TABLE PT7.2 Specific study objectives for Part Seven.

1. Understand the visual representations of Euler's, Heun's, and the midpoint methods
2. Know the relationship of Euler's method to the Taylor series expansion and the insight it provides regarding the error of the method
3. Understand the difference between local and global truncation errors and how they relate to the choice of a numerical method for a particular problem
4. Know the order and the step-size dependency of the global truncation errors for all the methods described in Part Seven; understand how these errors bear on the accuracy of the techniques
5. Understand the basis of predictor-corrector methods; in particular, realize that the efficiency of the corrector is highly dependent on the accuracy of the predictor
6. Know the general form of the Runge-Kutta methods; understand the derivation of the second-order RK method and how it relates to the Taylor series expansion; realize that there are an infinite number of possible versions for second- and higher-order RK methods
7. Know how to apply any of the RK methods to systems of equations; be able to reduce an nth-order ODE to a system of n first-order ODEs
8. Recognize the type of problem context where step size adjustment is important
9. Understand how adaptive step size control is integrated into a fourth-order RK method
10. Recognize how the combination of slow and fast components makes an equation or a system of equations stiff
11. Understand the distinction between explicit and implicit solution schemes for ODEs; in particular, recognize how the latter (1) ameliorates the stiffness problem and (2) complicates the solution mechanics
12. Understand the difference between initial-value and boundary-value problems
13. Know the difference between multistep and one-step methods; realize that all multistep methods are predictor-correctors but that not all predictor-correctors are multistep methods
14. Understand the connection between integration formulas and predictor-corrector methods
15. Recognize the fundamental difference between Newton-Cotes and Adams integration formulas
16. Know the rationale behind the polynomial and the power methods for determining eigenvalues; in particular, recognize their strengths and limitations
17. Understand how Hoteller's deflation allows the power method to be used to compute intermediate eigenvalues
18. Know how to use software packages and/or libraries to integrate ODEs and evaluate eigenvalues