**Q. write down 10 differences between linear regression, logistic regression, polynomial regression.**

1. **Dependent Variable Type:**

* **Linear Regression:** Deals with continuous dependent variables.
* **Logistic Regression:** Used for binary classification problems, predicting a categorical outcome with two classes.
* **Polynomial Regression**: Extends linear regression by introducing polynomial terms and is still used for continuous dependent variables.

1. **Equation Form:**

* **Linear Regression:** Simple linear equation \ (y = mx + b\).
* **Logistic Regression:** Utilizes the logistic function to model probabilities.
* **Polynomial Regression:** Involves higher-degree polynomial equations, like \(y = ax^2 + bx + c\) for quadratic regression.

1. **Output Interpretation:**

* **Linear Regression:** Predicts the value of a continuous variable.
* **Logistic Regression**: Predicts the probability of an event occurring.
* **Polynomial Regression:** Extends linear regression to capture more complex relationships in data.

1. **Application:**

* **Linear Regression:** Suitable for predicting trends and relationships.
* **Logistic Regression:** Applied in binary classification problems.
* **Polynomial Regression:** Useful when a linear model is too simple to capture the underlying pattern.

1. **Model Performance Measurement:**

* **Linear Regression:** Evaluated using metrics like Mean Squared Error (MSE).
* **Logistic Regression**: Assessed using classification metrics such as accuracy, precision, recall, and F1-score.
* **Polynomial Regression**: Evaluation metrics similar to linear regression, depending on the context.

1. **Assumption of Linearity:**

* **Linear Regression**: Assumes a linear relationship between the independent and dependent variables.
* **Logistic Regression**: Works well when the log-odds of the dependent variable is a linear combination of the independent variables.
* **Polynomial Regression:** Assumes a polynomial relationship between variables.

1. Risk of Overfitting:

* **Linear Regression**: Prone to underfitting if the relationship is non-linear.
* **Logistic Regression:** Can handle non-linear relationships but may overfit with complex data.
* **Polynomial Regression:** More prone to overfitting, especially with higher-degree polynomials.

1. **Coefficients and Parameters:**

* **Linear Regression**: Involves slope (m) and intercept (b).
* **Logistic Regression**: Utilizes coefficients for each predictor variable.
* **Polynomial Regression:** Includes coefficients for each term in the polynomial equation.

1. **Decision Boundary:**

* **Linear Regression:** Doesn't have a decision boundary; it predicts a continuous outcome.
* **Logistic Regression:** Decision boundary separates classes in the input space.
* **Polynomial Regression**: Decision boundary can be complex, depending on the polynomial degree.

1. **Computational Complexity:**

* **Linear Regression:** Computationally less intensive.
* **Logistic Regression:** Involves iterative optimization techniques.
* **Polynomial Regression:** Can be computationally expensive, especially with higher-degree polynomials.