1.12 Solution: In Green's theorem, Eq. (1.35), set $\phi = \Phi$ and $\psi = \Phi'$, we can obtain

$$\int_V \left(\Phi\nabla^2\Phi' - \Phi'\nabla^2\Phi\right) d^3x = \oint_S \left(\Phi\frac{\partial\Phi'}{\partial n} - \Phi'\frac{\partial\Phi}{\partial n}\right) da.$$

The Poisson equation states that

$$\nabla^2\Phi = -\frac{\rho}{\varepsilon_0}, \qquad \nabla^2\Phi' = -\frac{\rho'}{\varepsilon_0}.$$

Meanwhile,

$$\sigma = \varepsilon_0\frac{\partial\Phi}{\partial n}, \qquad \sigma' = \varepsilon_0\frac{\partial\Phi'}{\partial n}.$$

Here, notice that the normal vector is poiting outward from the volume of interest and, therefore, the above two identities differ from usual expressions by a minus sign.

Putting things together,

$$\frac{1}{\varepsilon_0}\int_V \left(-\rho'\Phi + \rho\Phi'\right) d^3x = \frac{1}{\varepsilon_0}\oint_S \left(\sigma'\Phi - \sigma\Phi'\right) da.$$

Rearrange the terms, we will obtain the Green's reciprocation theorem,

$$\int_V \rho\Phi' d^3x + \oint_S \sigma\Phi' da = \int_V \rho'\Phi d^3x + \oint_S \sigma'\Phi da.$$