Rookie Mistakes When Making Plots

1. Unlabeled axes. This is the worst. Both axes must have names, period. A name can be a symbol, although if you use a symbol, it's best to also have a true name. For example, an axis name might be "Position x (cm)". Note that symbols are always italicized. Make the font large enough for your audience to read, especially for PowerPoint plots that will be viewed from 25 feet away.
2. Missing unit on axes. After an axes name, you have to include units. This is often done in parenthesis. For example, "Position (cm)", or "θ (degrees)". Note that units may *never* be italicized. If your axis name is "Voltage", then you don't need to write "Voltage (V)". However, you *would* need to write "Voltage (mV)", or "Potential (V)".
3. Bad values for axes. Your axes each have numbers distributed across them. On any axis, each number must include the same number of digits after the decimal, even if they are extra zeroes. Each number must include at least one digit before the decimal, even if that means the number is just a zero. If the axis values are all integers, then don't use a decimal at all. Don't let the numbers smash into each other. You can use scientific notation when needed, but note that a plot that runs 3.4 mm to 4.8 mm is much better than one that runs from 0.0034 m to 0.0048 m, and is also better than one that runs 3.4×10^{-3} m to 4.8×10^{-3} m. If you use scientific notation, then sadly, the best you can do in Excel is 3.4E-3 m to 4.8E-3 m (i.e., you are stuck with the horribly unprofessional "E" notation).
4. Bad range for axes. If the region of interest is $30 \le x \le 50$, don't plot it from 0 to 100. However, sometimes seeing the zero in the plot has value even when the main region of interest only starts at 30. Be a scientist! *Decide* whether the reader's value is higher if you plot $0 \le x \le 50$, or $30 \le x \le 50$. Note that sometimes Excel attempts to auto-choose the vertical range, and does so badly. If you try to plot the points (0,10.1), (1,10.0), (2,10.2), then Excel will choose to plot $9.95 \le y \le 10.25$, which looks like a sharp "V" shape. However, what you're probably interested in showing is that the value is more or less constant, not "V" shaped. Change the vertical range to plot from $0 \le y \le 12$ to see what I mean.
5. Bad or missing tick marks or tick spacing. If the region of interest is from $30 \le x \le 50$, you should put tick marks in regular increments of 5. Make sure they can be seen. Don't make the ticks or grids increment in steps of 0.034543.
6. Bad line (and legend) colors. Why did you make one of your lines yellow? Nobody can see it against a white background, whether on paper or using powerpoint. Why did you make your six lines all slightly varying shades of blue that nobody can tell apart? Similarly, why did you decide to make your first line dark blue, and your second line pink? When you do this, what you're advertising is your laziness, because everyone already knows that this is the Excel default, and everyone also already knows that it's crappy.
7. Bad Lines or Markers. There is commonly some confusion about whether to use markers, smooth lines, "connect-the-dot lines", or some combination. If you measured it, it's a dot. If you found a best-fit or other fitted curve that results in a function for which you are able to compute new values of $y(x)$, then you should use a smooth line. *Connecting* the dots is usually wrong; an exception is when you have a lot of measured data containing oscillations (e.g., our Ultrasonic Interference lab). The reader needs to be able to order the data mentally, and the oscillations make this task very hard without a guide line.
8. Oversize Markers. If your markers overlap with each other on the plot, there's a good chance they're too large. The point of a marker is that the reader can see each dot distinctly.

9. Bad Titles. Generally, you use a title for a PowerPoint plot, or for any other "stand-alone" plot. In a lab report or publication, a plot usually has a caption instead (a sentence below the plot that explains it). For titles, "vs." is pretty amateur. If you must us "vs.", then do it right: It is always (vertical) vs. (horizontal). It will probably never happen in your lifetime that the vertical axis should be called "*y*". "*y*" is just a generic placeholder that we use until we know the real name of the axis. The same thing is true for the horizontal axis: it's only rarely called "*x*".
10. Using a "Trendline" with bad units or symbols. The "Trendline" tool can automatically display the numeric results for the best-fit line, but it does a bad job. Don't blame Excel, though: it can't read your mind. If you plot *x* vs *t*, and Trendline says "y=1.227x + 4.567", then you are required to change it to read "$x = 4.567\text{cm} + (1.227\ \text{cm/s})t$" instead. Note that changing a Trendline like this means that Excel will no longer update the result if you modify your dataset, so do this step last. It goes without saying that the default Trendline font is way too small. Fix it. Also, Trendline often uses scientific notation with only one significant digit. Fix it to reflect appropriate sig figs (i.e., use the same number of sig figs that you would use if you were writing this result in an abstract).
11. Bad font choices. If the title is in "Comic Sans", and the axes labels are in "Arial", and the axes numbers are in "Times", and the Trendline results are in "Sans Serif", and the legend labels are in "Symbol", then you have a font problem. Make them match. And make none of them be "Comic Sans". And then make them all big enough to read. In the "font" tab in Excel for each of these text options, you can turn off "auto-scale", so that once you set it to 14 point font, it stays that way, even if you re-size the plot.
12. Bad Legend Names. None of your lines is called "Series 1". It might be "Red Puck", or it might be "Low Temperature", or it might be "Divergent Lens". Since the purpose of a legend is to help the viewer distinguish between multiple lines, you NEVER have a legend unless there is more than one data set being plotted. Also, if you can fit it without covering up some data, let your legend overlap with the plot itself, so the true plot area will be larger.
13. Bad Plot Background. In older versions of Excel, plots came with a gray background, a gray border, and horizontal gridlines. There's a good chance that white is better for the background, and black is best for the border. Also, be careful with gridlines: sometimes they help, but if your plot is a thin dark line that runs near to a thin dark gridline, the reader can lose sight of the information. If you have gridlines, then your plot must be thicker than the gridlines, and it must be a different color. Tick marks are generally more desirable than gridlines.
14. Bad Aspect Ratio 1. If you're making contour or surface plots (i.e., distance vs. distance), it is incredibly rare to not have them share a scale. So, if a plot has the range $0\ \text{m} \le x \le 100\ \text{m}$, and $0\ \text{m} \le y \le 150\ \text{m}$, then the plot better be exactly 50% taller than it is wide. It should go without saying that I mean the active plot region, not counting borders, etc. So, if you measure (with a ruler on the screen or paper), then 100m must be the same distance horizontally or vertically.
15. Bad Aspect Ratio 2. If you're making an ordinary plot, then humans are generally conditioned to expect a 4:3 aspect ratio. Meaning, if your plot is 4 inches wide, it should be 3 inches tall. Some variance is permitted, but not much.