So suppose we want to approx. the derivatives of a (sufficiently) smooth function

$$f : I = [a,b] \to \mathbb{R}$$

Let $p[f|x_1,\dots,x_n]$ be the IP, then

k-th derivative

$$\frac{d^k f}{dx^k}(x) \approx \frac{d^k}{dx^k} p[f|x_0,\dots,x_n](x) = \frac{d^k}{dx^k} \sum_{j=0}^{n} L_j^n(x)\cdot f(x_j)$$

approx.

$$= \sum_{j=0}^{n} \frac{d^k L_j^n}{dx^k}(x)\cdot f(x_j)$$

This general procedure leads to so-called finite difference (FD) approximations of derivatives.

Usually one uses equidistantly spaced nodes

$$x_j = x_0 + j\cdot h \,, \quad j \in \mathbb{Z}$$

integers

where h is a constant spacing between nodes.