

## Schedule & Homework

Note: Z=Zhang, S=Strogatz, DHS=Devaney,Hirsch,Smale

Date	Topic	Notes	Assignments
Jan 26	Introduction: differential equations & dynamical systems		
Jan 28	First order autonomous equations Differential equations in dimension one: equilibrium & stability	Z3.1-3.2 S2.1-2.4	
Feb 2	Stability, Lyapunov function & examples	S2.4-2.7 Notes Bb	HW1 (due Feb 11)
Feb 4	Existence & uniqueness of solutions Bifurcations, normal forms	Z3.2, S2.5	
Feb 9	Bifurcations: saddle-node, transcritical & examples	Z3.3, S3.1-3.2 Notes Bb	HW2 (due Feb 18)
Feb 11	Bifurcations: transcritical, pitchfork, hysteresis	S3.3-3.4	
Feb 16	Dimension two: Linear systems	Z5, S5.1-5.2	
Feb 18	Classification of linear systems	S5.2, 6.1-6.2	HW3 (due Feb 25)
Feb 23	Nonlinear systems: sinks, saddles, sources, stability, hyperbolicity Hartman-Grobman theorem; Examples	S6.3-6.5	
Feb 25	Stable/unstable manifolds, closed orbits, limit cycles An example of Hopf bifurcation	S7.1, 8.2	HW4 (due Mar 8)
Mar 1	Conservative systems, energy and nonlinear centers	S6.5	
Mar 3	Gradient systems, Lyapunov functions and examples	S7.2, Z6.2	
Mar 8	Dulac's criterion, Bendixon's negative criterion	S7.1-7.3 Z6.3-6.4	HW5 (due Mar 24)
Mar 10	Poincaré-Bendixon theorem	Z6.4-6.5	
Mar 15	<i>Spring break (no class)</i>		
Mar 17	<i>Spring break (no class)</i>		
Mar 22	Applications of Poincaré-Bendixon theorem	S7.3	
Mar 24	Bifurcations in two-dimensional systems	S8.1-8.2	Practice problems
Mar 29	Hopf bifurcations Review	S8.2-8.3	Project Topics
Mar 31	<b>Midterm (1:00-2:20pm, in class) -- Midterm</b>		

Apr 5	Hopf bifurcations; Examples	Notes Bb <b>DHS Ch. 8</b>	
Apr 7	Homoclinic bifurcations; Lorenz system	<b>S8.4, S9.2</b>	
Apr 12	Lorenz system & properties	<b>S9.2, Notes Bb</b>	
Apr 14	Dissipative systems, attractors, examples	<b>S9.3, Notes Bb</b>	<b>HW6</b> (due Apr 21)
Apr 19	Lorenz attractor	<b>S9.3</b>	
Apr 21	A model for the Lorenz attractor Poincaré map	<b>DHS Ch. 14</b> <b>Pictures</b>	
Apr 26	Chaotic attractor Reading (see Figures 6, 7): <b>A new twist in knot theory</b> Animation several trajectories ( <b>Video</b> )	<b>DHS Ch. 14</b> <b>Pictures</b>	<b>HW7</b> (due May 5)
Apr 28	Discrete dynamical systems Chaos	<b>S10</b> <b>DHS Ch. 15</b>	
May 3	Discrete dynamical systems; Examples	<b>S10</b> <b>DHS Ch. 15</b>	
May 5	Fractals and dimension Three-dimensional ODEs - Open Problems	<b>S11</b>	
May 16	<b>Projects -- due at 5:30pm in Math Tower 4-103</b>		