Sec 2.4 Analytic Methods for Special Systems

Checking solutions

$$\frac{dx}{dt} = -x + y$$

$$\frac{dy}{dt} = -3x - 5y$$

The system can be rewritten in vector form

$$\frac{d\bar{Y}}{dt} = \bar{F}(\bar{Y})$$

where $\bar{Y}(t) = (x(t), y(t))$ and

$$\bar{F}(x,y) = (-x+y, -3x-5y)$$

Suppose we are told that

$$\bar{Y}(t) = (x(t), y(t)) = (e^{-4t} - 3e^{-2t}, -3e^{-4t} + 3e^{-2t})$$

is a solution. How do we check?

Decoupled Systems

Example 1: Completely decoupled

$$\frac{dx}{dt} = -2x$$

$$\frac{dy}{dt} = -y$$

Example 2 - Partially decoupled systems

$$\frac{dx}{dt} = 2x + 3y$$

$$\frac{dy}{dt} = -4y$$

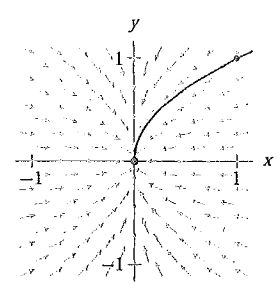

Figure 2.40
The solution curve
$Y(t) = (e^{-2t}, e^{-t})$.

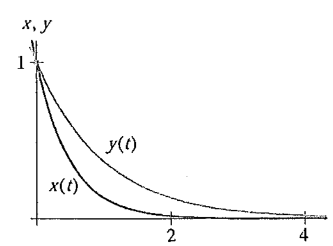

Figure 2.41
The $x(t)$- and $y(t)$-graphs for the solution
$(x(t), y(t)) = (e^{-2t}, e^{-t})$.