

# Ordinary Differential Equations

Steven R. Bell

1. Some Basic Mathematical Models; Direction Fields
2. Solutions of Some Differential Equations
3. Classification of Differential Equations
4. Linear Differential Equations; Method of Integrating Factors
5. Separable Differential Equations
6. Modeling with First-Order Differential Equations
7. Differences Between Linear and Nonlinear Differential Equations
8. Autonomous Differential Equations and Population Dynamics
9. Exact Differential Equations and Integrating Factors
10. Numerical Approximations: Euler's Method
11. Review
12. Homogeneous Differential Equations with Constant Coefficients
13. Solutions of Linear Homogeneous Equations; the Wronskian
14. Complex Roots of the Characteristic Equation
15. Repeated Roots; Reduction of Order
16. Nonhomogeneous Equations; Method of Undetermined Coefficients
17. Variation of Parameters
18. Mechanical and Electrical Vibrations
19. Forced Periodic Vibrations
20. General Theory of nth Order Linear Differential Equations
21. Homogeneous Differential Equations with Constant Coefficients
22. The Method of Undetermined Coefficients
23. The Method of Variation of Parameters

- 24. The Method of Variation of Parameters, Introduction of Systems of First-Order Linear Equations
- 25. Introduction of Systems of First-Order Linear Equations, Matrices
- 26. Systems of Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors
- 27. Basic Theory of Systems of First-Order Linear Equations
- 28. Homogeneous Linear Systems with Constant Coefficients, Complex-Valued Eigenvalues
- 29. Complex-Valued Eigenvalues, Fundamental Matrices
- 30. Repeated Eigenvalues
- 31. Nonhomogeneous Linear Systems
- 32. The Phase Plane: Linear Systems, Autonomous Systems and Stability
- 33. Locally Linear Systems, Competing Species
- 34. Review
- 35. Locally Linear Systems, Competing Species
- 36. Locally Linear Systems
- 37. Predator – Prey Equations
- 38. Definition of the Laplace Transform
- 39. Solution of Initial Value Problems
- 40. Step Functions, Differential Equations with Discontinuous Forcing Functions
- 41. Review
- 42. Review

June 11, 2025