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$$p(x) = \frac{1}{N} \frac{\sin\left(\frac{Nx}{2} - \pi j\right)}{\tan\left(\frac{x}{2} - \frac{\pi j}{N}\right)}$$

$$\begin{aligned} p'(x) &= \frac{\cos\left(\frac{Nx}{2} - \pi j\right)}{2 \tan\left(\frac{x}{2} - \frac{\pi j}{N}\right)} - \frac{\sec^2\left(\frac{x}{2} - \frac{\pi j}{N}\right) \sin\left(\frac{Nx}{2} - \pi j\right)}{2N \tan^2\left(\frac{x}{2} - \frac{\pi j}{N}\right)} \\ &= \frac{1}{2} \left[ \frac{\cos\left(\frac{Nx}{2} - \pi j\right)}{\tan\left(\frac{x}{2} - \frac{\pi j}{N}\right)} - \frac{\sin\left(\frac{Nx}{2} - \pi j\right)}{N \sin^2\left(\frac{x}{2} - \frac{\pi j}{N}\right)} \right] \end{aligned}$$

$$a = \frac{Nx}{2} - \pi j, \quad b = \frac{x}{2} - \frac{\pi j}{N}$$

$$p'(x) = \frac{1}{2} \left[ \frac{\cos(a)}{\tan(b)} - \frac{\sin(a)}{N \sin^2(b)} \right]$$

$$p'(x_i) = \frac{1}{2} \left[ \frac{\cos(a)}{\tan(b)} - \frac{1}{N} \frac{\sin(a)}{\sin^2(b)} \right]$$

$$a = \frac{N}{2} \left( \frac{2\pi i}{N} \right) - \pi j = \pi(i-j)$$

$$b = \frac{1}{2} \left( \frac{2\pi i}{N} \right) - \frac{\pi j}{N} = \frac{\pi}{N}(i-j)$$

$$\underline{D} = \begin{bmatrix} d_{11} & \dots & d_{1N} \\ d_{21} & & \vdots \\ \vdots & & \\ d_{N1} & \dots & d_{NN} \end{bmatrix}$$

$$d_{ij} = \begin{cases} 0 & \text{if } i=j \\ \frac{1}{2} \left( \frac{\cos(a)}{\tan(b)} - \frac{1}{N} \frac{\sin(a)}{\sin^2(b)} \right) & \text{if } i \neq j \end{cases}$$

$$\text{where } a = \pi(i-j), \quad b = \frac{\pi}{N}(i-j)$$