# Derivation of Partial Derivatives for Mean Squared Error (MSE)

## MSE Formula

The formula for the Mean Squared Error is:  
MSE = (1/n) Σ [y\_i - (mx\_i + b)]²  
  
Where:  
- y\_i: Actual value of the i-th data point.  
- mx\_i + b: Predicted value of the i-th data point (line equation).  
- n: Total number of data points.

## Partial Derivative of MSE with respect to m (Slope)

We need to find: ∂/∂m (MSE)  
  
Steps:  
1. Substitute the MSE formula:  
 MSE = (1/n) Σ [y\_i - (mx\_i + b)]²  
  
2. Take the derivative of MSE with respect to m:  
 Using the chain rule:  
 ∂/∂m [y\_i - (mx\_i + b)]² = 2 \* [y\_i - (mx\_i + b)] \* ∂/∂m [y\_i - (mx\_i + b)]  
  
3. Simplify the derivative of the inner term:  
 ∂/∂m [y\_i - (mx\_i + b)] = -x\_i  
  
4. Substitute back:  
 ∂/∂m [y\_i - (mx\_i + b)]² = 2 \* [y\_i - (mx\_i + b)] \* (-x\_i)  
  
5. Apply the summation and average:  
 ∂/∂m (MSE) = (2/n) Σ [-x\_i \* (y\_i - (mx\_i + b))]

## Partial Derivative of MSE with respect to b (Intercept)

We need to find: ∂/∂b (MSE)  
  
Steps:  
1. Start with the MSE formula:  
 MSE = (1/n) Σ [y\_i - (mx\_i + b)]²  
  
2. Take the derivative of MSE with respect to b:  
 Using the chain rule:  
 ∂/∂b [y\_i - (mx\_i + b)]² = 2 \* [y\_i - (mx\_i + b)] \* ∂/∂b [y\_i - (mx\_i + b)]  
  
3. Simplify the derivative of the inner term:  
 ∂/∂b [y\_i - (mx\_i + b)] = -1  
  
4. Substitute back:  
 ∂/∂b [y\_i - (mx\_i + b)]² = 2 \* [y\_i - (mx\_i + b)] \* (-1)  
  
5. Apply the summation and average:  
 ∂/∂b (MSE) = (2/n) Σ [-(y\_i - (mx\_i + b))]