

II.1.3 Newton's method

Idea: linearize f

Taylor at $x^{(k)}$:

$$f(x) = \underbrace{f(x^{(k)}) + f'(x^{(k)}) \cdot (x - x^{(k)}) + \frac{1}{2} f''(x^{(k)}) (x - x^{(k)})^2 + \dots}_{\tilde{f}(x) \stackrel{!}{=} 0 \rightsquigarrow x^{(k+1)}}$$

$$\rightsquigarrow \tilde{f}(x^{(k+1)}) = f(x^{(k)}) + f'(x^{(k)}) \cdot (x^{(k+1)} - x^{(k)}) = 0$$

$$\rightsquigarrow x^{(k+1)} = x^{(k)} - \frac{f(x^{(k)})}{f'(x^{(k)})}$$

