

6. REVIEW QUESTIONS

1. Why are numerical methods for boundary value problems important?
2. Discuss the advantages and disadvantages of using numerical methods for boundary value problems.
3. Convince yourself of the validity of the general idea of approximation. Consider, for example, the question of tiling a domed roof with triangular tiles.
4. What is the most basic premise in an approximation to the continuum? How do we justify the choice of a particular level of approximation?
5. What does the finite difference method attempt to approximate and how does it do it?
6. What is “finite” in finite difference approximations?
7. All finite difference approximations to a particular derivative are identical in terms of the error they introduce T/F. Explain.
8. What are forward difference approximations? Give an example.
9. What are backward difference approximations? Give an example and show when you might want to use it.
10. What are central difference approximations? Give an example.
11. Central difference approximations are usually more accurate than forward or backward finite difference approximations. Explain why this is so.
12. To increase the accuracy of a finite difference solution we need to define a better approximation to the derivative. How can this be done?
13. The method of moments uses a source approximation. Discuss the difference between this method of approximation and the finite difference method.
14. Discuss the basic principles of the method of moments.
15. Explain why the method of moments is more practical than the finite difference method when the solution domain is open or infinite in extent. Take as an example the calculation of the capacitance of a small plate in free space.
16. Consider and discuss the limitations of the method of moments. In particular, discuss the approximation, method of solution, structure of the system of equations, and so forth.
17. Discuss the basic principles of the finite element method.
18. How does the finite element method differ from the method of moments and the finite difference method?
19. What is “finite” in the finite element approximation method and how does this vary from the finite difference method or the method of moments?
20. The finite element method uses polynomial approximations on the finite element. We have used only first-order polynomials. Discuss the possibility and the advantages of using higher-order approximations.