4.2. Zeros and extremes of single–variable function

4.2.2. Newton method

based on linear approximation of a smooth function around its root

→ **Taylor expansion of** $f(x_0) = 0$ **around root** x_0

$$f(x_0) \approx f(x) + (x_0 - x)\ f'(x) + \ldots = 0$$

$x \mathrel{\widehat{=}}$ **trial value for root of** x_0 **at n-th step**

step x_{n+1}**:** $f(x_{n+1}) = f(x_n) + (x_{n+1} - x_n) \cdot f'(x_n) \simeq 0$

$$\rightarrow\ x_{n+1} = x_n - \frac{f_n}{f'_n} \text{ with } f_n = f(x_n)$$

often called also Newton–Raphson method

more efficient: large step created for small slope
small step for large slope
(efficient and avoids overshooting)