Central Difference Formulas

First Order (First Derivative)

3-point $$\frac{Y_1 - Y_{-1}}{2h}$$

5-point $$\frac{Y_{-2} - 8Y_{-1} + 8Y_1 - Y_2}{12h}$$

7-point $$\frac{-Y_{-3} + 9Y_{-2} - 45Y_{-1} + 45Y_1 - 9Y_2 + Y_3}{60h}$$

9-point $$\frac{3Y_{-4} - 32Y_{-3} + 168Y_{-2} - 672Y_{-1} + 672Y_1 - 168Y_2 + 32Y_3 - 3Y_4}{840h}$$

Second Order (Second Derivative)

3-point $$\frac{Y_{-1} - 2Y_0 + Y_1}{h^2}$$

5-point $$\frac{-Y_{-2} + 16Y_{-1} - 30Y_0 + 16Y_1 - Y_2}{12h^2}$$

7-point $$\frac{2Y_{-3} - 27Y_{-2} + 270Y_{-1} - 490Y_0 + 270Y_1 - 27Y_2 + 2Y_3}{180h^2}$$

9-point $$\frac{-9Y_{-4} + 128Y_{-3} - 1008Y_{-2} + 8064Y_{-1} - 14350Y_0 + 8064Y_1 - 1008Y_2 + 128Y_3 - 9Y_4}{5040h^2}$$

2-point First Order (First Derivative) Forward Difference: $\frac{Y_1 - Y_0}{h}$

2-point First Order (First Derivative) Backward Difference: $\frac{Y_0 - Y_{-1}}{h}$