Loss and Cost Functions

1. What are these loss functions?

- **MSE (Mean Squared Error)**:
  - It checks how far off your guesses are from the real answers, and it punishes big mistakes more.
  - **Example**:
    - You guess 5 but the real answer is 8.
    - The error is 3.
    - MSE = $3^2 = 9$.
    - If you guess 10 instead, the error is 2, and MSE = $2^2 = 4$.
    - MSE punishes bigger errors more.
- **MAE (Mean Absolute Error)**:
  - It checks how far off your guesses are, but it treats all mistakes equally, no matter how big or small.
  - **Example**:
    - You guess 5 but the real answer is 8.
    - The error is 3.
    - MAE = 3.
    - If you guess 10 instead, the error is 2.
    - MAE = 2.
    - No punishment for bigger mistakes, just the difference.
- **RMSE (Root Mean Squared Error)**:
  - It's like MSE but it gives the result back in the same size as the data.
  - **Example**:
    - Using the same guesses as MSE, the errors are 3 and 2.
    - MSE for both = 9 and 4.
    - Now, RMSE = $\sqrt{9} = 3$ and $\sqrt{4} = 2$.
    - RMSE gives the result back in the same scale as your guesses.

2. Why use these loss functions?

- **MSE**:
  - Use this if you want to care more about big mistakes.
  - **Example**: Predicting house prices where big mistakes matter a lot.
- **MAE**:
  - Use this if you want a simple way to check mistakes.
  - **Example**: Predicting how many apples are sold each day, where all mistakes matter the same.
- **RMSE**:
  - Use this if you want to keep the mistakes in the same size as the data.
  - **Example**: Predicting temperature, where you want the result in the same units (°C or °F).

3. How to use them?

- **MSE**:
  - If you want to focus on fixing big mistakes.
- **MAE**:
  - If you want to see how far off you are, without worrying about big mistakes.
- **RMSE**:
  - If you want to see the mistakes in the same units as the data.

In short:

- **MSE**: Big mistakes are worse.
- **MAE**: All mistakes are equal.
- **RMSE**: Like MSE, but the result is in the same size as the data.