Certainly! Here's a concise answer for each question, limited to 50 words each.

1. Using a graph to illustrate slope and intercept, define basic linear regression.

Linear regression fits a line, \(y = mx + b\), through data points. The slope \(m\) indicates the line's steepness, and the intercept \(b\) is where the line crosses the y-axis.

2. In a graph, explain the terms rise, run, and slope.

Slope (\(m\)) is \(\frac{rise}{run}\). Rise is the vertical change between two points, and run is the horizontal change.

3. Use a graph to demonstrate slope, linear positive slope, and linear negative slope, as well as the different conditions that contribute to the slope.

Positive slope: line ascends rightward. Negative slope: line descends rightward. Conditions include data trend direction and magnitude of change.

4. Use a graph to demonstrate curve linear negative slope and curve linear positive slope.

Positive curved slope: upward curve. Negative curved slope: downward curve. These show acceleration or deceleration in data trends.

5. Use a graph to show the maximum and low points of curves.

A curve’s highest point is the maximum (peak); the lowest is the minimum (trough).

6. Use the formulas for \(a\) and \(b\) to explain ordinary least squares.

OLS formulas: \(b = \frac{\sum (x\_i - \bar{x})(y\_i - \bar{y})}{\sum (x\_i - \bar{x})^2}\), \(a = \bar{y} - b\bar{x}\). They minimize the sum of squared residuals.

7. Provide a step-by-step explanation of the OLS algorithm.

1. Calculate means (\(\bar{x}, \bar{y}\)).

2. Compute slope \(b\).

3. Determine intercept \(a\).

4. Form equation \(y = ax + b\).

8. What is the regression's standard error? To represent the same, make a graph.

Standard error measures the average distance between observed and predicted values. It's shown as error bars around the regression line.

9. Provide an example of multiple linear regression.

Model: \(y = b\_0 + b\_1x\_1 + b\_2x\_2 + ... + b\_nx\_n\). Example: predicting house prices using size, location, and age as variables.

10. Describe the regression analysis assumptions and the BLUE principle.

Assumptions: linearity, independence, homoscedasticity, normality. BLUE: Best Linear Unbiased Estimator; OLS estimates are the most accurate under these assumptions.

11. Describe two major issues with regression analysis.

Multicollinearity: predictors are highly correlated. Heteroscedasticity: non-constant variance of errors.

12. How can the linear regression model's accuracy be improved?

Improve accuracy with feature selection, data transformation, regularization, and cross-validation.

13. Using an example, describe the polynomial regression model in detail.

Polynomial regression fits a curve to data: \(y = b\_0 + b\_1x + b\_2x^2 + ... + b\_nx^n\). Example: modeling growth rates with quadratic terms.

14. Provide a detailed explanation of logistic regression.

Logistic regression models binary outcomes using the sigmoid function: \(P(y=1) = \frac{1}{1+e^{-(b\_0 + b\_1x\_1 + ... + b\_nx\_n)}}\).

15. What are the logistic regression assumptions?

Assumptions: binary dependent variable, linearity in logit, no multicollinearity, large sample size.

16. Go through the details of maximum likelihood estimation.

MLE finds parameters that maximize the likelihood function. It iteratively adjusts parameters to improve fit between the model and observed data.