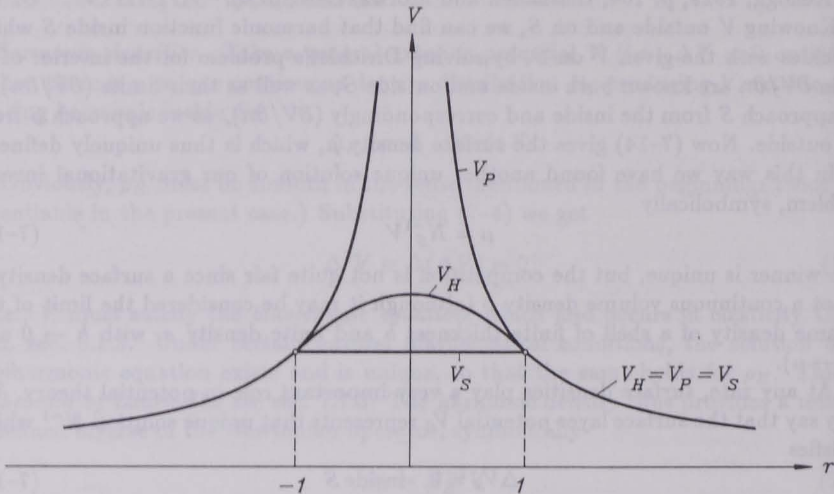

FIGURE 7.2: The potentials V_P, V_H and V_P; negative arguments are for the symmetry of the figure only (negative r are without geometric meaning!)

is continuous and differentiable everywhere, but it is not an analytic function in R^3 because it is represented by two different analytic functions: by (7–19) for $r \leq 1$ and by (7–17) for $r \geq 1$; both functions are welded smoothly together at $r = 1$, so that their combination forms the nice bell-shaped curve for V_H in Fig. 7.2. On the other hand, V_S has a discontinuous derivative at S ($r = 1$), which shows that it cannot be the potential of a volume distribution. At any rate, V_H and V_S "bridge", in different ways, the singularity of V_P at the origin $r = 0$.

7.4 A "General" Solution

It is well known that the general solution of an inhomogeneous linear equation is obtained *as the sum of one particular solution of the inhomogeneous equation and the general solution of the corresponding homogeneous equation.* In our case, the particular solution is provided by the harmonic density described in the preceding section. The general solution of the homogeneous equation (7–7) (homogeneous means zero right-hand side) is the set of zero-potential densities forming the kernel of the Newtonian operator N.

Thus we find the general solution of the gravitational inverse problem by determining the uniquely defined harmonic density that corresponds to the given external potential, and adding any zero-potential density determined by the continuation method described in sec. 7.2; cf. also Fig. 7.1.

We may also proceed directly in the following way. We take the given harmo-