Plotting Bessel functions

This simple example uses Matlab to produce a plot of the first six Bessel functions. Two plots are shown, one created by Matlab and a second created by LaTeX using the plotting package `pgfplots` and the data exported from Matlab.

This example is based upon the Mathworks example at https://au.mathworks.com/matlabcentral/fileexchange/35229-matlab-plot-gallery-standard-line-colors.

```
x  = 0:0.1:15;
y0 = besselj(0,x);
y1 = besselj(1,x);
y2 = besselj(2,x);
y3 = besselj(3,x);
y4 = besselj(4,x);
y5 = besselj(5,x);

plot(x, y0, 'r', x, y1, 'g', x, y2, 'b',  ...
     x, y3, 'c', x, y4, 'm', x, y5, 'y');
legend('J_0','J_1','J_2','J_3','J_4','J_5');

print(gcf,'example_04_fig.png','-dpng');

% Note: using ' on [x;y0...]' ensures the six functions are written as columns of example_01.txt

dlmwrite ('example_04.txt',[x;y0;y1;y2;y3;y4;y5]','delimiter',' ','precision','% .8e');
```

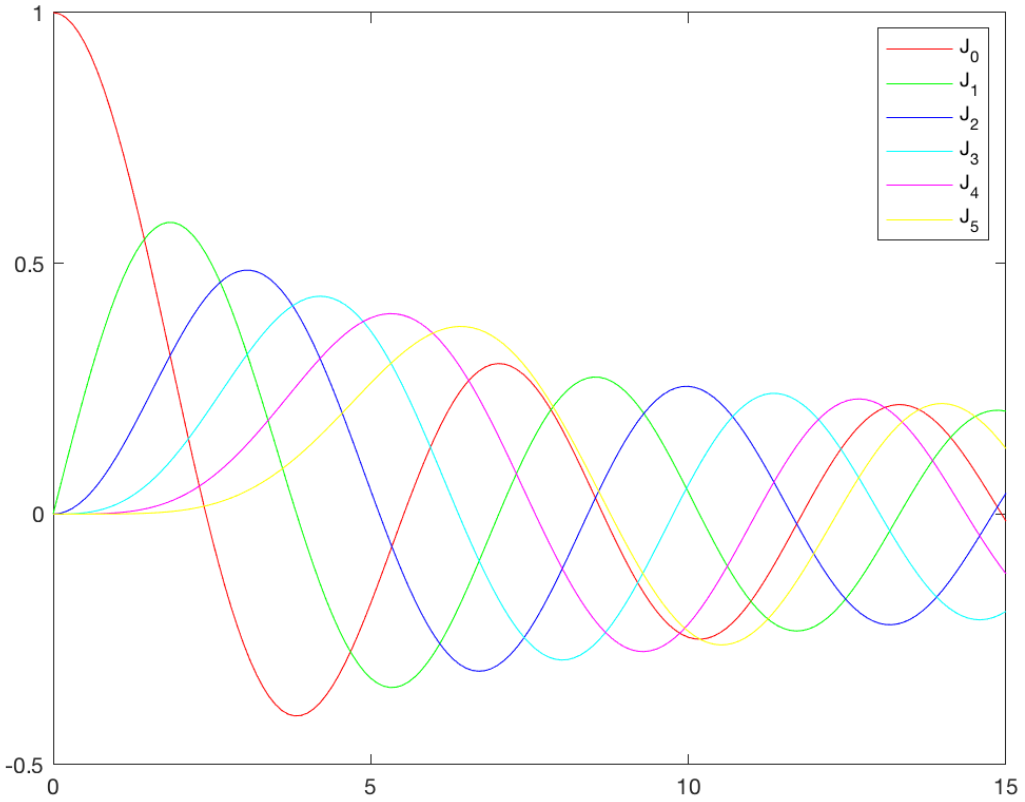

Figure 1: The first six Bessel functions.

Using pgfplots

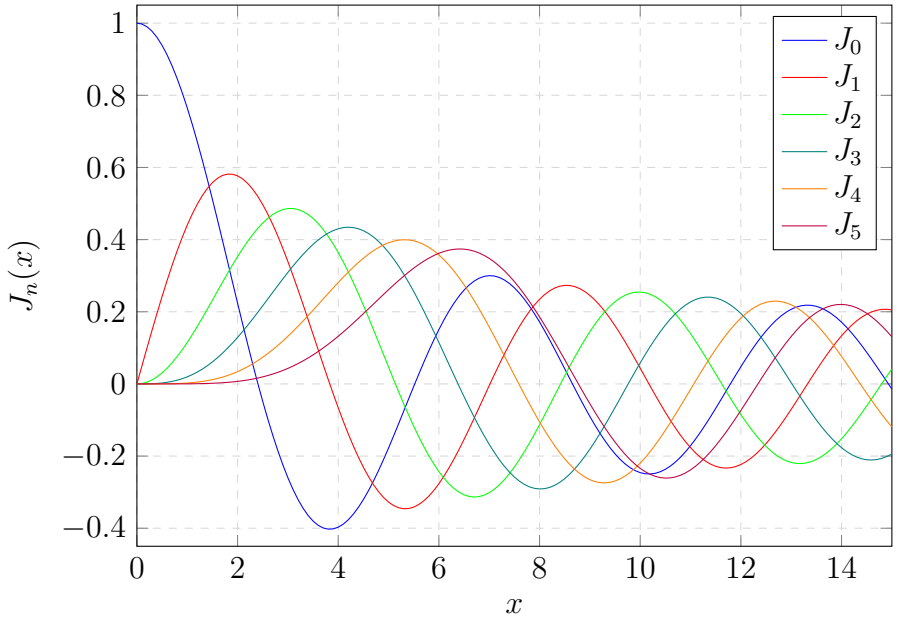

Figure 2: The first six Bessel functions.

```
\begin{tikzpicture} % requires \usepackage{pgfplots}
   \begin{axis}
      [xmin= 0.0,  xmax=15.0,
       ymin=-0.45, ymax=1.05,
       xlabel=$x$, ylabel=$J_n(x)$,
       grid=major, grid style={dashed,gray!30},
       legend entries = {$J_0$, $J_1$, $J_2$, $J_3$, $J_4$, $J_5$}]
       \addplot[blue]   table [x index=0, y index=1]{example_04.txt};
       \addplot[red]    table [x index=0, y index=2]{example_04.txt};
       \addplot[green]  table [x index=0, y index=3]{example_04.txt};
       \addplot[teal]   table [x index=0, y index=4]{example_04.txt};
       \addplot[orange] table [x index=0, y index=5]{example_04.txt};
       \addplot[purple] table [x index=0, y index=6]{example_04.txt};
   \end{axis}
\end{tikzpicture}
\captionof{figure}{The first six Bessel functions.} % requires \usepackage{caption}
```