$$l_3(x) = \frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)}$$

$$= \frac{(x-1)(x-2)(x-3)}{6}$$

$\therefore$ polynomial $P(x)$,

$$P(x) = \sum_{i=0}^{n} f(x_i) \cdot l_i(x)$$

$$P(x) \approx \ln(x) \approx \ln(1) \cdot l_0(x) + \ln(2) \cdot l_1(x) + \ln(3) \cdot l_2(x) + \ln(4) \cdot l_3 x$$

$$\approx 0 + \frac{\ln(2)}{2} \cdot (x-1)(x-3)(x-4) + \frac{\ln(3)}{-2}(x-1)(x-2)(x-4) + \frac{\ln(4)}{6}(x-1)(x-2)(x-3)$$

$$\approx 0.0264x^3 - 0.3143x^2 + 1.4373x - 1.1514$$

Q2. Consider function $f(x) = 1$.

when $f(x)$ is approximated with lagrange interpolating polynomial it can be expressed as,

$$P(x) = \sum_{i=0}^{n} f(x_i) \cdot l_i(x)$$

since $f(x_i) = 1$ for x.

$$P(x) = \sum_{i=0}^{n} 1 \cdot l_i(x)$$

so $p(x) = f(x) = 1$ polynomial perfectly interpolates any $x_1, x_2, \ldots x_n$ by reason of the interpolating polynomial is unique.

$$\therefore \sum_{i=0}^{n} l_i(x) = 1 \quad \text{for all } x.$$