PRACTICAL-5(a): GAUSS JACOBI METHOD

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```
GaussJacobi[A0_, b0_, X0_, maxiter_] :=
  Module[{A = N[A0], b = N[b0], xk = X0, xk1, i, j, k = 0, n, m,
    OutputDetails},
   size = Dimensions[A];
   n = size[[1]];
   m = size[[2]];
   If[n ≠ m,
    Print[
     "Not a square matrix, cannot proceed with gauss jacobi method"];
    Return[]];
   OutputDetails = {xk};
   xk1 = Table[0, {n}];
   While[k < maxiter,
    For[i = 1, i ≤ n, i++,
     xk1[[i]] = 1/A[[i, i]] * (b[[i]] - Sum[A[[i, j]] * xk[[j]], {j, 1, i-1}] - Sum[A[[i, j]] * xk[[j]], {j, i+1, n}]);];
    k++;
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[X[s], {s, 1, n}];
   Print[NumberForm[TableForm[OutputDetails,
      TableHeadings → {None, colHeading}], 6]];
   Print["No of iterations performed", maxiter];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0};
GaussJacobi[A, b, X0, 15]
```

X[1]	X[2]	X[3]
0	0	0
2.	−1.55556	4.71429
0.425397	−2.98413	4.55556
0.774603	−3.43845	3.92245
1.11871	−3.04067	3.84253
1.07112	−2.89044	4.00534
0.975953	−2.97867	4.04146
0.979148	−3.02644	4.00266
1.00422	−3.00813	3.98947
1.00584	−2.99391	3.99828
0.99947	−2.99729	4.00257
0.998428	−3.00132	4.0007
0.999985	−3.00083	3.9994
1.00041	−2.99974	3.99976
1.00004	−2.99976	4.00013
0.999898	−3.00004	4.00008

No of iterations performed15

Gauss Jacobi with error

```
GaussJacobiwithErr[A0_, b0_, X0_, maxiter_] :=
  Module[{A = N[A0], b = N[b0], xk = X0, xk1, i, j, k = 0, n, m,
    OutputDetails},
   size = Dimensions[A];
   n = size[[1]];
   m = size[[2]];
   If[n ≠ m,
    Print[
     "Not a square matrix, cannot proceed with gauss jacobi method"];
    Return[]];
   OutputDetails = {xk};
   maxNorm = .001;
   xk1 = Table[0, {n}];
   While[maxNorm > error,
    For[i = 1, i ≤ n, i++,
     xk1[[i]] = 1/A[[i, i]] * (b[[i]] - Sum[A[[i, j]] * xk[[j]], {j, 1, i-1}] - Sum[A[[i, j]] * xk[[j]], {j, i+1, n}]);]
    k++;
    maxNorm = Max[Abs[xk1 - xk]];
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[X[s], {s, 1, n}];
   Print[NumberForm[TableForm[OutputDetails,
      TableHeadings → {None, colHeading}], 6]];
   Print["No of iterations takens to acheive desired accuracy=", k];
   Print["Max norm at", k, "th iterations=", maxNorm];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0}
error = 10^-4
GaussJacobiwithErr[A, b, X0, error]
```

{0, 0, 0}

$\frac{1}{10000}$

X[1]	X[2]	X[3]
0	0	0
2.	−1.55556	4.71429
0.425397	−2.98413	4.55556
0.774603	−3.43845	3.92245
1.11871	−3.04067	3.84253
1.07112	−2.89044	4.00534
0.975953	−2.97867	4.04146
0.979148	−3.02644	4.00266
1.00422	−3.00813	3.98947
1.00584	−2.99391	3.99828
0.99947	−2.99729	4.00257
0.998428	−3.00132	4.0007
0.999985	−3.00083	3.9994
1.00041	−2.99974	3.99976
1.00004	−2.99976	4.00013
0.999898	−3.00004	4.00008
0.999979	−3.00007	3.99997
1.00002	−2.99999	3.99998

No of iterations takens to acheive desired accuracy=17

Max norm at17th iterations=0.000072592