```
(** ESERCIZIO 3.1.3 e 7 (a) **)

n = 3;
x[0] = 8.1; x[1] = 8.3; x[2] = 8.6; x[3] = 8.7;
y[0] = 16.94410; y[1] = 17.56492; y[2] = 18.50515; y[3] = 18.82091;
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p3[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{8.4, p3[8.4]}};
pl2 = ListPlot[pts, PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}];
pl3 = Plot[p3[xx], {xx, 8.1, 8.7}];
pl4 = Plot[xx * Log[xx], {xx, 8.1, 8.7}];
Show[pl1, pl2, pl3, pl4]
```
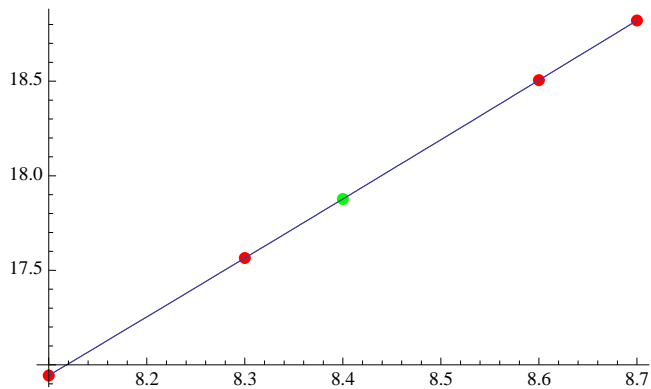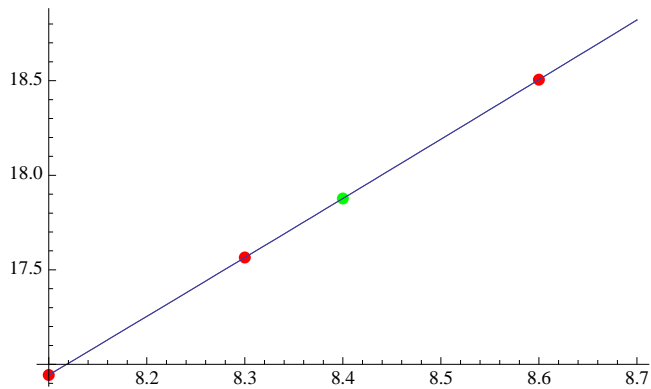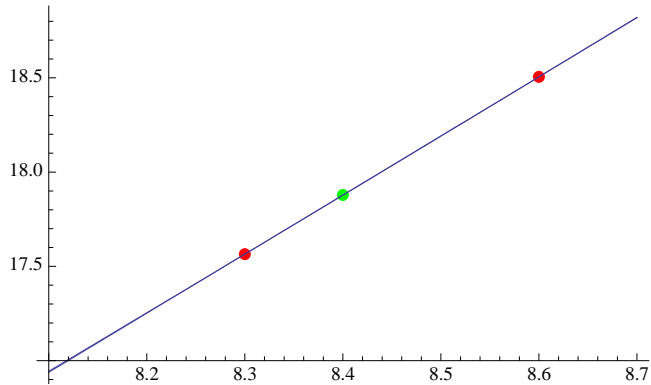


```
n = 2;
x[0] = 8.1; x[1] = 8.3; x[2] = 8.6;
y[0] = 16.94410; y[1] = 17.56492; y[2] = 18.50515;
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p2[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{8.4, p3[8.4]}};
pl2 = ListPlot[pts, PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}];
pl3 = Plot[p2[xx], {xx, 8.1, 8.7}];
pl4 = Plot[xx * Log[xx], {xx, 8.1, 8.7}];
Show[pl1, pl2, pl3, pl4]
```

```
n = 1;
x[0] = 8.3; x[1] = 8.6;
y[0] = 17.56492; y[1] = 18.50515;
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p1[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{8.4, p3[8.4]}};
pl2 = ListPlot[pts, PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}];
pl3 = Plot[p1[xx], {xx, 8.1, 8.7}];
pl4 = Plot[xx * Log[xx], {xx, 8.1, 8.7}];
Show[pl1, pl2, pl3, pl4]
```
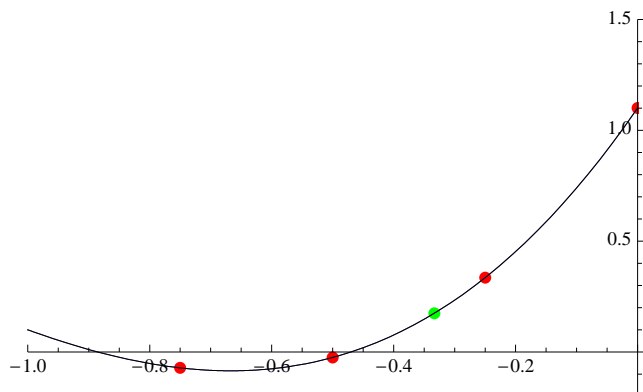


```
(** ESERCIZIO 3.1.3 e 7 (b) **)
```

```
n = 3;
x[0] = -0.75; x[1] = -0.5; x[2] = -0.25; x[3] = 0.;
y[0] = -0.07181250; y[1] = -0.02475; y[2] = 0.3349375; y[3] = 1.101;
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.5}}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p3[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{-1. / 3., p3[-1. / 3.]}};
pl2 = ListPlot[pts,
    PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.5}}];
pl3 = Plot[p3[xx], {xx, -1, 0}, PlotRange → {{-1, 0}, {-0.2, 1.5}}];
f[x_] := x^3 + 4.001 * x^2 + 4.002 * x + 1.101;
pl4 = Plot[f[xx], {xx, -1, 0},
    PlotRange → {{-1, 0}, {-0.2, 1.5}}, PlotStyle -> RGBColor[0, 0, 0]];
Show[
 pl1,
 pl2,
 pl3,
 pl4]
```
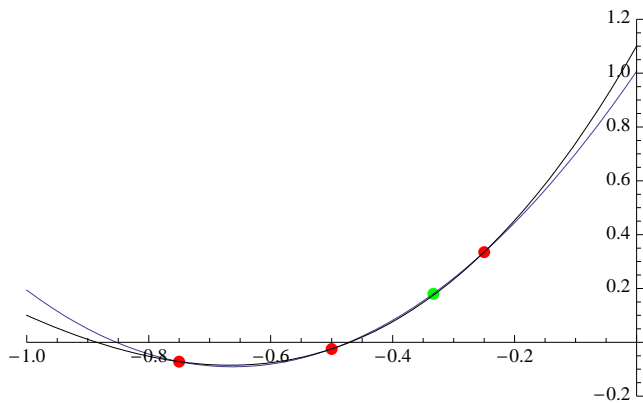
```
n = 2;
x[0] = -0.75; x[1] = -0.5; x[2] = -0.25;
y[0] = -0.07181250; y[1] = -0.02475; y[2] = 0.3349375;
(* x[0]=-0.5;x[1]=-0.25;x[2]=0.;
 y[0]=-0.02475;y[1]=0.3349375;y[2]=1.101;*)
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p3[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{-1. / 3., p3[-1. / 3.]}};
pl2 = ListPlot[pts,
    PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
pl3 = Plot[p3[xx], {xx, -1, 0}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
f[x_] := x^3 + 4.001 * x^2 + 4.002 * x + 1.101;
pl4 = Plot[f[xx], {xx, -1, 0},
    PlotRange → {{-1, 0}, {-0.2, 1.2}}, PlotStyle -> RGBColor[0, 0, 0]];
Show[
 pl1,
 pl2,
 pl3,
 pl4]
```
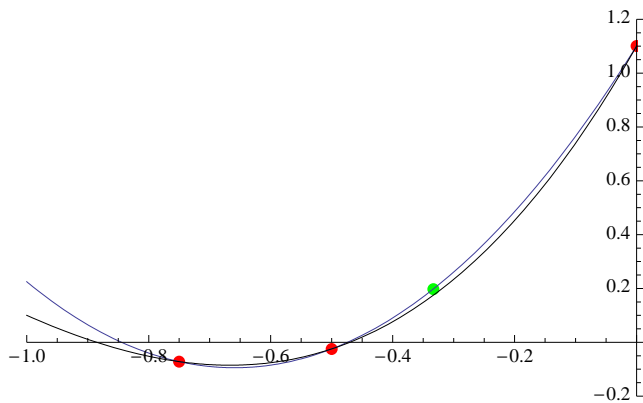
```
n = 2;
x[0] = -0.75; x[1] = -0.5; x[2] = 0.;
y[0] = -0.07181250; y[1] = -0.02475; y[2] = 1.101;
(* x[0]=-0.5;x[1]=-0.25;x[2]=0.;
 y[0]=-0.02475;y[1]=0.3349375;y[2]=1.101;*)
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p3[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{-1. / 3., p3[-1. / 3.]}};
pl2 = ListPlot[pts,
    PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
pl3 = Plot[p3[xx], {xx, -1, 0}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
f[x_] := x ^ 3 + 4.001 * x ^ 2 + 4.002 * x + 1.101;
pl4 = Plot[f[xx], {xx, -1, 0},
    PlotRange → {{-1, 0}, {-0.2, 1.2}}, PlotStyle -> RGBColor[0, 0, 0]];
Show[
 pl1,
 pl2,
 pl3,
 pl4]
```
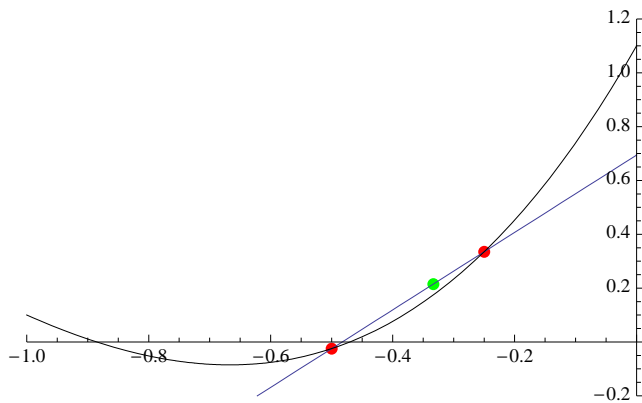
```
n = 1;
x[0] = -0.5; x[1] = -0.25;
y[0] = -0.02475; y[1] = 0.3349375;
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p3[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pts = {{-1. / 3., p3[-1. / 3.]}};
pl2 = ListPlot[pts,
    PlotStyle → {PointSize[0.02], RGBColor[0, 1, 0]}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
pl3 = Plot[p3[xx], {xx, -1, 0}, PlotRange → {{-1, 0}, {-0.2, 1.2}}];
f[x_] := x^3 + 4.001 * x^2 + 4.002 * x + 1.101;
pl4 = Plot[f[xx], {xx, -1, 0},
    PlotRange → {{-1, 0}, {-0.2, 1.2}}, PlotStyle -> RGBColor[0, 0, 0]];
Show[
 pl1,
 pl2,
 pl3,
 pl4]
```
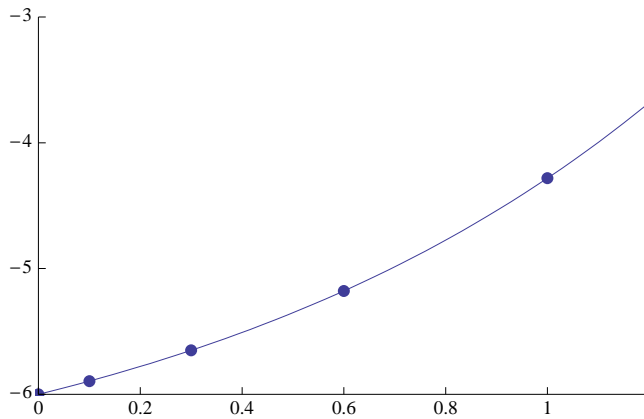


```
(** ESERCIZIO 3.2.4 (a) **)

Clear[f]
n = 4;
x[0] = 0; f[0] = -6.0;
x[1] = 0.1; f[1] = -5.89483;
x[2] = 0.3; f[2] = -5.65014;
x[3] = 0.6; f[3] = -5.17788;
x[4] = 1.0; f[4] = -4.28172;
ff = Table[{x[k], f[k]}, {k, 0, n}]
```

{{0, -6.}, {0.1, -5.89483}, {0.3, -5.65014}, {0.6, -5.17788}, {1., -4.28172}}

```
ticks1 = {{0, 0.2, 0.4, 0.6, 0.8, 1}, {-6, -5, -4, -3}};
pl1 = ListPlot[ff, PlotStyle → PointSize[0.02], Ticks → ticks1];

(* ALGORITMO 3.2 del Faires Burden *)
Do[d[k][0] = f[k], {k, 0, n}]
Do[d[k][j] = (d[k][j - 1] - d[k - 1][j - 1]) / (x[k] - x[k - j]), {k, 1, n}, {j, 1, k}]
pn[x_] = Sum[d[k][k] * Product[(x - x[j]), {j, 0, k - 1}], {k, 0, n}];
pl2 = Plot[pn[x], {x, 0, 1.2}];
```
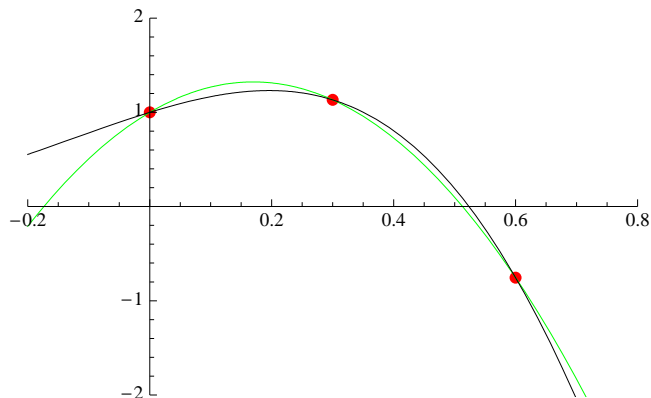
```
Show[pl1, pl2, PlotRange → {{0, 1.2}, {-6, -3}}]
```
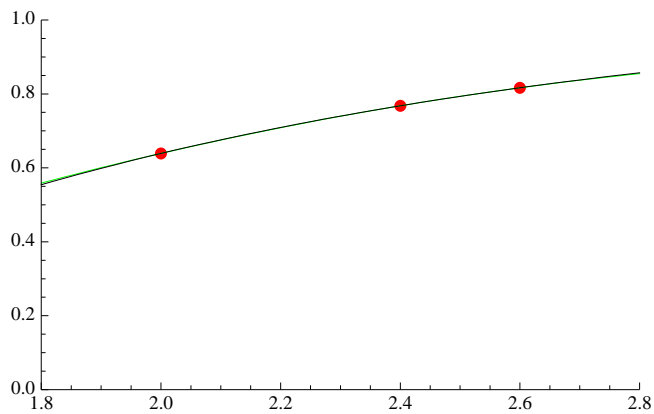


```
(* ESERCIZIO 3.2.15 *)

n = 2;
f[xx_] := Exp[2 * xx] * Cos[3 * xx]
x[0] = 0.0; x[1] = 0.3; x[2] = 0.6;
y[0] = f[x[0]]; y[1] = f[x[1]]; y[2] = f[x[2]];
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{-0.2, 0.8}, {-2, 2}}];
pl4 = Plot[f[xx], {xx, -0.2, 0.8}, PlotRange → {{-0.2, 0.8}, Automatic},
    PlotStyle -> RGBColor[0, 0, 0]];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p2[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pl3 = Plot[p2[xx], {xx, -0.2, 0.8},
    PlotRange → {{-0.2, 0.8}, Automatic}, PlotStyle -> RGBColor[0, 1, 0]];
pl4 = Plot[f[xx], {xx, -0.2, 0.8}, PlotRange → {{-0.2, 0.8}, Automatic},
    PlotStyle -> RGBColor[0, 0, 0]];
Show[pl1, pl3, pl4]
```

```
n = 2;
f[xx_] := Sin[Log[xx]];
x[0] = 2.0; x[1] = 2.4; x[2] = 2.6;
y[0] = f[x[0]]; y[1] = f[x[1]]; y[2] = f[x[2]];
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff,
    PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, PlotRange → {{1.8, 2.8}, {0, 1}}];
pl4 = Plot[f[xx], {xx, 1.8, 2.8}, PlotRange → {{1.8, 2.8}, {0, 1}},
    PlotStyle -> RGBColor[0, 0, 0]];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p2[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pl3 = Plot[p2[xx], {xx, 1.8, 2.8},
    PlotRange → {{1.8, 2.8}, {0, 1}}, PlotStyle -> RGBColor[0, 1, 0]];
pl4 = Plot[f[xx], {xx, 1.8, 2.8}, PlotRange → {{1.8, 2.8}, {0, 1}},
    PlotStyle -> RGBColor[0, 0, 0]];
Show[pl1, pl3, pl4]
```
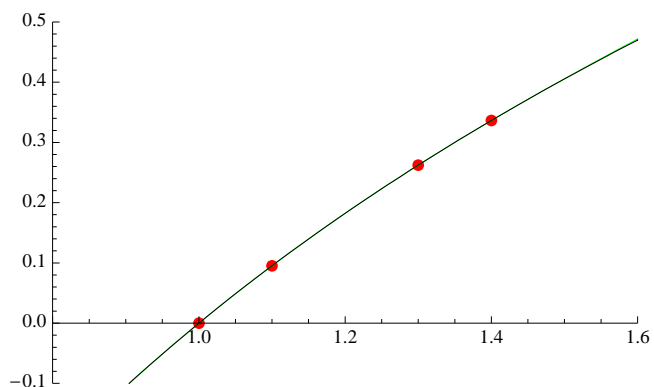
```
n = 3;
f[xx_] := Log[xx];
x[0] = 1.0; x[1] = 1.1; x[2] = 1.3; x[3] = 1.4;
y[0] = f[x[0]]; y[1] = f[x[1]]; y[2] = f[x[2]]; y[3] = f[x[3]];
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]},
    PlotRange → {{0.8, 1.6}, {-0.1, 0.5}}];
pl4 = Plot[f[xx], {xx, 0.8, 1.6}, PlotRange → {{0.8, 1.6}, {-0.1, 1}},
    PlotStyle -> RGBColor[0, 0, 0]];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p2[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pl3 = Plot[p2[xx], {xx, 0.8, 1.6},
    PlotRange → {{0.8, 1.6}, {-0.1, 0.5}}, PlotStyle -> RGBColor[0, 1, 0]];
pl4 = Plot[f[xx], {xx, 0.8, 1.6}, PlotRange → {{0.8, 1.6}, {-0.1, 0.5}},
    PlotStyle -> RGBColor[0, 0, 0]];
Show[pl1, pl3, pl4]
```

```
n = 3;
f[xx_] := Cos[xx] + Sin[xx];
x[0] = 0.0; x[1] = 0.25; x[2] = 0.5; x[3] = 1.0;
y[0] = f[x[0]]; y[1] = f[x[1]]; y[2] = f[x[2]]; y[3] = f[x[3]];
ff = Table[{x[i], y[i]}, {i, 0, n}];
pl1 = ListPlot[ff, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]},
    PlotRange → {{-0.2, 1.2}, {0.8, 1.5}}];
pl4 = Plot[f[xx], {xx, -0.2, 1.2}, PlotRange → {{-0.2, 1.2}, {0.8, 1.5}},
    PlotStyle -> RGBColor[0, 0, 0]];
num[k_, xx_] := Product[xx - x[i], {i, 0, k - 1}] * Product[xx - x[i], {i, k + 1, n}]
den[k_, xx_] := Product[x[k] - x[i], {i, 0, k - 1}] * Product[x[k] - x[i], {i, k + 1, n}]
L[k_, xx_] := num[k, xx] / den[k, xx];
p2[xx_] := Sum[y[k] * L[k, xx], {k, 0, n}]
pl3 = Plot[p2[xx], {xx, -0.2, 1.2},
    PlotRange → {{-0.2, 1.2}, {0.8, 1.5}}, PlotStyle -> RGBColor[0, 1, 0]];
pl4 = Plot[f[xx], {xx, -0.2, 1.2}, PlotRange → {{-0.2, 1.2}, {0.8, 1.5}},
    PlotStyle -> RGBColor[0, 0, 0]];
Show[pl1, pl3, pl4]
```