first Order = $f_0 + (x\_new - x_0) * f_1$

Second Order = $f_0 + (x\_new - x_0) * f_1 + (x\_new - x_0) * (x\_new - x_1) * f_2$

Third Order = $f_0 + (x\_new - x_0) * f_1 + (x\_new - x_0) * (x\_new - x_1) * f_2$

$+ (x\_new - x_0) * (x\_new - x_1) * (x\_new - x_2) * f_3$

$f_0 = f_{x_0}$

$\underline{f_1} = F[x_1, x_0] = \dfrac{f_{x_1} - f_{x_0}}{(x_1 - x_0)}$

$\underline{f_2} = F[x_2, x_1, x_0] = \dfrac{F[x_2, x_1] - F[x_1, x_0]}{(x_2 - x_0)}$

$= \dfrac{\dfrac{f_{x_2} - f_{x_1}}{x_2 - x_1} - f_1}{(x_2 - x_0)}$

$\underline{f_3} = F[x_3, x_2, x_1, x_0] = \dfrac{F[x_3, x_2, x_1] - F[x_2, x_1, x_0]}{x_3 - x_0}$

$= \dfrac{\dfrac{\dfrac{f_{x_3} - f_{x_2}}{x_3 - x_2} - \dfrac{f_{x_2} - f_{x_1}}{x_2 - x_1}}{x_3 - x_1} - f_2}{x_3 - x_0}$