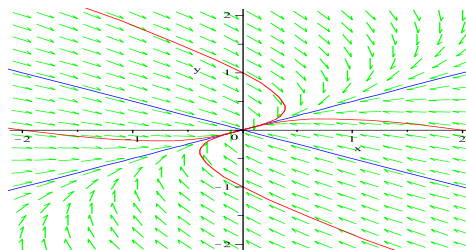
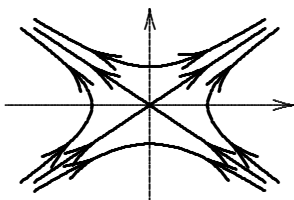


1. (a) $\mathbf{z}(t) = c_1 e^{-2t} \begin{pmatrix} 2 \\ 1 \end{pmatrix} + c_2 e^{-6t} \begin{pmatrix} -2 \\ 1 \end{pmatrix}$. (b)

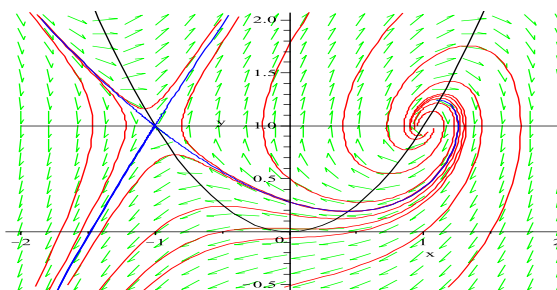
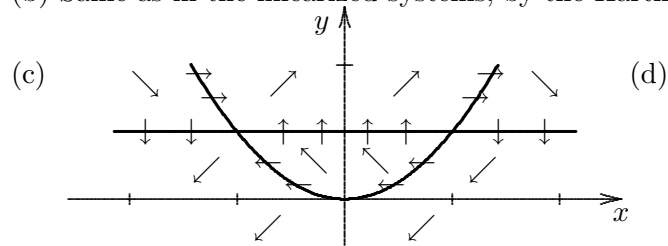


2. $y^2 - x^2 = C$;



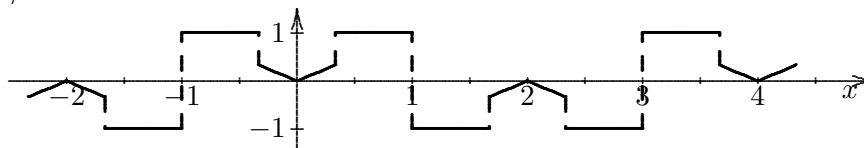
3. (a) $(1, 1)$: unstable focus (unstable); $(-1, 1)$: saddle (unstable).

(b) Same as in the linearized systems, by the Hartman-Grobman Theorem.



4. (b) $c = 1, \quad d = 4/\pi$.

5.



(b) (i) 0, at $x = 0$, (ii) $2/3$, at $x = 1/3$, (iii) 0, at $x = 3$.

6. QRS:

$$u(x, t) = \sum_{n=1,3,5,\dots} \frac{20}{n\pi} \sin\left(\frac{n\pi x}{6}\right) e^{-(n\pi/3)^2 t}$$

7. (b) With $\lambda = \kappa^2$: $\tan 3\kappa = -\kappa$; (c) See below; (d) $c_n = \frac{\langle f, \phi_n \rangle}{\langle \phi_n, \phi_n \rangle} = \frac{\int_0^3 f(x) \sin \kappa_n x \, dx}{\int_0^3 \sin^2 \kappa_n x \, dx}$

