Let

$$P(x) = p_0 + p_1 x + p_2 x^2 + \cdots + p_n x^n$$

and extend x to a dual number $x + \dot{x}\mathbf{d}$.
Then,

$$\begin{aligned} P(x + \dot{x}\mathbf{d}) &= p_0 + p_1(x + \dot{x}\mathbf{d}) + \cdots + p_n(x + \dot{x}\mathbf{d})^n \\ &= p_0 + p_1 x + p_2 x^2 + \cdots + p_n x^n \\ &\quad + p_1\dot{x}\mathbf{d} + 2p_2 x\dot{x}\mathbf{d} + \cdots + np_n x^{n-1}\dot{x}\mathbf{d} \\ &= P(x) + P'(x)\dot{x}\mathbf{d} \end{aligned}$$

- $\dot{x}$ may be chosen arbitrarily, so choose $\dot{x} = 1$ (currently).
- *The second component is the derivative of $P(x)$ at x*