Quadratic probs. \( \min \frac{1}{2} x^T Q x + c^T x \) \\
--- closed form \\
Equality const. \( A x = b \) \\
--- \\
Swap out criterion with \( f(x) \) \\
\( \Rightarrow \) Newton's method reduces prob to \( a \) sequence of eq.const. quad. probs. \\
--- \\
Added ineq. const. \( h_i(x) \leq 0, i = 1 \ldots m \) \\
\( \Rightarrow \) Barrier method reduces to seq. of probs w/o ineq. constraints \\
\( \Rightarrow \) P.D. interior-point method \\
--- \\
perturbed \( \tau(x,u,v) = 0 \).

KKT conditions 
\[
0 = \tau(x+\Delta x, u+\Delta u, v+\Delta v) \\
\approx \tau(x,u,v) + D\tau(x,u,v) \begin{pmatrix} \Delta x \\ \Delta u \\ \Delta v \end{pmatrix}
\]

Substitute in \( u_i = \frac{1}{h_i(x)} \) \( i = 1 \ldots m \) \( \Rightarrow \) primal-dual interior-point methods do not do this \\
repeat \\
\( \Rightarrow \) Newton's steps \( \Rightarrow \) Barrier method \\

\( \tau(x,u,v) = \begin{pmatrix} \text{dual} \\ \text{cent} \\ \text{prin} \end{pmatrix} \)
\[ v(x, u, v) = \begin{pmatrix} \nabla f(x) + D_h(x)^T u + A^T v \\ -\text{diag}(u) h(x) - \frac{1}{k} \\ A x - b \end{pmatrix} \]

\[ \nabla f(x) + D_h(x)^T u + A^T v = 0 \]

\[ \iff \]

\[ x \text{ minimizes } L(x, u, v) \text{ over } x \]

\[ \text{so } g(u, v) = L(x, u, v) \]

\[ \text{i.e. } (u, v) \text{ is in domain of } g \text{ (because } L(x, u, v) > -\infty) \]

\[ \eta = \frac{m}{t}; \quad t = \frac{m}{\eta} \]