#Q	Method	Formula	Convergence/Info	Rate
1	Gaussian Elimination	Swap, X, − rows of $[A \mid B]$ to get UTM Bckwd Sub to get values of [X]. ≫ X = A\B	Partial Pivot: PAX = PB ↳ pivot = largest magnitude	Both = $O(N^3)$ fwd/bwd Sub = $O(N^2)$
	L.U. Factorization	U = UTM, using Gauss. Elim. on [A]. L = LTM, 1 on diag., then multipliers. ≫ [L U P] = lu(A)	A = LU ⇒ LUX = B., UX = Y & LY = B PLUX = PB ⇒ UX = Y & PLY = PB	
1	Eigenvalues Eigenvectors Power Method	$\det(A-\lambda I)=0$ ≫ [V D] = eig(A) $(A-\lambda I)\vec{V}=0$ $Y_k = AX_k$, $X_{k+1} = 1/c_{k+1}(Y_k)$ ↳ c_{k+1} is largest mag. coord. of Y_k.	★ At least one a_{kk} will = 0 ↳ let $V_k = 1$ dom. e-val is unique → conv. d. e-v. not unique (3,-3) → div.	N/A N/A $\left(\frac{\lambda_2}{\lambda_1}\right)^k$
2-3	Fixed Point $f(x)=0 \rightarrow x=g(x)$	$p_{k+1} = g(p_k)$ ≫ roots(P) ★ P = [coeffs of poly]	$g, g' \in C[a,b] \wedge p$ & $p_0 \in [a,b]$ $\lvert g'(p)\rvert < 1$ → conv. " > 1 → div.	N/A " = 1 → may/not
	Bisection	$c=(a+b)/2$ & find f(c) ★ f(c)=0 → Stop ↳ use c to replace a or b to keep [+,−]	$f \in C[a,b] \wedge f(a)f(b)<0$ → GC	linear
	Regula Falsi	$c = b - [f(b)(b-a) \div (f(b)-f(a))]$	" ∧ " → GC	linear
	Secant	$p_{k+1} = p_k - [f(p_k)(p_k - p_{k-1}) \div (f(p_k) - f(p_{k-1}))]$	$f \in C[a,b]$ → LC	M=1 → quad.
	{M} Newton	$x_k = x_{k-1} - \{M\}[f(x_{k-1}) \div f'(x_{k-1})]$	" ∧ $f'(x_{k-1}) \neq 0$ → LC	M>1 → linear
1	Jacobi	$x_{k+1} = f_1(y_k, z_k)$ $z_{k+1} = f_3(x_k, y_k)$ $y_{k+1} = f_2(x_k, z_k)$	A is strictly diagonally dom. ↳ $\lvert a_{kk}\rvert > \sum_{j=1, j\neq k}^{n} \lvert a_{kj}\rvert, \forall k$ ⇒ convergense ↳ else, may/not conv.	N/A
	Gauss-Seidel	$x_{k+1} =$ " $y_{k+1} = f_2(x_{k+1}, z_k)$ $z_{k+1} = f_3(x_{k+1}, y_{k+1})$		N/A
	Non-Linear	Both = same as linear, but conv. is new. ↳ $g_1, g_2, \partial g \in [R] \wedge (p,q)$ & $(p_0,q_0) \in [R]$	$\left\lvert \frac{\partial g_N}{\partial x}(p)\right\rvert + \left\lvert \frac{\partial g_N}{\partial y}(p)\right\rvert < 1$ ∀N → conv.	N/A
	Lagrange	$P_N(x) = \sum_{k=0}^{N} y_k L_{N,k}(x)$ & $L_{N,k}(x) = \prod_{j=0\neq k}^{N} \frac{x-x_j}{x_k-x_j}$	$E_N = \frac{f^{N+1}(c)(x-x_0)\cdots(x-x_N)}{(N+1)!}$	N/A $c \in [x_0, x_N]$
1	Newton	$P_1(x) = a_0 + a_1(x-x_0)$ $P_2(x) =$ " $+ a_2(x-x_0)(x-x_1)$ $P_N(x) =$ " + " $+ \ldots + a_N(x-x_0)\ldots(x-x_{N-1})$	$E_N =$ " $a_0 \cdots a_N$ → use div. diff. table	N/A
1-2	Differentiation Taylor's Poly.	See Difference Formulas Sheet $f(x) + h/1![f'(x)] + h^2/2![f''(x)] + h^3/3![f'''(x)] + \ldots$ $f(x) - h/1![f'(x)] + h^2/2![f''(x)] - h^3/3![f'''(x)] + \ldots$	E-Err = $\lvert$exact − approx$\rvert$ $= f(x+h)$ R-Err = E-Err/exact $= f(x-h)$	N/A "
1	L□ Line $y=Ax+B$ L□ Power $y=Ax^M$ L□ Change Var	$A\sum x_k^2 + B\sum x_k = \sum x_k y_k$ & $A\sum x_k + NB = \sum y_k$ $A = \sum x_k^M y_k \div \sum x_k^{2M}$ ① $y = A/x + B \rightarrow X = 1/x$ ④ $y=(Ax+B)^{-2} \rightarrow Y = 1/\sqrt{y}$ ② $y = 1/(Ax+B) \rightarrow Y = 1/y$ ⑤ $y = x/(A+Bx)$ ③ $y = A\ln x + B \rightarrow X = \ln x$ ↳ $Y = 1/y$ & $X = 1/x$	RMSE = $E_2 = [1/n \sum_{k=1}^{n} (f(x_k)-y_k)^2]^{1/2}$ ⑥ $y = ce^{Ax} \rightarrow Y = \ln y$ & $B = \ln c$ ⑦ $y = cx^A \rightarrow Y = \ln y$ & $X = \ln x$ & $B = \ln c$	N/A " "
1	Trapezoidal	$h = b-a$ & $\int_a^b f(x)dx = h/2[f_0+f_1]$	E-Err & R-Err are same.	$O(h^3)$, deg 1
	Comp. Trap.	$\int_a^b f(x)dx = h/2[f_0 + 2(f_1+\ldots+f_{M-1}) + f_M]$	$h = (b-a)/M$	$O(h^2)$
	Simpson	$\int_a^b f(x)dx = h/3[f_0 + 4f_1 + f_2]$	$h = (b-a)/2$	$O(h^5)$, deg 3
	Comp. Simp.	$\int_a^b f(x)dx = h/3[f_0 + 4(\sum f_{odd}) + 2(\sum f_{even}) + f_{2M}]$	$h = (b-a)/2M$	$O(h^4)$
1	Optimization	$f'(x)=0$ or DNE → x is possible max/min • f' changes from +ve to −ve @ c → max=c • f' changes from −ve to +ve @ c → min=c	f' doesn't change sign @ c ↳ c is neither max nor min ≫ fminsearch('f', [x_0, y_0])	
	Golden Ratio	See formula sheet. • $f(c) \leq f(d)$ → new = [a,d], $d_{k+1} = c_k$ • $f(c) > f(d)$ → new = [c,b], $c_{k+1} = d_k$	f is unimodal on [a,b] ↳ unique min point in [a,b] AND $f \in C[a,b]$.	