Newton's Method

input : starting point $\vec{x}_0$, tolerance E_s
output: $\vec{x}^*$, estimate of a local minimizer

$k \leftarrow 0$
while $\|\nabla f(\vec{x}_k)\| > E_s$ **do**
  $\vec{p}_k \leftarrow -H(\vec{x}_k) \backslash \nabla f(\vec{x}_k)$ `// stationary point of quadratic fit`
  if $\nabla f(\vec{x}_k)^\mathsf{T} \vec{p}_k \geq 0$ **then**
    $\vec{p}_k \leftarrow -\nabla f(\vec{x}_k)$ `// not downhill: use steepest descent`
  end
  $\alpha_k \leftarrow$ line search along $\vec{p}_k$ with $\alpha_{\text{init}} = 1$
  $\vec{x}_{k+1} \leftarrow \vec{x}_k + \alpha_k \vec{p}_k$
  $k \leftarrow k + 1$
end
return $\vec{x}^* = \vec{x}_k$