

1. In the floating point system  $0.d_1d_2d_3 \times 10^p, p \in [-5, 5]$ , how does the computer represent  $(300 - 1.5)$  when rounding? chopping?
2. How many steps does the secant method take to converge to the root of a linear function?
3. Name two limitations of Newton's method.
4. Solve  $Ax = b$  using Gaussian elimination where

$$A = \begin{pmatrix} 3 & 10 \\ 1 & 2 \end{pmatrix} \quad \text{and} \quad b = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$$

5. Numerically, should we pivot in the above problem?
6. Find the polynomial which passes through the points  $(1, 1)$ ,  $(2, 2)$  and  $(3, -1)$  using Lagrange interpolation.
7. Find the maximum value of the Chebyshev polynomial  $T_n(x) = \cos(n \arccos(x))$
8. Draw the figure in the  $xy$ -plane which corresponds to  $\|v\|_2 = 1$ , if  $v = (x, y)$ .
9. Calculate  $\|A\|_1$  for

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & -1 & 2 \\ 8 & -4 & 1 \end{pmatrix}$$

10. (T/F) An iterative method may converge if  $\rho(M) > 1$ ?
11. (T/F) There exists matrices with  $\|M\|_\infty = 0$  and  $\|M\|_1 = 1$ ?
12. (T/F) There exists matrices with  $\rho(M) = 0$  and  $\|M\|_\infty = 1$ ?
13. (T/F) If a method for solving the IVP  $y' = f(y)$  has truncation error  $O(h^2)$ , then the method converges as  $h \rightarrow 0$
14. (T/F) The backward Euler method  $\frac{y_{n+1} - y_n}{h} = f(y_{n+1})$  is explicit.
15. If Gaussian Quadrature is applied to find  $\int_{-1}^1 f(x)dx \approx \sum w_j f(x_j)$ , find  $x_j$  and  $w_j$  if there is one point (so that the quadrature is exact for polynomials of degree  $2n-1=1$ ).
16. In this case Gaussian Quadrature is equivalent to what other method?
17. Given  $a(x, h) = b(x) + O(h^2)$  use Richardson extrapolation to find an  $O(h^3)$  formula for  $b(x)$
18. (T/F) Simpson's rule uses piecewise cubic functions to approximate an integral.
19. (T/F) The Forward Euler scheme is linearly stable when applied to a function with  $\lambda = -5$  using step size  $h = 1/2$
20. (T/F) The Gauss Seidel Method diverges when applied to  $A$  which are not diagonal dominant.