# MTH 343 Numerical Analysis: Lecture 12

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## Interpolation

1. Solving Systems of Equations
2. Lagrange Polynomials

| $x_i$ | $f_i$ |
|---|---|
| $x_0$ | $f_0$ |
| $x_1$ | $f_1$ |
| $x_2$ | $f_2$ |

$$P_2(x) = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)}f_0 + \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)}f_1 + \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)}f_2$$

| $x_i$ | $f_i$ |
|---|---|
| 0 | 1 |
| $-1$ | 2 |
| 2 | 3 |

$$P_2(x) = \frac{(x+1)(x-2)}{(0+1)(0-2)} + \frac{(x-0)(x-2)}{(-1-0)(-1-2)}2 + \frac{(x-0)(x+1)}{(2-0)(2+1)}3$$

$P_n(x) = \sum_0^n L_{n,i} f(x_i)$

## Lagrange Polynomial Error Function

$$E(x) = |f(x) - P_n(x)| = \frac{|(x-x_0)(x-x_1)\dots(x-x_n)f^{n+1}(\xi)|}{(n+1)!}$$

Where $\xi$ is the element in the smallest interval containing $x_0, x_1, \dots, x_n$