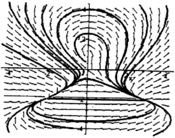
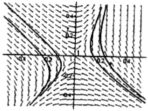
and $(3,-2)$.

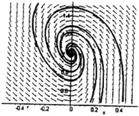
(b)



(c). Near the origin, the trajectories resemble those of a *saddle*, and hence it is *unstable*.



Near the critical point $(0,1)$, the trajectories resemble those of a stable *spiral*. Hence the equilibrium point is *asymptotically stable*.



Based on the global phase portrait, it is evident that the other critical points are *nodes*. Closer examination reveals that the point $(-2,-2)$ is *asymptotically stable*, whereas the point $(3,-2)$ is *unstable*.

9.3 5(a). The critical points consist of the solution set of the equations

$$(2+x)(y-x)=0$$
$$(4-x)(y+x)=0\,.$$

As shown in Prob. 13 of Section 9.2, the only critical points are at $(0,0)$, $(4,4)$ and $(-2,2)$.

(b,c). First note that $F(x,y)=(2+x)(y-x)$ and $G(x,y)=(4-x)(y+x)$. The *Jacobian* matrix of the vector field is

$$\mathbf{J}=\begin{pmatrix} F_x(x,y) & F_y(x,y) \\ G_x(x,y) & G_y(x,y)\end{pmatrix}=\begin{pmatrix} -2-2x+y & 2+x \\ 4-y-2x & 4-x\end{pmatrix}.$$