

Chapter 9

Questions to Guide Your Review

1. What is a first-order differential equation? When is a function a solution of such an equation?
2. How do you solve separable first-order differential equations?
3. What is the law of exponential change? How can it be derived from an initial value problem? What are some of the applications of the law?
4. What is the slope field of a differential equation $y' = f(x, y)$? What can we learn from such fields?
5. How do you solve linear first-order differential equations?
6. Describe Euler's method for solving the initial value problem $y' = f(x, y), y(x_0) = y_0$ numerically. Give an example. Comment on the method's accuracy. Why might you want to solve an initial value problem numerically?
7. Describe the improved Euler's method for solving the initial value problem $y' = f(x, y), y(x_0) = y_0$ numerically. How does it compare with Euler's method?
8. What is an autonomous differential equation? What are its equilibrium values? How do they differ from critical points? What is a stable equilibrium value? Unstable?
9. How do you construct the phase line for an autonomous differential equation? How does the phase line help you produce a graph which qualitatively depicts a solution to the differential equation?
10. Why is the exponential model unrealistic for predicting long-term population growth? How does the logistic model correct for the deficiency in the exponential model for population growth? What is the logistic differential equation? What is the form of its solution? Describe the graph of the logistic solution.