

1. Write the formula for the  $j^{\text{th}}$  Chebyshev point on the interval  $[-1, 1]$ .
2. How many points must one use for Gaussian quadrature to be exact for a polynomial of degree 5.
3. Write the formula for the trapezoidal quadrature rule with  $n$  points.
4. Write the formula for Simpson's quadrature rule with  $n$  points.
5. How does the error scale, as a function of the step size  $h$ , for the midpoint quadrature rule.
6. What is the least squares solution to  $Ax = b$ .
7. Write the Lagrange polynomial of degree two which passes through  $(1, 1)$ ,  $(2, 0)$  and  $(3, -1)$ .
8. Write the general formula for a Newton's divided difference polynomial of degree  $n$ .
9. The best step size  $h$ , for the leapfrog method scales like  $h \sim \epsilon^p$ , what is  $p$ ?
10. T/F, If a matrix has  $\det(A) = 0$  then there is no solution to  $Ax = b$ .
11. T/F, Gaussian elimination always yields a solution to  $Ax = b$ .
12. Define Richardson Extrapolation
13. Define the spectral radius  $\rho(A)$ .
14. Define the induced matrix p-norm  $\|A\|_p$  in terms of corresponding vector p-norm.
15. At what rate will Newton's method converge to  $p = 3$  if  $f(x) = (x - 3)^2$ .
16. What is the motivation to use an implicit scheme for solving an ODE  $f'(t) = g(f, t)$ .
17. One iteration of  $x_{k+1} = Mx_k + f$ , with  $M$  and  $n \times n$  matrix, requires  $O(n^p)$  multiplications, for what  $p$ ?
18. Gaussian Elimination for an  $n \times n$  matrix, requires  $O(n^p)$  multiplications, for what  $p$ ?
19. The method of false position converges at like  $E_{n+1} = CE_n^\alpha$  for  $\alpha$  in what interval?
20. Write  $15/8$  as a binary decimal.
21. Are there floating point errors when  $1/2$  is added to  $1/256$  in storage type double?
22. What interval of numbers is represented by 1 in a floating point system if rounding is used? if chopping is used?
23. Compute  $\|A\|_1$ , for a given matrix  $A$ .