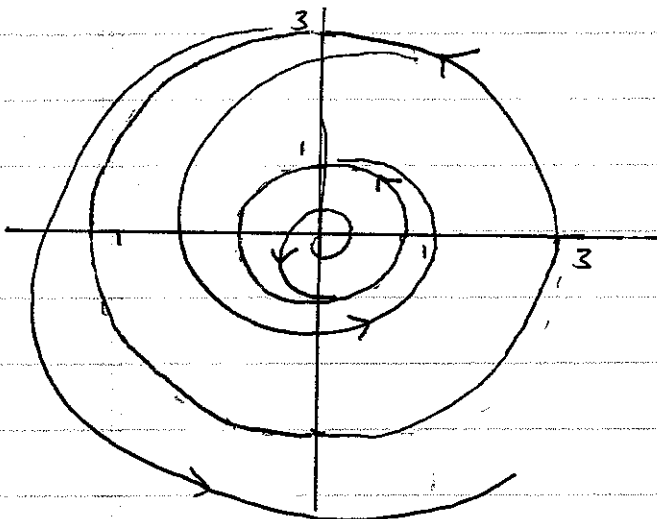
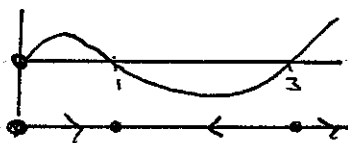


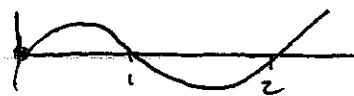
MATH 5825
HWK 5

(7.1.2) $\dot{r} = r(1-r^2)(4-r^2)$



(7.1.3)

$\dot{r} = r(1-r^2)(4-r^2)$

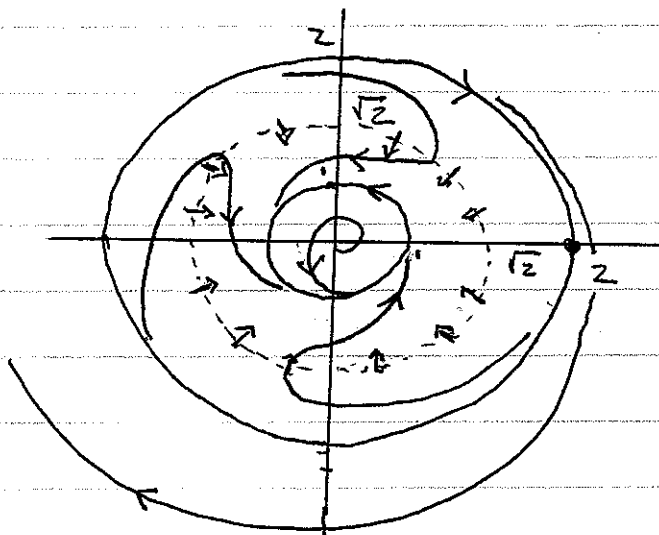


$\dot{\theta} = 2 - r^2$ $\dot{\theta} = 0$ when $r = \sqrt{2}$

$r < \sqrt{2}$ $\dot{\theta} > 0$ COUNTER

$r > \sqrt{2}$ $\dot{\theta} < 0$ CLOCK

$r = \sqrt{2}$ $\dot{\theta} = 0$ ALL RADIAL



(7.2.1) $DF(0) = \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}$

$Tr = 2$ $\det = 2$ UNSTABLE FOCUS

let $x = r \cos \theta$ $y = r \sin \theta$

$\dot{r} = r(1 - r^2 - r^2 \sin^2 2\theta)$

$\dot{\theta} = 1 + 4r^2 \cos \theta \sin^3 \theta$

$\dot{r} \geq 0$ if $r = r^3 - r^3 \sin^2 2\theta \geq 0$

$\dot{r} > 0$ if $\frac{r - r^3}{r^3} > \sin^2 2\theta$

$\frac{1 - r^2}{r^2} > 1 \Rightarrow r < \frac{\sqrt{2}}{2}$

$\dot{r} < 0$ if $\frac{r - r^3}{r^3} < 0$

$r - r^3 < 0 \Rightarrow r > 1$

