1. Newton's interpolating polynomial
2. Lagrange interpolating polynomial
3. Natural cubic spline
4. LU decomposition
5. Least-square polynomial (with or without weights)
6. Least-square linear model
7. Gaussian elimination (with or without full pivoting)
8. Matrix inversion (with or without full pivoting)
9. Given an interval and a weight function, construct the first few orthogonal polynomials (Gram-Schmidt).
10. Fit a function, over a specific interval, by the 'best' polynomial of a given degree, utilizing either Legendre or Chebyshev polynomials.

    Be able to apply

11. the composite trapezoidal rule (with Romberg),
12. the composite Simpson rule (with Romberg),
13. or the n point Gaussian rule, to any $\int_A^B y(x)dx$ type of integral.
14. For the same integral, be able to derive your own rule, given the nodes.
15. Also for the $\int_A^B w(x) \cdot y(x)dx$ case, where $w(x)$ is a given weight function.
16. Given the nodes, derive a formula for a specific derivative of $y(x)$, at $x = x_0$ (understand Richardson extrapolation).
17. Find a solution to n non-linear equations for n unknows (initial values provided).
18. Solve a second order (linear or non-linear) ODE with given two boundary values and the number of subintervals.

19. Householder's technique for reducing a symmetric matrix to its tri-diagonal form.

20. QR decomposition and finding eigenvalues of a matrix , utilizing 'shift'.