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In[1]:= (* MA39110 / Assignment 6 / 16MA20053 / NER ROHIT *)
        ClearAll["Global`*"];

In[2]:= Thomas[a_, b_, c_, d_] :=
          Module[{c1 = Range[Length[c]], d1 = Range[Length[d]], x = Range[Length[b]]},
            c1[[1]] = c[[1]] / b[[1]]; d1[[1]] = d[[1]] / b[[1]];
            Do[
             If[i ≠ Length[d], c1[[i]] = c[[i]] / (b[[i]] - a[[i - 1]] * c1[[i - 1]])];
             d1[[i]] = (d[[i]] - a[[i - 1]] * d1[[i - 1]]) / (b[[i]] - a[[i - 1]] * c1[[i - 1]]);
             , {i, 2, Length[d]}];
            x[[Length[b]]] = d1[[Length[b]]];
            Do[
             x[[i]] = d1[[i]] - c1[[i]] * x[[i + 1]];
             , {i, Length[b] - 1, 1, -1}];
            x];
        Model[n0_, r0_] := Module[{n = n0, r = r0},
          x0 = 0; xf = 1; h = (xf - x0) / n;
          A = Table[0, {x, 1, n - 1}, {y, 1, n - 1}];
          X = Table[x0 + x * h, {x, 1, n - 1}];
          XT = Table[x0 + x * h, {x, 0, n}];
          B = Table[0, {x, 1, n - 1}];
          t = 100;
          PLT = Table[0, {x, 1, t}];
          y[x_] = Sin[Pi * x];
          Y = N[y[XT]];
          For[j = 1, j <= t, j++,
            {
             For[i = 1, i < n, i++,
              {
               im = i + 1;
               A[[i, i]] = 1 + 2 r;
               B[[i]] = Y[[im]];
               If[i ≠ 1, A[[i, i - 1]] = -r];
               If[i ≠ n - 1, A[[i, i + 1]] = -r];
              }];
             Y = N[Flatten[
                 {{y[0]}, Thomas[Diagonal[A, -1], Diagonal[A], Diagonal[A, 1], B], {y[1]}}]];
             PLT[[j]] = ListLinePlot[Transpose[{XT, Y}]];
            };];
          Show[PLT[[1 ;; ;; 5]], PlotLabel → Style[StringForm["h = ``, r = ``", h, r]]]
          ];

In[4]:= p1 = Model[4, 1 / 4];
        p2 = Model[8, 1 / 4];
        p3 = Model[8, 1 / 8];
        p4 = Model[4, 1 / 8];
        Rotate[GraphicsGrid[{{p1, p4}, {p2, p3}}], Pi / 2]
```

$h = \frac{1}{4}, r = \frac{1}{4}$

$h = \frac{1}{4}, r = \frac{1}{8}$

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