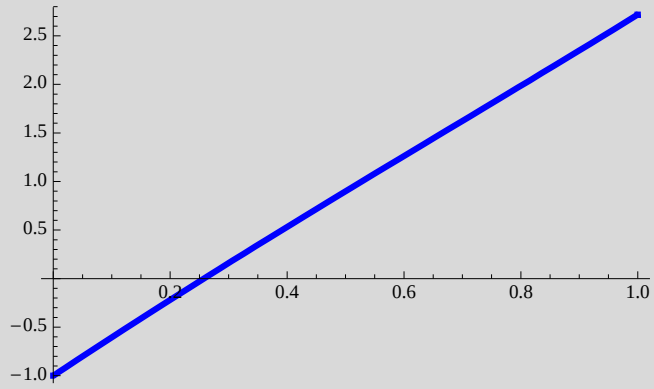
```
(** EQUAZIONI NONLINEARI ESEMPIO **)
```

In[1]:=
```
Clear[f];
f[x_] := Exp[x] - x^2 + 3 x - 2;
Plot[f[x], {x, 0, 1}, PlotStyle → {RGBColor[0, 0, 1], Thickness[0.01]}]
```

Out[3]=



In[23]:=
```
a = 0.0; b = 1.0;
tol = 10^(-4);
fa = f[a];
fb = f[b];
an[0] = a; bn[0] = b;
cn[0] = 0.5 * (a + b);
testbis[0] = bn[0] - an[0];
nmax = 10;
Do[fa = f[an[n - 1]]; fc = f[cn[n - 1]];
  If[fa * fc < 0, {an[n] = an[n - 1]; bn[n] = cn[n - 1]}, {an[n] = cn[n - 1]; bn[n] = bn[n - 1]}];
  cn[n] = 0.5 * (an[n] + bn[n]); testbis[n] = Abs[bn[n] - an[n]], {n, 1, nmax}];
Clear[x];
nmax = 10; x[0] = 4.;
Do[x[n + 1] = x[n] - f[x[n]] / f'[x[n]]; testnr[n] = Abs[x[n + 1] - x[n]], {n, 0, nmax}];
```

In[35]:=
```
xnr = Table[x[n], {n, 0, nmax}]
xbi = Table[cn[n], {n, 0, nmax}]
errbis = Table[testbis[n], {n, 0, nmax}]
errnr = Table[testnr[n], {n, 0, nmax}]
```

Out[35]=
```
{4., 3.02016, 1.96405, 0.808766, 0.25266,
 0.257528, 0.25753, 0.25753, 0.25753, 0.25753, 0.25753}
```

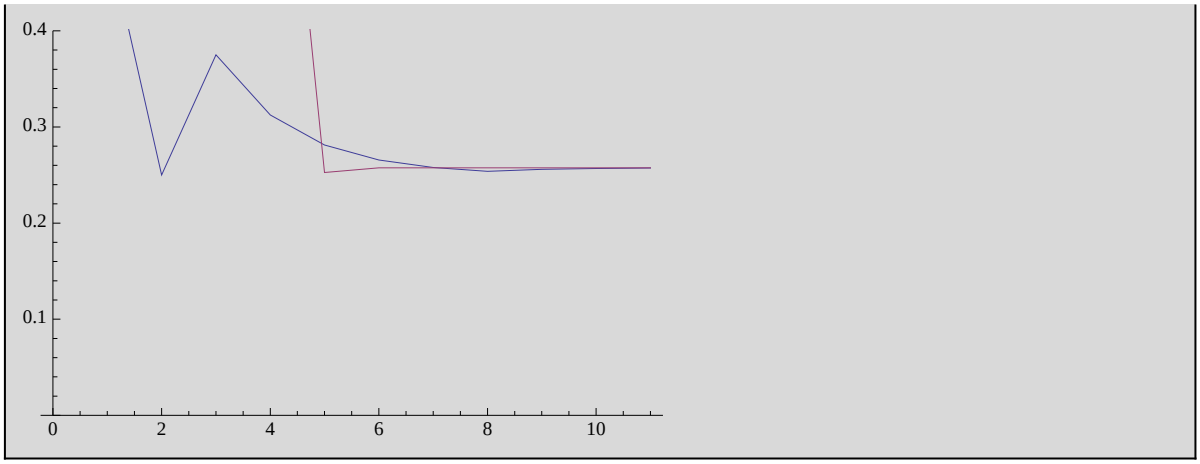
Out[36]=
```
{0.5, 0.25, 0.375, 0.3125, 0.28125, 0.265625,
 0.257813, 0.253906, 0.255859, 0.256836, 0.257324}
```

Out[37]=
```
{1., 0.5, 0.25, 0.125, 0.0625, 0.03125,
 0.015625, 0.0078125, 0.00390625, 0.00195313, 0.000976563}
```

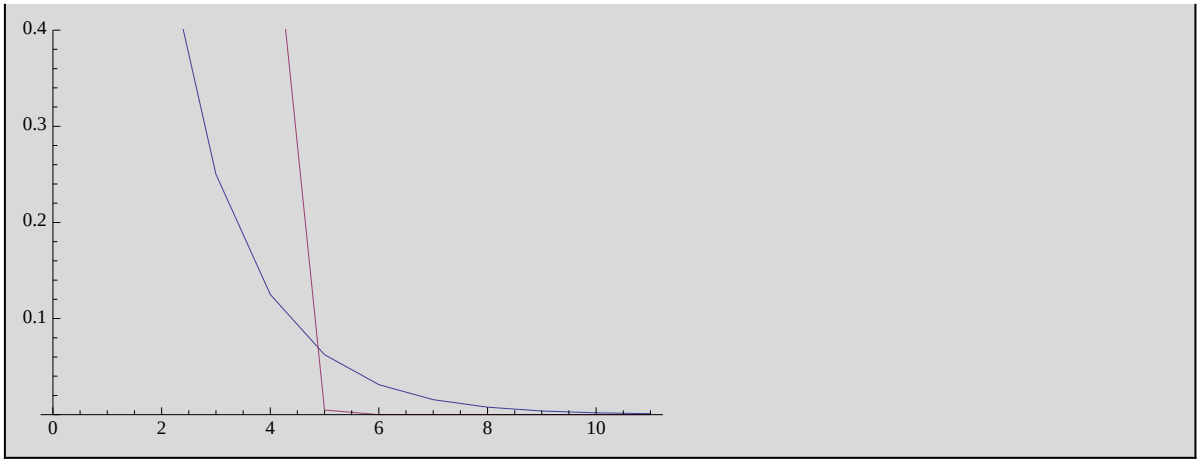
Out[38]=
```
{0.979838, 1.05611, 1.15528, 0.556105,
 0.00486783, 2.22763 × 10^-6, 4.63685 × 10^-13, 0., 0., 0., 0.}
```

In[39]:=
```
ListPlot[{xbi, xnr}, Joined → True, PlotRange → {0, 0.4}]
ListPlot[{errbis, errnr}, Joined → True, PlotRange → {0, 0.4}]
```

Out[39]=



Out[40]=



In[41]:=
```
Do[Print["n= ", n, "  c[n] = ", cn[n], "  x[n] = ", x[n],
   "  testbis = ", testbis[n], "  testnr = ", testnr[n]], {n, 0, nmax}];
```

n= 0 c[n] = 0.5 x[n] = 4. testbis = 1. testnr = 0.979838

n= 1 c[n] = 0.25 x[n] = 3.02016 testbis = 0.5 testnr = 1.05611

n= 2 c[n] = 0.375 x[n] = 1.96405 testbis = 0.25 testnr = 1.15528

n= 3 c[n] = 0.3125 x[n] = 0.808766 testbis = 0.125 testnr = 0.556105

n= 4 c[n] = 0.28125 x[n] = 0.25266 testbis = 0.0625 testnr = 0.00486783

n= 5 c[n] = 0.265625 x[n] = 0.257528 testbis = 0.03125 testnr = 2.22763×10^{-6}

n= 6 c[n] = 0.257813 x[n] = 0.25753 testbis = 0.015625 testnr = 4.63685×10^{-13}

n= 7 c[n] = 0.253906 x[n] = 0.25753 testbis = 0.0078125 testnr = 0.

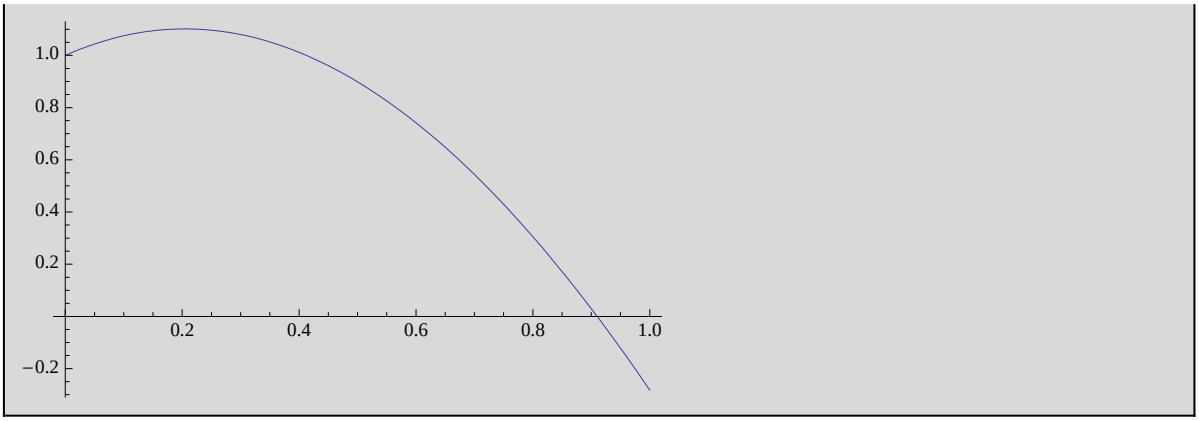
n= 8 c[n] = 0.255859 x[n] = 0.25753 testbis = 0.00390625 testnr = 0.

n= 9 c[n] = 0.256836 x[n] = 0.25753 testbis = 0.00195313 testnr = 0.

n= 10 c[n] = 0.257324 x[n] = 0.25753 testbis = 0.000976563 testnr = 0.

In[42]:=
```
Clear[f];
f[x_] := Exp[x] - 3 x^2
Plot[f[x], {x, 0, 1}]
```

Out[44]=



In[45]:=
```
a = 0.0; b = 1.0;
tol = 10^(-5);
fa = f[a];
fb = f[b];
an[0] = a; bn[0] = b;
cn[0] = 0.5 * (a + b);
test = b - a;
testbis[0] = bn[0] - an[0];
nmax = 10;
n = 1; While[test > tol, {fa = f[an[n - 1]]; fc = f[cn[n - 1]];
  If[fa * fc < 0, {an[n] = an[n - 1]; bn[n] = cn[n - 1]}, {an[n] = cn[n - 1]; bn[n] = bn[n - 1]}];
  cn[n] = 0.5 * (an[n] + bn[n]); test = Abs[bn[n] - an[n]]; n++}];
Print["Bisezione: n = ", n - 1, "  c = ", cn[n - 1]]
Clear[x]; test = 1.0; n = 0;
x[0] = 0.4;
While[test > tol, {x[n + 1] = x[n] - f[x[n]] / f'[x[n]]; test = Abs[x[n + 1] - x[n]]; n++}]
Print["Newton: n = ", n, "  c = ", x[n]]
```

```
Bisezione: n = 17  c = 0.910007

Newton: n = 6  c = 0.910008
```

In[60]:=
```
Do[fa = f[an[n - 1]]; fc = f[cn[n - 1]];
  If[fa * fc < 0, {an[n] = an[n - 1]; bn[n] = cn[n - 1]}, {an[n] = cn[n - 1]; bn[n] = bn[n - 1]}];
  cn[n] = 0.5 * (an[n] + bn[n]); testbis[n] = Abs[bn[n] - an[n]], {n, 1, nmax}];
Clear[x];
x[0] = 0.6;
Do[x[n + 1] = x[n] - f[x[n]] / f'[x[n]]; testnr[n] = Abs[x[n + 1] - x[n]], {n, 0, nmax}];
```

In[64]:=
```
Do[Print["n= ", n, "  c[n] = ", cn[n], "  x[n] = ", x[n],
   "  testbis = ", testbis[n], "  testnr = ", testnr[n]], {n, 0, nmax}];
```

n= 0 c[n] = 0.5 x[n] = 0.6 testbis = 1. testnr = 0.417418

n= 1 c[n] = 0.75 x[n] = 1.01742 testbis = 0.5 testnr = 0.101655

n= 2 c[n] = 0.875 x[n] = 0.915762 testbis = 0.25 testnr = 0.00573512

n= 3 c[n] = 0.9375 x[n] = 0.910027 testbis = 0.125 testnr = 0.0000193767

n= 4 c[n] = 0.90625 x[n] = 0.910008 testbis = 0.0625 testnr = 2.21789×10^{-10}

n= 5 c[n] = 0.921875 x[n] = 0.910008 testbis = 0.03125 testnr = 1.11022×10^{-16}

n= 6 c[n] = 0.914063 x[n] = 0.910008 testbis = 0.015625 testnr = 0.

n= 7 c[n] = 0.910156 x[n] = 0.910008 testbis = 0.0078125 testnr = 0.

n= 8 c[n] = 0.908203 x[n] = 0.910008 testbis = 0.00390625 testnr = 0.

n= 9 c[n] = 0.90918 x[n] = 0.910008 testbis = 0.00195313 testnr = 0.

n= 10 c[n] = 0.909668 x[n] = 0.910008 testbis = 0.000976563 testnr = 0.

In[65]:=
```
Plot[f[x], {x, 3, 5}]
```

Out[65]=