In[1]:=
```
ClearAll["Global`*"];
```

In[2]:=
```
f[x_, u_, ud_] := 2 u ud;
g[x_, v_, vd_, u_, ud_] := 2 (v ud + vd u);
u0 = 0.5;
uf = 1;
s = 0.3;
ud0 = s;
v0 = 0;
vd0 = 1;
phi = 1;
x0 = 0;
xf = 1;
```

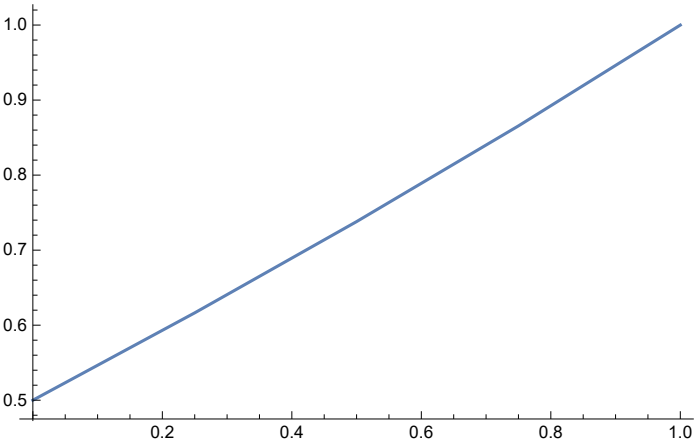
In[13]:=
```
n = 4;
h = (xf - x0) / n;
x = Table[j, {j, 1, n + 1}];
x[[1]] = x0;

u = Table[j, {j, 1, n + 1}];
ud = Table[j, {j, 1, n + 1}];
u[[1]] = u0;
ud[[1]] = ud0;

v = Table[j, {j, 1, n + 1}];
vd = Table[j, {j, 1, n + 1}];
v[[1]] = v0;
vd[[1]] = vd0;

While[Abs[phi] > 0.0005,
 For[i = 1, i < n + 1, i++,
  {
   k1 = (h^2 / 2) * f[x[[i]], u[[i]], ud[[i]]];
   k2 = (h^2 / 2) * f[x[[i]] + (2 / 3) * h,
      u[[i]] + (2 / 3) * h * ud[[i]] + (2 / 3) * k1, ud[[i]] + (4 / 3) * h * k1];
   u[[i + 1]] = u[[i]] + h * ud[[i]] + (1 / 2) * (k1 + k2);
   ud[[i + 1]] = ud[[i]] + (h / 2) * (k1 + 3 * k2);
   x[[i + 1]] = x[[i]] + h;
  }];
 phi = u[[n + 1]] - uf;
 Print[u];
 For[i = 1, i < n + 1, i++,
  {
   k1 = (h^2 / 2) * g[x[[i]], v[[i]], vd[[i]], u[[i]], ud[[i]]];
   k2 = (h^2 / 2) * g[x[[i]] + (2 / 3) * h,
      v[[i]] + (2 / 3) * h * vd[[i]] + (2 / 3) * k1, vd[[i]] + (4 / 3) * h * k1, u[[i]], ud[[i]]];
   v[[i + 1]] = v[[i]] + h * vd[[i]] + (1 / 2) * (k1 + k2);
   vd[[i + 1]] = vd[[i]] + (h / 2) * (k1 + 3 * k2);
   x[[i + 1]] = x[[i]] + h;
  }];
 phid = v[[n + 1]];
 s = s - (phi / phid);
 ud[[1]] = s;
]
ListLinePlot[Transpose[{x, u}]]
```

```
{0.5, 0.584957, 0.673023, 0.764595, 0.860121}
```

```
{0.5, 0.61721, 0.739642, 0.86808, 1.00344}
```

```
{0.5, 0.616437, 0.738039, 0.86558, 0.999959}
```

Out[26]=



In[27]:=
```
ClearAll["Global`*"];
s = NDSolve[{y''[x] == 2 * y[x] * y'[x], y[0] == 0.5, y[1] == 1}, y, {x, 0, 1}];
Plot[Evaluate[y[x] /. s], {x, 0, 1}, PlotRange → All]
```

Out[29]=