4. $x'_t = f_1(x)g_1(y)\Phi(x,y,t), \quad y'_t = f_2(x)g_2(y)\Phi(x,y,t).$

First integral:

$$\int \frac{f_2(x)}{f_1(x)}\,dx - \int \frac{g_1(y)}{g_2(y)}\,dy = C, \qquad (*)$$

where C is an arbitrary constant.

On solving (*) for x (resp., y) and on substituting the resulting expression into either equation of the original solution, one arrives at a first-order equation for determining y (resp., x).

