

1. TEMPLATE FOR INCLUDING FIGURES

In this document I show how to include plots (saved as images in .PNG format) in LaTeX code, and how to use MATLAB for these. You can also have these images saved as .PDF.

Always refer properly to the code, figures, and tables.

We provide three examples of plots in Figure 1 (a-c), with MATLAB code templates in Sections 1.1–1.3, respectively. You can judge them yourself!

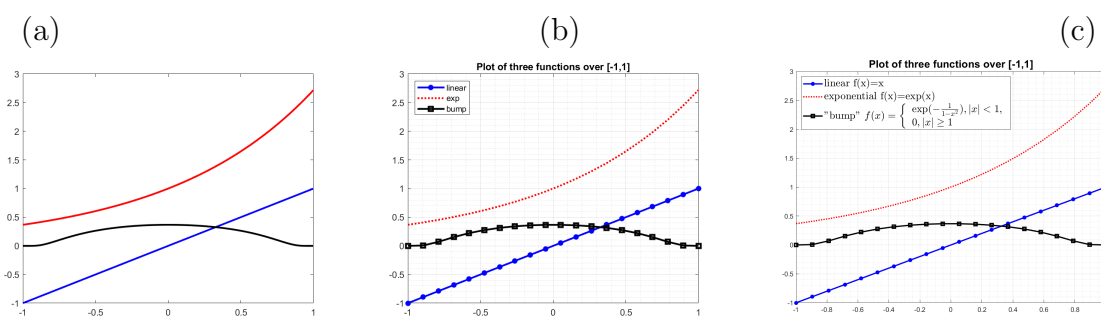


FIGURE 1. Plot of three functions: (a) quick but uninformative, (b) useful [MP: with explanation in LaTeX...], where the bump function is $\text{bump}(x) = \exp(-\frac{1}{1-x^2})$ for $|x| < 1$ and 0 for $|x| \geq 1$, (c) fancy legend, which requires extra effort in MATLAB.

1.1. Code “quick but uninformative”.

```

%% plot two built-in functions
x=linspace(-1,1,20); plot(x,x,'b',x,exp(x),'r')
%% define "bump" function as a handle and plot all three
b=@(x)( (abs(x)>=1).*(0*x)+ (abs(x)<1).*exp(1./(x.^2-1)) )
x=linspace(-1,1,20); plot(x,x,'b',x,exp(x),'r',x,b(x),'k')
%% .. or, define the function "bump" in M-file bump.m
function v = bump(x)
% bump function: smooth with compact support in [-1,1]
    t = 1-x.^2; v=exp(-1./t);
    v(abs(x)>=1)=0;
end
%% plot again and print
x=linspace(-1,1,20); plot(x,x,'b',x,exp(x),'r',x,bump(x),'k')
print -dpng useless.png
    
```

1.2. Code “useful plot”.

```
%% do extra work on the exposition
clf
x=linspace(-1,1,20); plot(x,x,'b*-',x,exp(x),'r:',x,bump(x),'ks-')
title('Plot of three functions over [-1,1]')
legend('linear f(x)=x','exponential f(x)=exp(x)',...
'bump f(x)=exp(-1/1-1-x^2)','location','northwest');
grid on; grid minor;
print -dpng useful.png
```

1.3. Code “fancy formatting”.

```
clf
x=linspace(-1,1,20); plot(x,x,'b*-',x,exp(x),'r:',x,bump(x),'ks-')
title('Plot of three functions over [-1,1]', 'FontSize',16)
h=legend('linear f(x)=x','exponential f(x)=exp(x)',...
'bump $f(x)=\exp(-\frac{1}{1-x^2})$', 'location','northwest');
%% or you can also use LaTeX within MATLAB
h=legend('linear f(x)=x','exponential f(x)=exp(x)',...
'"bump" $f(x)=\left\{\begin{array}{ll}\exp(-\frac{1}{1-x^2}),|x|<1,\\
0,|x|\geq 1\end{array}\right.$', 'location','northwest');
set(h,'Interpreter','latex');set(h,'FontSize',16)
grid on; grid minor;
print -dpng fancy.png
```

Include proper citations to any sources you used including software.

2. HOW TO IMPROVE EVEN MORE?

Now one more thing: MATLAB and other sources of images frequently come with a large white space margin. After you make an effort to remove this white space. the result looks much better; See Figure 2 for a result.

How to remove this white space? You can use Acrobat, Paint. In UNIX, you can use utilities from ImageMagick family and in particular command line as follows

```
convert -trim fancy.png fancy-trim.png
```

and you can then do this for a batch of images by writing a script to process these in a loop.

Hint: various environments such as `subfigure` etc. exist that let you control things even better. Also, these are not always portable to the journal stylefiles, thus I prefer a “plain vanilla” LaTeX as much as possible.

REFERENCES

- [1] W. Boyce, R. DiPrima *Elementary Differential Equations*. Wiley, 9th edition, 2008.
- [2] Roger Temam, *Navier-Stokes Equations: Theory and Numerical Analysis*, American Mathematical Society, UK ed. edition (2000)
- [3] CTAN archive of the LaTeX package listings <https://ctan.org/pkg/listings>

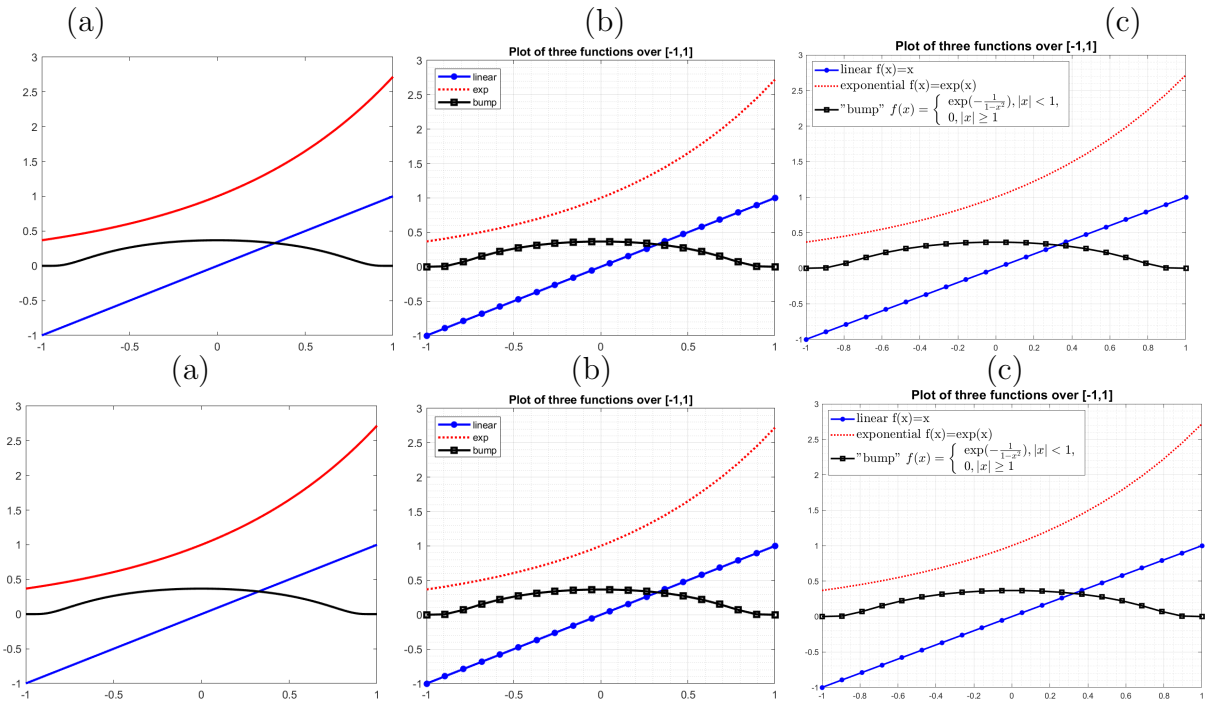


FIGURE 2. Plot of three functions to be compared to Figure 1. Bottom display uses the environment `tabular` to get more control on the placement of tags.