

Combining Plots &/or ListPlots and Using Legends, Text and Arrows with Plots

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NOTE: Need to use the *Mathematica* "PlotLegend" Package and the Epilog[] command.

Plot Example:

```
(*Initializing variables*)
```

```
Clear[R, T, v, p, n]
```

```
(*Calling the PlotLegends package *)
```

```
Needs["PlotLegends`"]
```

```
v[p_, T_] :=  $\frac{n R T}{P}$ 
```

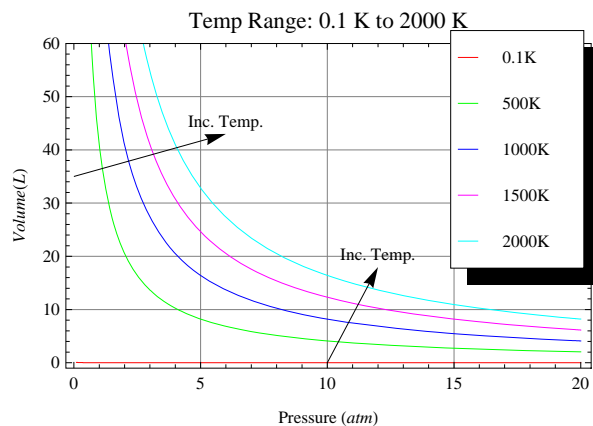
```
(*Constants*)
```

```
n = 1; (*number of moles; moles*)
```

```
R = 0.08206; (*atm L / (mol K) *)
```

```
(*Plots the volume versus pressure WRT Temp with a Legend*)
```

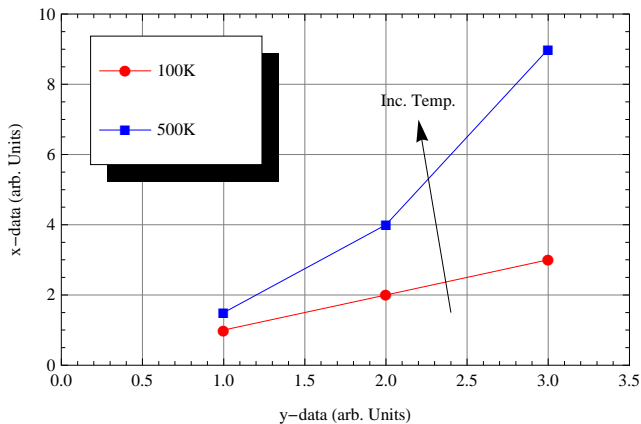
```
Plot[{v[p, 0.1], v[p, 500], v[p, 1000], v[p, 1500], v[p, 2000]},  
  {p, .1, 20}, PlotRange → {-1, 60}, Frame → True, GridLines → Automatic,  
  PlotStyle → {{RGBColor[1, 0, 0]}, {RGBColor[0, 1, 0]},  
  {RGBColor[0, 0, 1]}, {RGBColor[1, 0, 1]}, {RGBColor[0, 1, 1]}},  
  FrameLabel → {"Pressure (atm)", "Volume (L)"},  
  PlotLabel → "Temp Range: 0.1 K to 2000 K",  
  Epilog → {Arrow[{{0, 35}, {6, 43}}], Text["Inc. Temp.", {6, 45}],  
  Arrow[{{10, 0}, {12, 18}}], Text["Inc. Temp.", {12, 20}]},  
  PlotLegend → {"0.1K", "500K", "1000K", "1500K", "2000K"},  
  LegendSize → 0.7, LegendPosition → {0.3, -0.15}]
```



ListPlot Example:

```
Needs["PlotLegends`"]
Clear[data1, data2, f]
data1 = {{1, 1}, {2, 2}, {3, 3}};
data2 = {{1, 1.5}, {2, 4}, {3, 9}};

listplot = ListPlot[{data1, data2}, PlotRange -> {{0, 3.5}, {0, 10}},
  Frame -> True, GridLines -> Automatic, PlotStyle ->
  {{RGBColor[1, 0, 0], PointSize[0.02`]}, {RGBColor[0, 0, 1], PointSize[0.02`]}},
  FrameLabel -> {"y-data (arb. Units)", "x-data (arb. Units)"},
  PlotLegend -> {"100K", "500K"}, LegendSize -> 0.5,
  LegendPosition -> {- .75, 0.15}, Joined -> {True, True}, PlotMarkers -> Automatic,
  Epilog -> {Arrow[{{2.4, 1.5}, {2.2, 7}}, Text["Inc. Temp.", {2.2, 7.5}]}]}
```



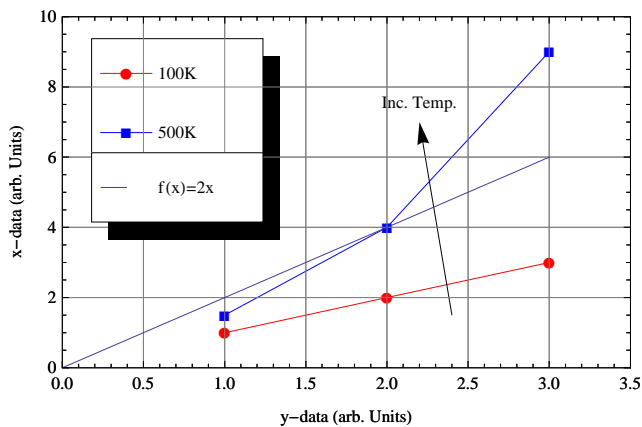
Two examples of combining ListPlots and Plots of functions:

First Example: uses the Show command. The issue is that two legends are generated. Hence, the plots have to be aligned and thus have the same options such as PlotRange, AxesOrigin and AxesLabel. The legends will lie on top of one another, so one of the legends need to be moved.

```
Needs["PlotLegends`"]
Clear[data1, data2, f]
data1 = {{1, 1}, {2, 2}, {3, 3}};
data2 = {{1, 1.5}, {2, 4}, {3, 9}};
f[x_] = 2 x;

listplot = ListPlot[{data1, data2}, PlotRange -> {{0, 3.5}, {0, 10}},
  Frame -> True, GridLines -> Automatic, PlotStyle ->
  {{RGBColor[1, 0, 0], PointSize[0.02`]}, {RGBColor[0, 0, 1], PointSize[0.02`]}},
  FrameLabel -> {"y-data (arb. Units)", "x-data (arb. Units)"},
  PlotLegend -> {"100K", "500K"}, LegendSize -> 0.5,
  LegendPosition -> {- .75, 0.15}, Joined -> {True, True}, PlotMarkers -> Automatic,
  Epilog -> {Arrow[{{2.4, 1.5}, {2.2, 7}}], Text["Inc. Temp.", {2.2, 7.5}]}];

plot = Plot[f[x], {x, 0, 3},
  PlotRange -> {{0, 3.5}, {0, 10}}, Frame -> True, GridLines -> Automatic,
  FrameLabel -> {"y-data (arb. Units)", "x-data (arb. Units)"},
  PlotLegend -> {"f(x)=2x"}, LegendSize -> 0.5, LegendPosition -> {- .75, -0.01}];
Show[listplot, plot]
```



Second Example: uses the Table command on the functions to generate a table of numbers . That way, only one ListPlot Command needs to be used and thus a nice legend is generated.

```
Needs["PlotLegends`"]
Clear[data1, data2, f, g, plot1, plot2]
(*data*)
data1 = {{1, 1}, {2, 2}, {3, 3}};
data2 = {{1, 1.5}, {2, 4}, {3, 9}};
(*functions*)
f[x_] = 2 x;
g[x_] = 4 x;

(*Generating tables*)
plot1 = Table[{x, f[x]}, {x, 0, 3}];
plot2 = Table[{x, g[x]}, {x, 0, 3}];

(*ListPlot of all the data and tables*)
listplot = ListPlot[{data1, data2, plot1, plot2},
  PlotRange -> {{0, 3.5}, {0, 10}}, Frame -> True, GridLines -> Automatic,
  PlotStyle -> {{RGBColor[1, 0, 0], PointSize[0.02`]}, {RGBColor[0, 0, 1],
    PointSize[0.02`]}, {RGBColor[0, 1, 0], Dashed}, {RGBColor[1, 0, 1]}},
  FrameLabel -> {"y-data (arb. Units)", "x-data (arb. Units)"},
  PlotLegend -> {"100K", "500K", "f(x)", "g(x)"},
  LegendSize -> 0.5, LegendPosition -> {-0.75, 0.15},
  Joined -> {True, True, True}, PlotMarkers -> {#, #, "", ""},
  Epilog -> {Arrow[{{2.4, 1.5}, {2.2, 7}}], Text["Inc. Temp.", {2.2, 7.5}]}
```

