```
(** DERIVATE - FORMULA A TRE PUNTI E CONFRONTI VARI **)
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In[153]:= 
```
Clear[f]
f[x_] := Sin[x];
df[x_] := Cos[x];
```

In[200]:= 
```
n = 8;
h = 2. Pi / n;
x[0] = 0.0;
x[n] = 2. Pi;
Do[x[i] = x[i - 1] + h, {i, 1, n - 1}]
Do[y[i] = f[x[i]], {i, 0, n}]
Do[d1[i] = (y[i + 1] - y[i - 1]) / (2 * h), {i, 1, n - 1}]
d1[0] = (-3 y[0] + 4 y[1] - y[2]) / (2 * h);
d1[n] = (3 y[n] - 4 y[n - 1] + y[n - 2]) / (2 * h);
dcalc = Table[{x[i], d1[i]}, {i, 0, n}];
ticks1 = {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {-1, 0, 1}};
pl1 = ListPlot[dcalc, PlotStyle → {PointSize[0.02], RGBColor[1, 0, 0]}, Ticks → ticks1];
pl2 = Plot[df[x], {x, 0, 2. Pi}, Ticks → ticks1,
    PlotStyle → {Thickness[0.004], RGBColor[0, 0, 0]}];
pp2 = Show[pl1, pl2]
```

Out[213]=



In[214]:= 
```
Show[pp1, pp2]
```

Out[214]=
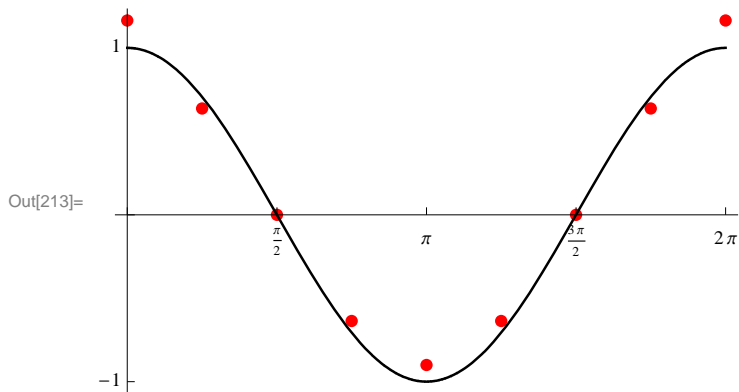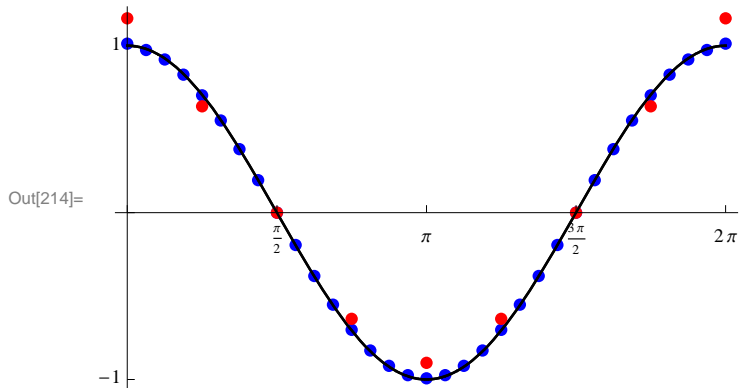


In[215]:= 
```
Clear[f]
f[x_] := Sin[x + Pi / 4];
df[x_] := Cos[x + Pi / 4];
```

In[218]:= `ticks2 = {{0, 0.02, 0.04, 0.06, 0.08}, {0.00005, 0.0001, 0.00015}};`
`a = 0.0; b = 2.0; dftrue = df[0.5 * (a + b)]`
`x[0] = a;`
`nmax = 200;`
`Do[x[n] = b; h = (b - a) / n; hh[n] = h; Do[x[i] = x[i - 1] + h, {i, 1, n - 1}];`
`  Do[y[i] = f[x[i]], {i, 0, n}];`
`  Do[d1[i] = (y[i + 1] - y[i - 1]) / (2 * h), {i, 1, n - 1}];`
`  d1[0] = (-3 y[0] + 4 y[1] - y[2]) / (2 * h);`
`  d1[n] = (3 y[n] - 4 y[n - 1] + y[n - 2]) / (2 * h);`
`  err[n] = Abs[d1[n / 2] - dftrue], {n, 4, nmax, 2}]`
`pl1 = ListPlot[Table[{hh[n], err[n]}, {n, 4, nmax, 2}],`
`  PlotStyle → RGBColor[0, 0, 1], PlotRange → {{0, 0.1}, {0, 0.0002}}, Ticks → ticks2]`

Out[219]= `-0.212958`

Out[223]= 
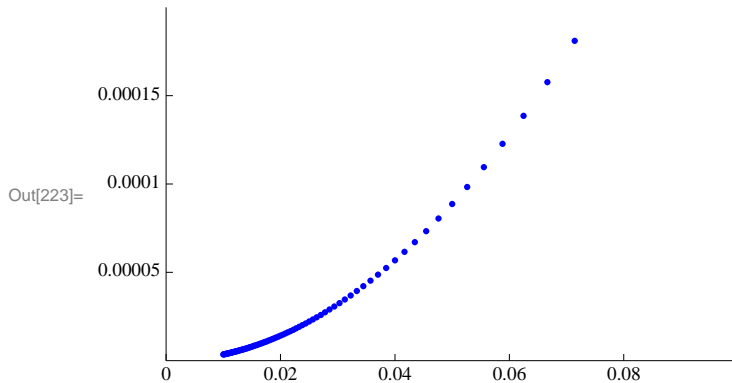
In[224]:= `ticks3 = {{0, 0.02, 0.04, 0.06, 0.08}, {0.0000005, 0.000001, 0.0000015}};`
`a = 0.0; b = 2.0;`
`x[0] = a;`
`nmax = 200;`
`Do[x[n] = b; h = (b - a) / n; hh[n] = h; Do[x[i] = x[i - 1] + h, {i, 1, n - 1}];`
`  Do[y[i] = f[x[i]], {i, 0, n}];`
`  Do[d2[i] = (y[i - 2] - 8 y[i - 1] + 8 y[i + 1] - y[i + 2]) / (12 * h), {i, 2, n - 2}];`
`  d2[0] = (-3 y[0] + 4 y[1] - y[2]) / (2 * h);`
`  d2[1] = (y[2] - y[0]) / (2 * h);`
`  d2[n - 1] = (y[n] - y[n - 2]) / (2 * h);`
`  d2[n] = (3 y[n] - 4 y[n - 1] + y[n - 2]) / (2 * h);`
`  err[n] = Abs[d2[n / 2] - dftrue], {n, 4, nmax, 2}]`
`pl2 = ListPlot[Table[{hh[n], 1000. * err[n]}, {n, 4, nmax, 2}],`
`  PlotStyle → RGBColor[1, 0, 0], PlotRange → {{0, 0.1}, {0, 0.0002}}, Ticks → ticks2]`
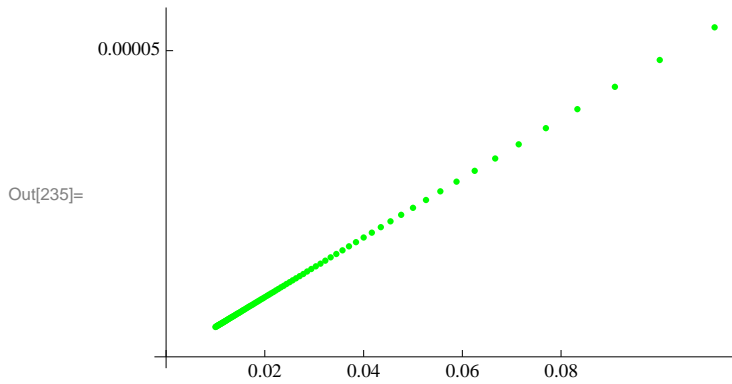
Out[229]= 
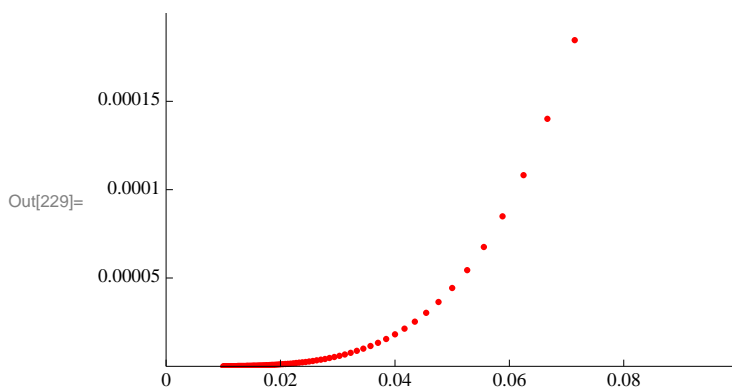
In[230]:= `ticks2 = {{0, 0.02, 0.04, 0.06, 0.08}, {0.00005, 0.0001, 0.00015}};`
`a = 0.0; b = 2.0;`
`x[0] = a;`
`nmax = 200;`
`Do[x[n] = b; h = (b - a) / n; hh[n] = h; Do[x[i] = x[i - 1] + h, {i, 1, n - 1}];`
` Do[y[i] = f[x[i]], {i, 0, n}];`
` Do[d3[i] = (y[i + 1] - y[i]) / h, {i, 0, n - 1}];`
` d3[n] = (y[n] - y[n - 1]) / h;`
` err[n] = Abs[d3[n / 2] - dftrue], {n, 4, nmax, 2}]`
`pl3 = ListPlot[Table[{hh[n], err[n] / 1000.}, {n, 4, nmax, 2}],`
`  PlotStyle → RGBColor[0, 1, 0], Ticks → ticks2]`

Out[235]=



In[236]:= `Show[pl1, pl2, pl3]`

Out[236]=