

$$b) \quad \nabla f(x^k + d e^i) = \nabla f(x^k + d e^i) \cdot \nabla$$

$$f = \frac{1}{2} x^t A x + b^t x$$

$$\frac{1}{2} (x^k + d e^i)^t A (x^k + d e^i) + b^t (x^k + d e^i) =$$

$$\frac{d}{2} \left(x^{k^t} A x^k + 2 x^{k^t} A d e^i + d^2 A(i, i) \right) + b^t x^k + d b_i$$

$$(e^i)^t A e^i = e^t A(i, i) = A(i, i)$$

$$\frac{d A_{ii} + x^{k^t} A e^i + b_i}{= 0}$$

$$d A_{ii} + (x^k)^t A_{i, \cdot} + b_i = 0$$

$$d = \frac{-b_i - (x^k)^t A_{i, \cdot}}{A_{ii}}$$