Sales

2025-02-15

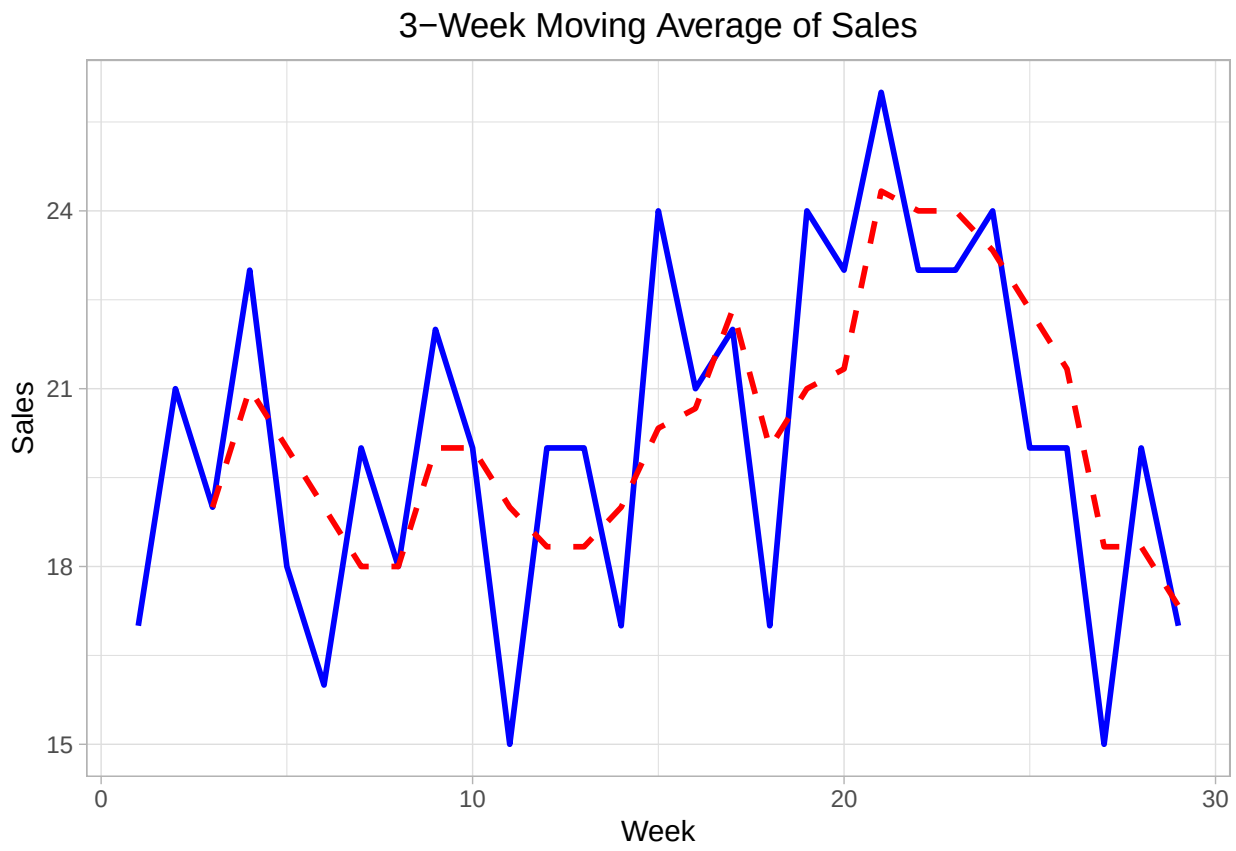
```
summary(sales_data)
```

```
##       Week        Sales
##  Min.   : 1   Min.   :15.00
##  1st Qu.: 8   1st Qu.:18.00
##  Median :15   Median :20.00
##  Mean   :15   Mean   :20.17
##  3rd Qu.:22   3rd Qu.:23.00
##  Max.   :29   Max.   :26.00
```

```
sales_data %>%
  ggplot(aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_3), color = "red", size = 1, linetype = "dashed") +
  theme_light() +
  labs(title = "3-Week Moving Average of Sales",
       y = "Sales",
       x = "Week") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Using ‘size‘ aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use ‘linewidth‘ instead.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.
```

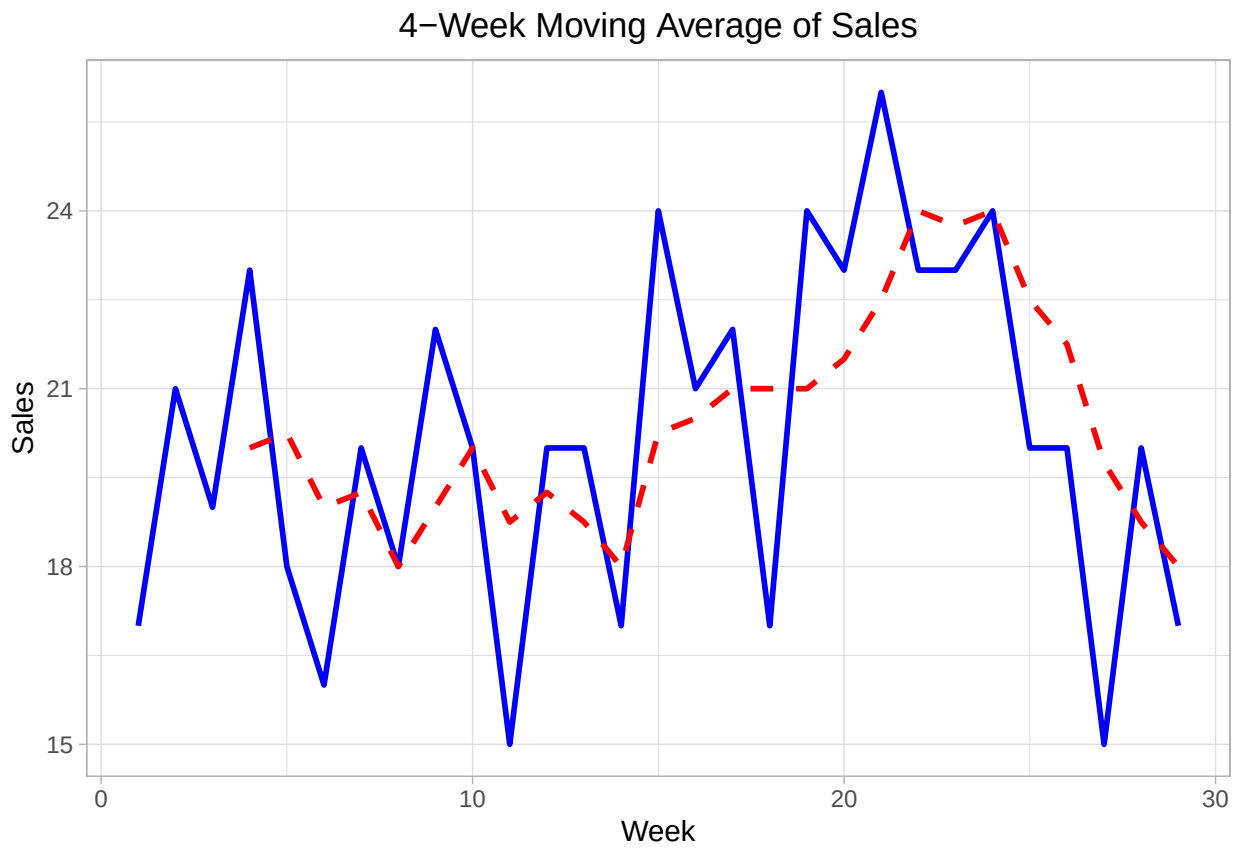
```
## Warning: Removed 2 rows containing missing values or values outside the scale range
## (‘geom_line()‘).
```




```
sales_data <- sales_data %>%
  mutate(MA_4 = rollmean(Sales, k = 4, fill = NA, align = "right"))
```

```
sales_data %>%
  ggplot(aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_4), color = "red", size = 1, linetype = "dashed") +
  theme_light() +
  labs(title = "4-Week Moving Average of Sales",
       y = "Sales",
       x = "Week") +
  theme(plot.title = element_text(hjust = 0.5))
```

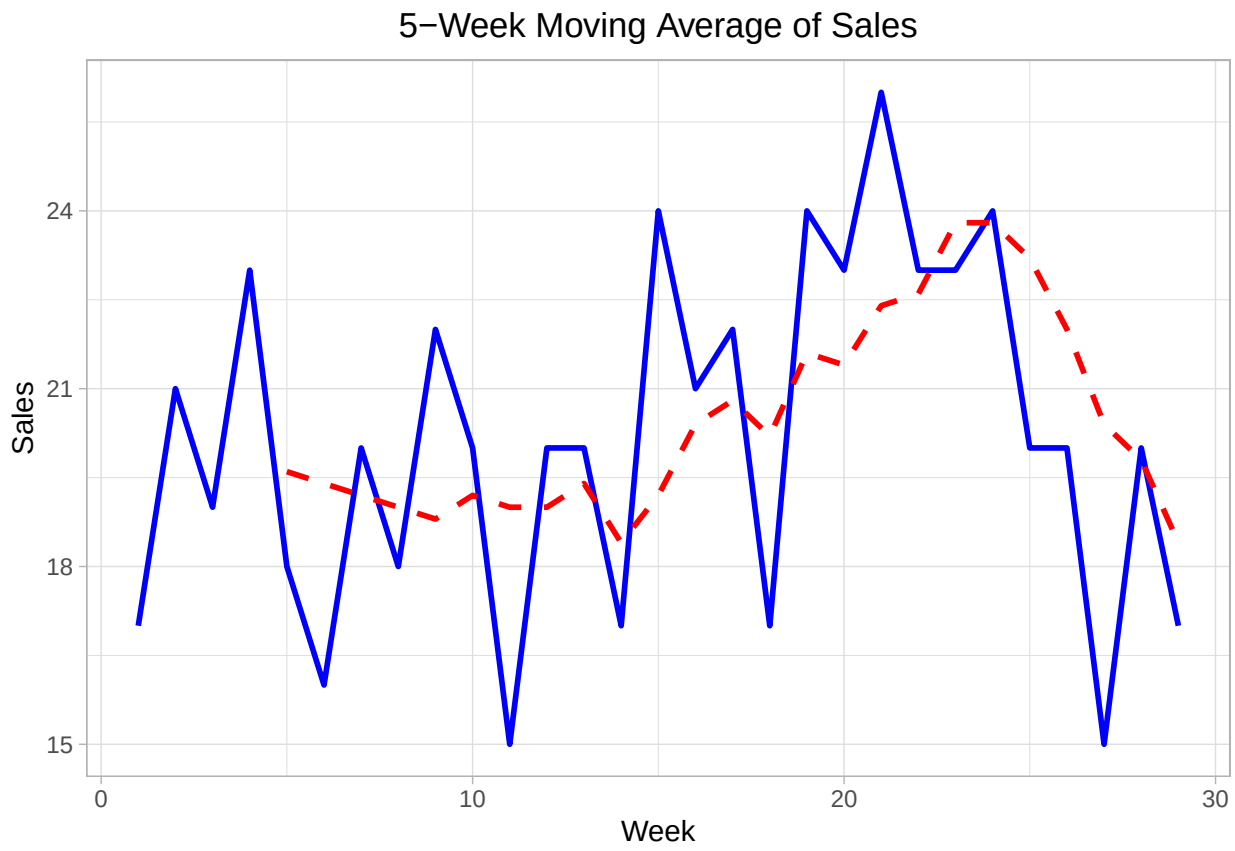
```
## Warning: Removed 3 rows containing missing values or values outside the scale range
## (`geom_line()`).
```




```
sales_data <- sales_data %>%
  mutate(MA_5 = rollmean(Sales, k = 5, fill = NA, align = "right"))
```

```
sales_data %>%
  ggplot(aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_5), color = "red", size = 1, linetype = "dashed") +
  theme_light() +
  labs(title = "5-Week Moving Average of Sales",
       y = "Sales",
       x = "Week") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Removed 4 rows containing missing values or values outside the scale range
## (`geom_line()`).
```



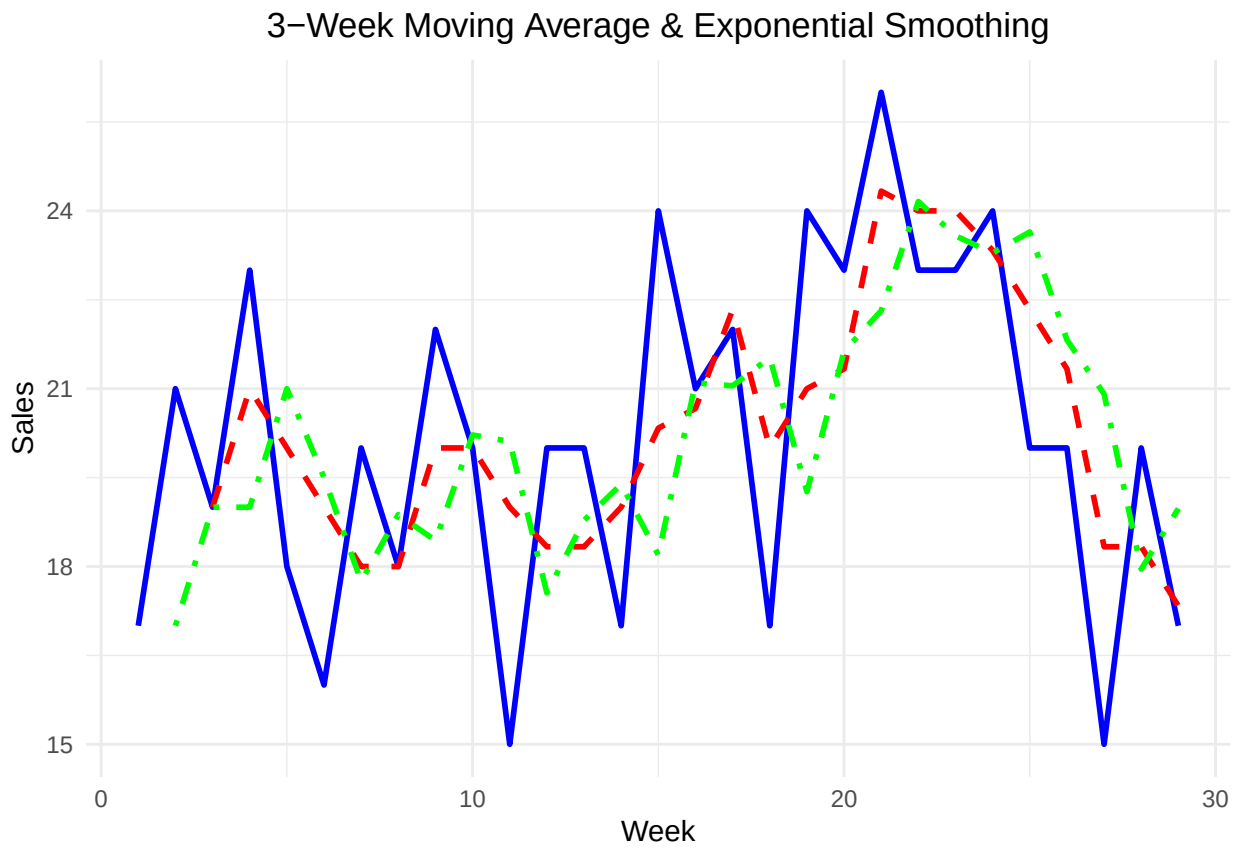

```
exp_model <- HoltWinters(sales_data$Sales, alpha = 0.5, beta = FALSE, gamma = FALSE)
```

```
sales_data$Exp_Smooth_0.5 <- c(NA, exp_model$fitted[,1])
```

```
ggplot(sales_data, aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_3), color = "red", size = 1, linetype = "dashed") +
  geom_line(aes(y = Exp_Smooth_0.5), color = "green", size = 1, linetype = "dotdash") +
  theme_minimal() +
  labs(title = "3-Week Moving Average & Exponential Smoothing",
       x = "Week", y = "Sales") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Removed 2 rows containing missing values or values outside the scale range
## (`geom_line()`).
```

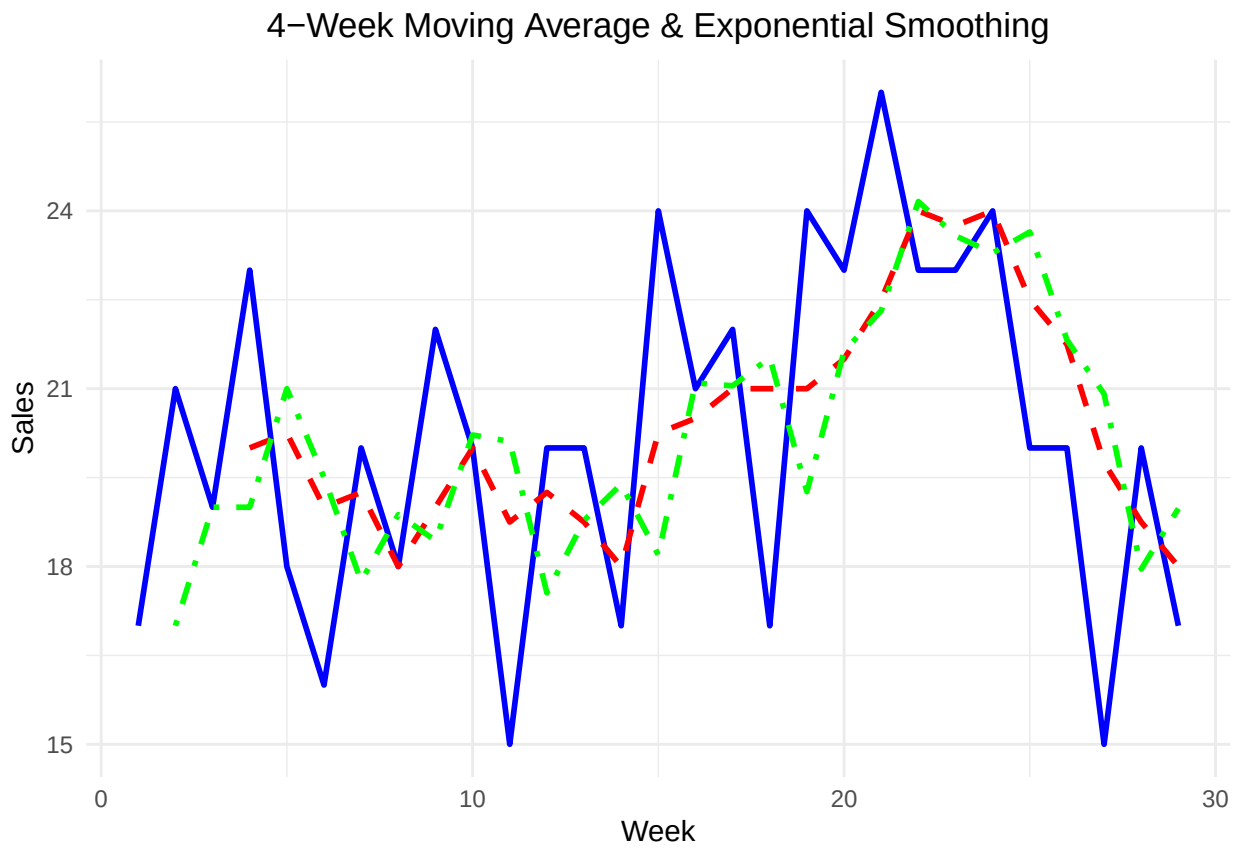
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_line()`).
```




```
ggplot(sales_data, aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_4), color = "red", size = 1, linetype = "dashed") +
  geom_line(aes(y = Exp_Smooth_0.5), color = "green", size = 1, linetype = "dotdash") +
  theme_minimal() +
  labs(title = "4-Week Moving Average & Exponential Smoothing",
       x = "Week", y = "Sales") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Removed 3 rows containing missing values or values outside the scale range
## (`geom_line()`).
```

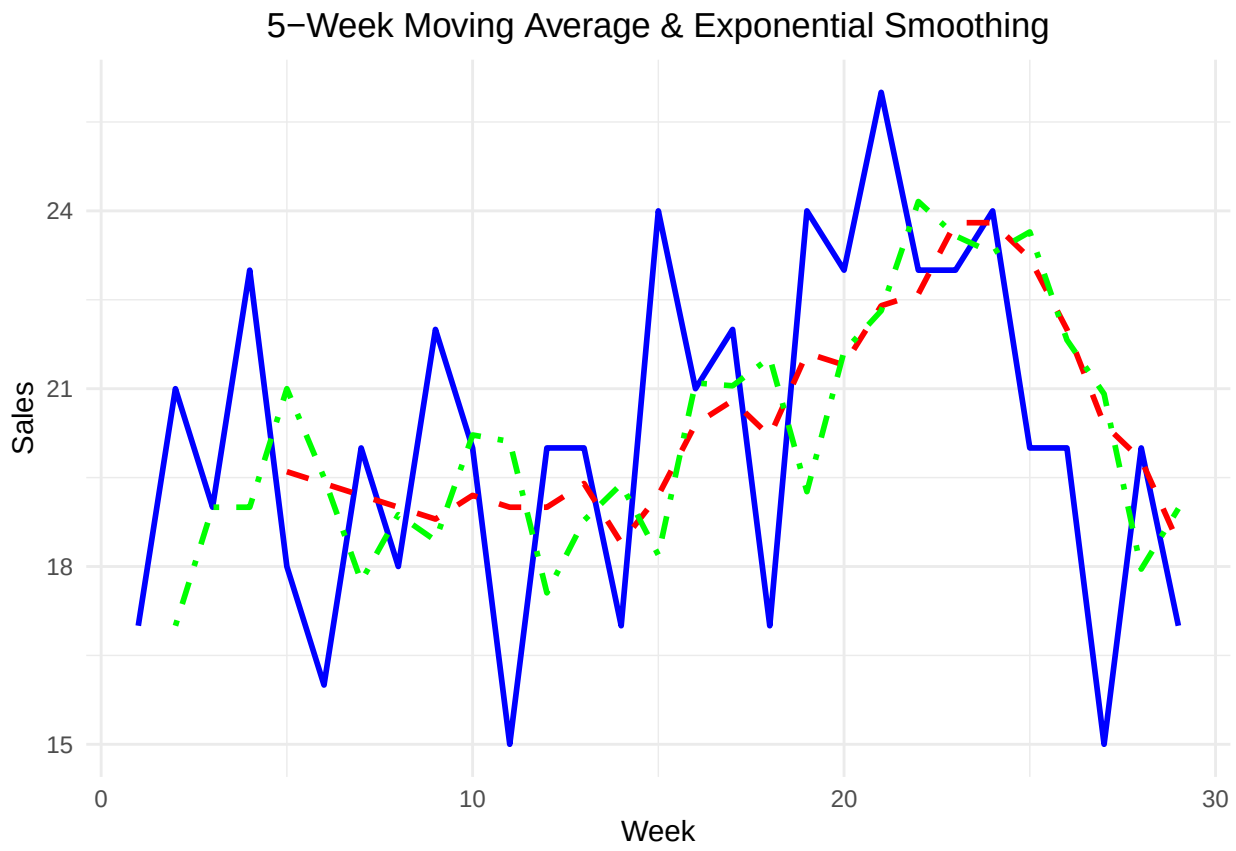
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_line()`).
```




```
ggplot(sales_data, aes(x = Week)) +
  geom_line(aes(y = Sales), color = "blue", size = 1) +
  geom_line(aes(y = MA_5), color = "red", size = 1, linetype = "dashed") +
  geom_line(aes(y = Exp_Smooth_0.5), color = "green", size = 1, linetype = "dotdash") +
  theme_minimal() +
  labs(title = "5-Week Moving Average & Exponential Smoothing",
       x = "Week", y = "Sales") +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Removed 4 rows containing missing values or values outside the scale range
## (`geom_line()`).
```

```
## Warning: Removed 1 row containing missing values or values outside the scale range
## (`geom_line()`).
```




```
sales_clean <- sales_data %>% filter(!is.na(MA_3) & !is.na(MA_4) & !is.na(MA_5))
```

```
mse_3 <- mean((sales_clean$Sales - sales_clean$MA_3)^2)
mae_3 <- mean(abs(sales_clean$Sales - sales_clean$MA_3))
mape_3 <- mean(abs((sales_clean$Sales - sales_clean$MA_3) / sales_clean$Sales)) * 100
```

```
cat("3 week MSE:", mse_3, "\nMAE:", mae_3, "\nMAPE:", mape_3, "%\n\n")
```

```
## 3 week MSE: 4.297778
## MAE: 1.746667
## MAPE: 9.142283 %
```

```
mse_4 <- mean((sales_clean$Sales - sales_clean$MA_4)^2)
mae_4 <- mean(abs(sales_clean$Sales - sales_clean$MA_4))
mape_4 <- mean(abs((sales_clean$Sales - sales_clean$MA_4) / sales_clean$Sales)) * 100
```

```
cat("4 week MSE:", mse_4, "\nMAE:", mae_4, "\nMAPE:", mape_4, "%\n\n")
```

```
## 4 week MSE: 5.265
## MAE: 1.84
## MAPE: 9.629621 %
```

```r
mse_5 <- mean((sales_clean$Sales - sales_clean$MA_5)^2)
mae_5 <- mean(abs(sales_clean$Sales - sales_clean$MA_5))
mape_5 <- mean(abs((sales_clean$Sales - sales_clean$MA_5) / sales_clean$Sales)) * 100
```

```r
cat("5 week MSE:", mse_5, "\nMAE:", mae_5, "\nMAPE:", mape_5, "%\n\n")
```

```
## 5 week MSE: 5.9424
## MAE: 1.952
## MAPE: 10.25463 %
```

```r
mse_function <- function(alpha) {
  exp_model <- HoltWinters(sales_data$Sales, alpha = alpha, beta = FALSE, gamma = FALSE)
  fitted_values <- exp_model$fitted[,1]
  mse <- mean((sales_data$Sales[-1] - fitted_values)^2, na.rm = TRUE)
  return(mse)
}
```

```r
best_alpha <- optimize(mse_function, interval = c(0, 1))$minimum
```

```r
cat("Best Alpha for Minimum MSE:", best_alpha, "\n")
```

```
## Best Alpha for Minimum MSE: 0.3238811
```

#comments

Out of all my forecasts my week 3 moving average forecast performs the best with the least amount of errors which means it is the closest to our actual data