Newton's Divided Difference Interpolation Method

Theory:

Newton's Divided Difference Interpolation Method is a more general approach that does not require equally spaced data points. It constructs the interpolation polynomial using divided differences, which are computed recursively.

The divided difference interpolation polynomial is,

$$P(x) = y_0 + \sum_{k=1}^{n} \frac{(x - x_0)(x - x_1) \cdots (x - x_{k-1})}{k!} [x_0, x_1, \ldots, x_k]$$

This method is particularly useful when data points are irregularly spaced or when new data points need to be added without recomputing the entire polynomial. Compared to forward and backward interpolation methods, divided difference interpolation offers greater flexibility but involves more computational steps.