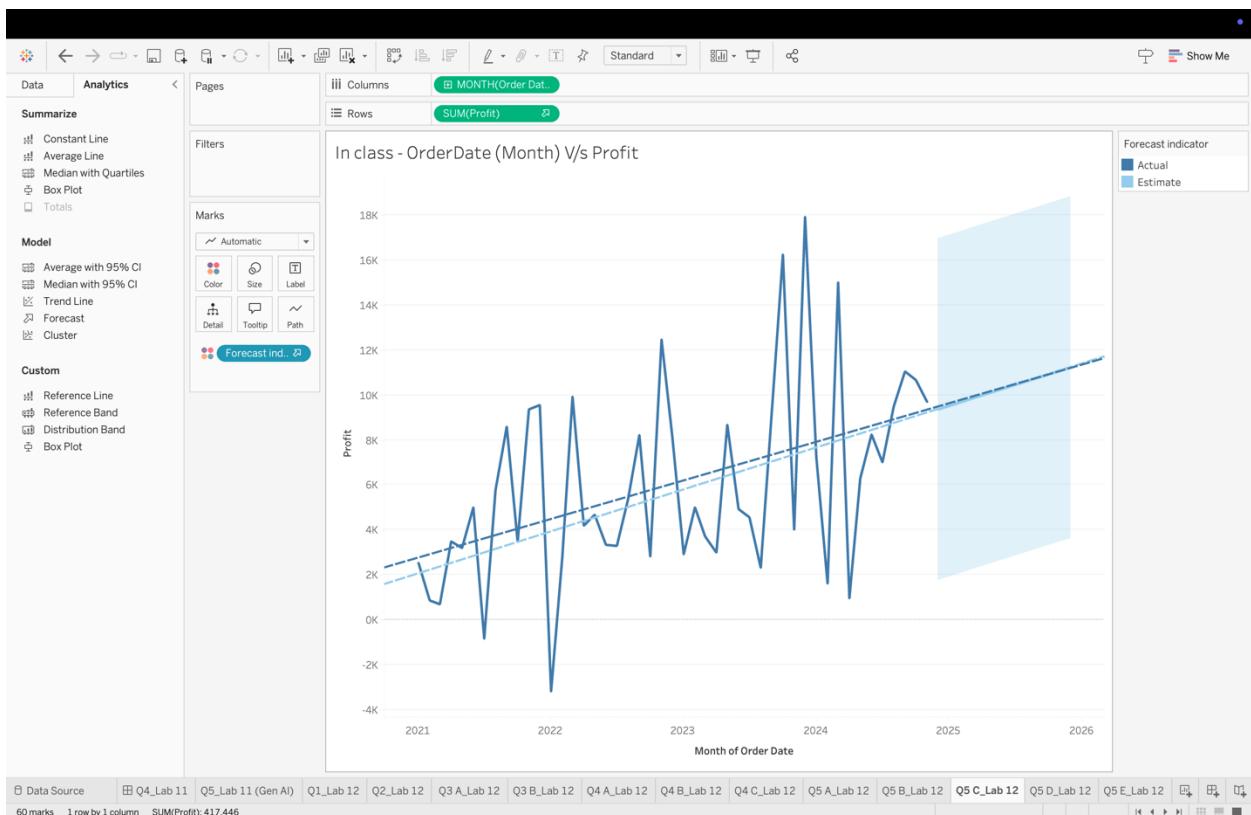
## 5. Gen AI and Prompt Engineering

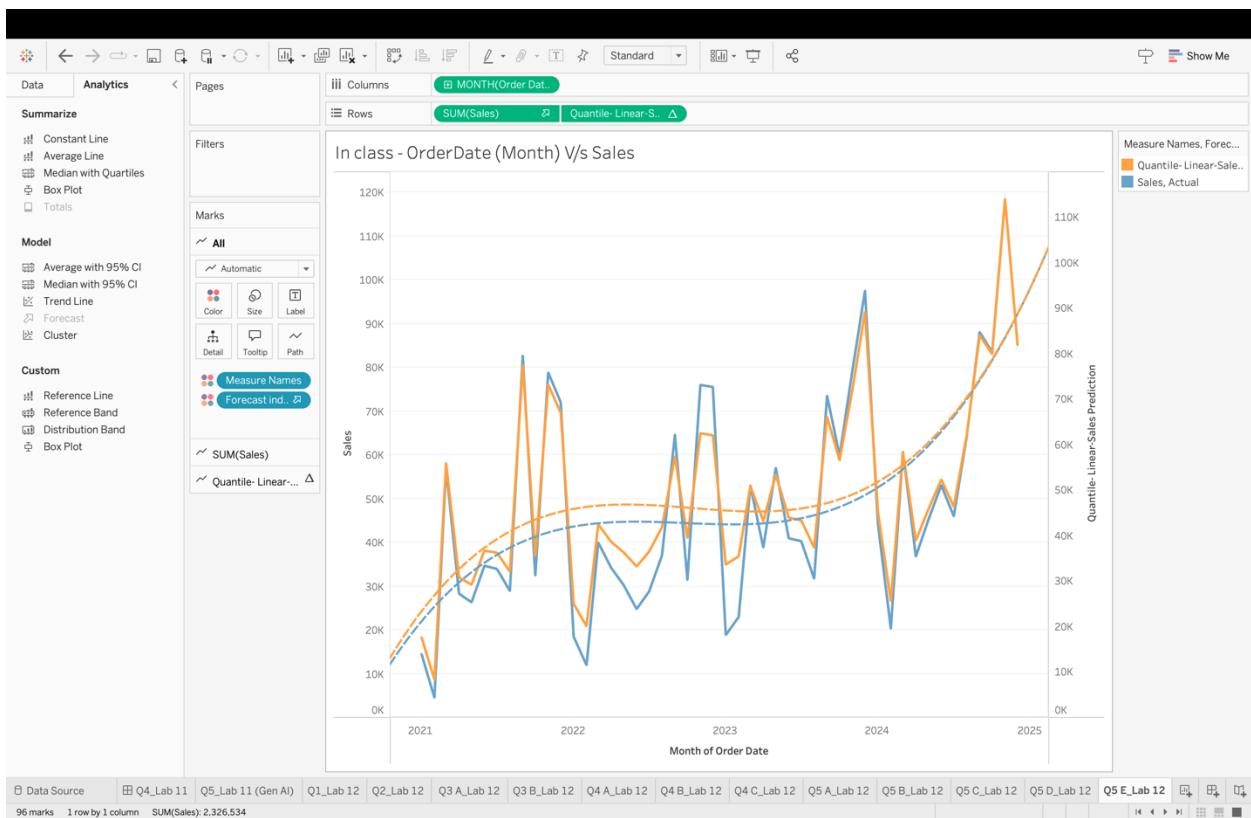
During class, using sample – superstore dataset, we created time series of Sales over time (using month option). We also created a trend line for the time series. We then created a forecast model. After we create the forecast model, Tableau creates a new trend line for the forecast and leaves the previous one. You now have two trend lines: Actual and Estimate. Each has its own intercept and slope. Use your AI bot to explain/interpret the slope of the estimate in comparison to the actual. If the estimate slope is higher than the actual slope, does it mean that the forecast model overshoots, i.e. overestimates the forecast (future sale) value (not known now) compared to the future actual value (also not known now). Conversely, if estimate slope is lower than actual slope, does the forecast model undershoots (underestimates) the future sales. Ask your AI bot, what does it mean, how to use in decision making; i.e. if the forecast model overshoots, we reduce its forecast value by a percentage (perhaps look at ratio of both slopes and decide), i.e. use 80% of forecast for planning purposes. Or, if the forecast model undershoots, increase its forecast value by a percentage, i.e. use 120% of forecast for planning purposes. Submit an insightful report. This is a very interesting problem.

### I am using Claude.ai

In class - forecast model (trend lines: Actual and Estimate)







Prompt:

Claude Time Series Forecasting of Monthly Sales and Profit

**S** These are give time series forecasting of Months by Sales/Profit. Interpret the slope of the estimate in comparison to the actual of all the given images

Reply to Claude...

Claude 3.5 Sonnet Choose style

## Gen AI Solution:

Claude Time Series Forecasting of Monthly Sales and Profit ▾

Let me analyze the slope patterns in these time series forecasts:

1. Monthly Sales (Image 1):
  - The actual sales (dark blue line) shows high volatility with values ranging from about 10K to 120K
  - The forecast trend line (dotted) shows a steady upward slope
  - The actual trend appears to be steeper than the forecast, suggesting the model may be underestimating the growth rate
  - The confidence interval (light blue area) widens significantly into the future, indicating increasing uncertainty
2. Quarterly Sales (Image 2):
  - Less volatile than monthly data but still shows significant fluctuations
  - Both actual and forecast lines show positive slopes
  - The forecast slope appears more conservative than the actual trend
  - Similar widening confidence interval in future periods
3. Monthly Profit (Image 3):
  - High volatility in actual profits, ranging from -4K to 18K
  - The forecast trend shows a gradual upward slope
  - Actual profit growth appears to be outpacing the forecast
  - Some negative profit periods in early 2022
  - Wide confidence intervals in the forecast period
4. Quarterly Profit (Image 4):
  - Smoother trend compared to monthly data
  - Clear upward trajectory in both actual and forecast
  - Forecast slope is slightly more conservative than the actual trend
  - Notable spike in profits around 2023 Q4 to about 38K

Reply to Claude...  

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Wide confidence intervals in the forecast period

4. Quarterly Profit (Image 4):
  - Smoother trend compared to monthly data
  - Clear upward trajectory in both actual and forecast
  - Forecast slope is slightly more conservative than the actual trend
  - Notable spike in profits around 2023 Q4 to about 38K
5. Quantile Analysis (Image 5):
  - Shows both actual sales (blue) and quantile predictions (orange)
  - The quantile forecast seems to capture the general trend better
  - Both lines show similar slopes in the middle of the time series
  - The quantile prediction appears to be more responsive to recent trends

Overall patterns:

- All metrics show positive growth trends
- Quarterly data is less volatile than monthly data
- Forecasts tend to be more conservative than actual trends
- Models appear to underestimate the growth rate in recent periods
- Wider confidence intervals in future periods indicate increasing uncertainty in the predictions

Would you like me to elaborate on any particular aspect of these trend comparisons?

 Copy Retry 

Claude can make mistakes. Please double-check responses.

Reply to Claude...  

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