1 Lagrange Interpolating Polynomial

We are trying to write a polynomial which, if we are considering the points $x_0, \ldots, x_n$, is equal to one at x_i, and equal to zero for all x_j, with $j \neq i$. We exhibit this polynomial below.

$$p_i(x) = \prod_{j \neq i} \frac{x - x_j}{x_i - x_j} \tag{1}$$

If we want our polynomial to have the value $f(x_i)$ at each point x_i, we can sum several of these polynomials, so that the resultant polynomial has the characteristics which we desire:

$$p(x) = \sum_i f(x_i) \left(\prod_{j \neq i} \frac{x - x_j}{x_i - x_j} \right) \tag{2}$$