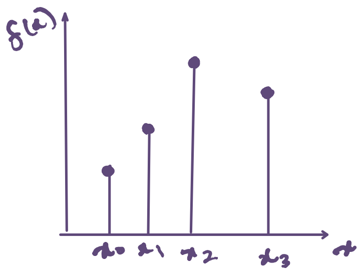
Numerical Interpolation

If x is in (a, b)

↳ Interpolation to predict X



$$P_N(x) = a_0 + a_1(x-x_0) + a_2(x-x_0)(x-x_1) + a_3(x-x_0)(x-x_1)(x-x_2)$$
$$+ a_n(x-x_0)\cdots\cdots(x-x_{n-1})$$

but $P_N(x_i) = f(x_i) = y_i$

so, $a_0 = f(x_0)$

$a_0 + a_1(x_1 - x_0) = f(x_1)$

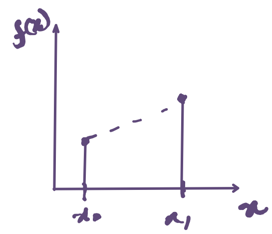
$a_0 + a_1(x_2 - x_0) + a_2(x_2-x_0)(x_2-x_1)$

The formula created by Lagrange

$$P_n(x) = \sum_{i=0}^{N} \prod \frac{x - x_k}{x_i - x_k} y_i$$

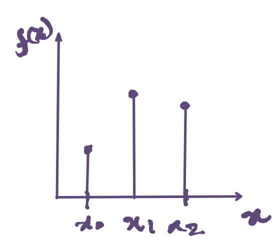
ex:

If we have 2 points



$$P_1(x) = y_0\left(\frac{x-x_1}{x_0-x_1}\right) + y_1\left(\frac{x-x_0}{x_1-x_0}\right)$$

If 3 points



$$P_2(x) = y_0\left(\frac{x-x_1}{x_0-x_1}\right)\left(\frac{x-x_2}{x_0-x_2}\right)$$
$$+ y_1\left(\frac{x-x_0}{x_1-x_0}\right)\left(\frac{x-x_2}{x_1-x_2}\right)$$
$$+ y_2\left(\frac{x-x_0}{x_2-x_0}\right)\left(\frac{x-x_1}{x_2-x_1}\right)$$