Assume that $b \gg a$, so that the perturbation due to the hole has a negligible influence on the stresses near the outer surface, $r = b$.

4. The area A on the surface of an elastic half-space is subjected to a purely normal pressure $p(x, y)$ corresponding to the total force, F. The loaded region is now expanded in a self-similar manner by multiplying all its linear dimensions by the same ratio, λ. Each point in the new contact area is subjected to a self-similar loading such that the pressure at the point $(\lambda x, \lambda y)$ is $Cp(x, y)$, where the constant C is chosen to ensure that the total force F is independent of λ.

Show that the deflection at corresponding points $(\lambda x, \lambda y, \lambda z)$ will then be proportional to F/λ.

5. The surface of the half space $z > 0$ is traction-free and a concentrated heat source Q is applied at the origin. Determine the stress and displacement field in the half space in the steady state.

The traction-free condition can be satisfied by using solution P of Table 20.1. You can then use dimensional arguments to determine the dependence of the heat flux on R and hence to choose the appropriate singular potential.