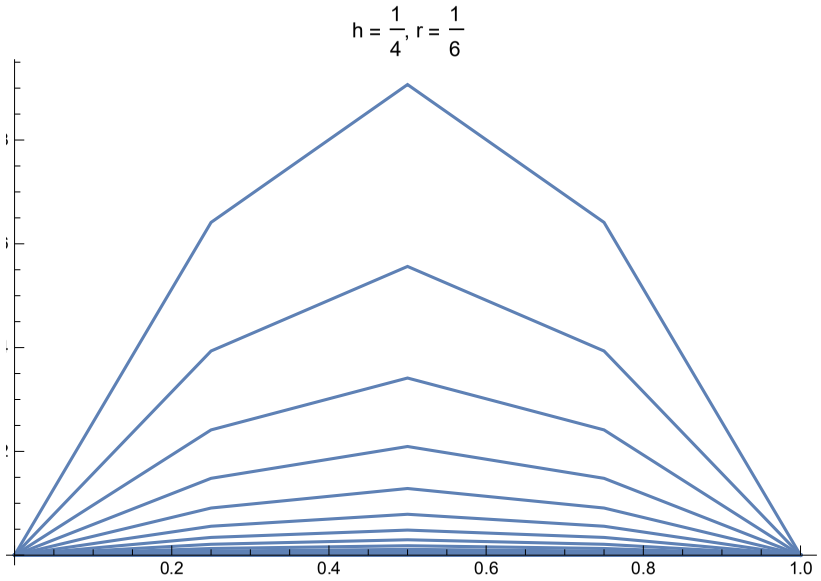
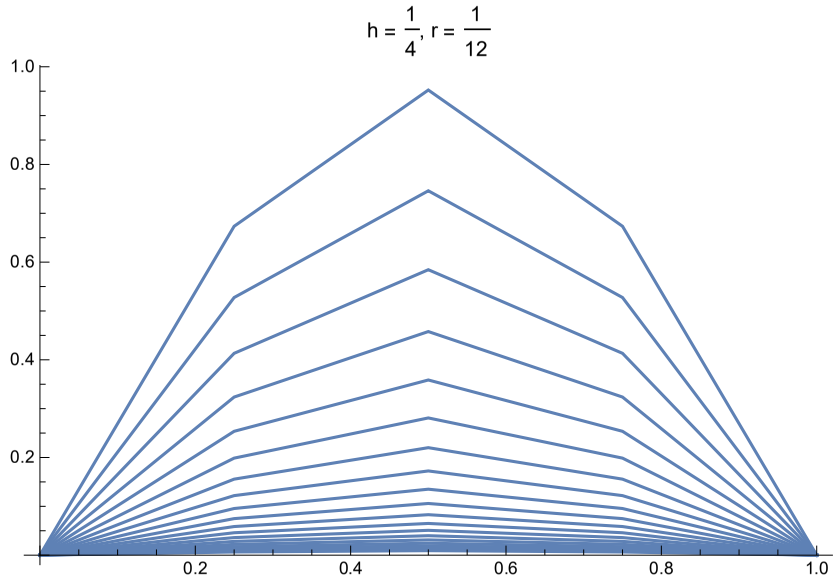
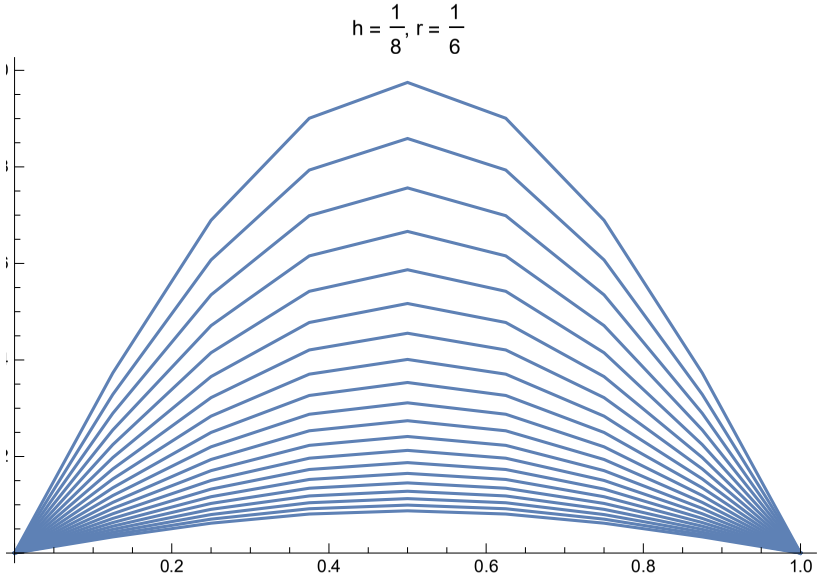
In[1]:=
```
(* MA39110 / Assignment 7 / 16MA20053 / NER ROHIT *)
ClearAll["Global`*"];
```

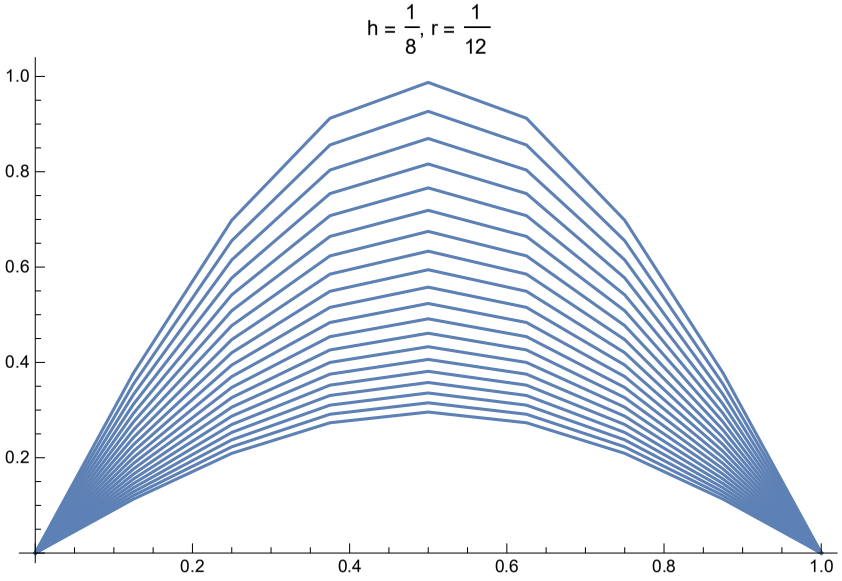
In[2]:=
```
Thomas[a_, b_, c_, d_] :=
  Module[{c1 = Range[Length[c]], d1 = Range[Length[d]], x = Range[Length[b]]},
   c1[[1]] = c[[1]] / b[[1]]; d1[[1]] = d[[1]] / b[[1]];
   Do[
    If[i ≠ Length[d], c1[[i]] = c[[i]] / (b[[i]] - a[[i - 1]] * c1[[i - 1]])];
    d1[[i]] = (d[[i]] - a[[i - 1]] * d1[[i - 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]] = -r - 1;
        B[[i]] = -(r / 2) (Y[[im - 1]] - 2 Y[[im]] + Y[[im + 1]]) - Y[[im]];
        If[i ≠ 1, A[[i, i - 1]] = r / 2];
        If[i ≠ n - 1, A[[i, i + 1]] = r / 2];
       }];
      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]]]
  ];

p1 = Model[4, 1 / 6];
p2 = Model[8, 1 / 6];
p3 = Model[8, 1 / 12];
p4 = Model[4, 1 / 12];
Rotate[GraphicsGrid[{{p1, p4}, {p2, p3}}], Pi / 2]
```


h = 1/4, r = 1/6
0.2
0.4
0.6
0.8
1.0


h = 1/4, r = 1/12
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0


h = 1/8, r = 1/6
0.2
0.4
0.6
0.8
1.0


h = 1/8, r = 1/12
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0