Exponentials vs. Powers[1]

1. Enter the following sequence commands:

   Important note: Do not omit the semicolons! Also, do not omit the `.` before the `^` !

   (a) `x1 = -1.15:0.01:1.15; ...` (This makes $x1$ a vector with entries from -1.15 to 1.15 in $.01$ increments.)

   (b) `x2 = -1.39:0.01:1.39;`

   (c) `y1 = x1.^10; .....` (This evaluates $x1^{10}$ for each entry of $x1$.)

   (d) `y2 = exp(x2);`

   (e) `plot(x1, y1, 'b', x2, y2, 'r')`

   These plots of $y = x^{10}$ and $y = e^x$ *suggest* that the equation $x^{10} = e^x$ has two solutions — one positive and one negative. Approximate these two solutions (to three decimal places) by "zooming". (To "zoom in" click on the button that looks like a magnifying glass with a plus sign, and then click on the graph. To "zoom out" select the magnifying glass with the minus sign.)

2. Explain why there must be another positive solution of $x^{10} = e^x$ larger than the one that you found in #1.

   By changing the beginning and ending values of $x1$ and $x2$ (you may leave the increments the same) and plotting as above, determine an interval that reveals this larger solution. (Note. You can use the up-arrow key to do this, but you must reevaluate $y1$ and/or $y2$ each time you change $x1$ and/or $x2$.)

   Approximate this solution (to two decimal places) by "zooming".

3. Explain why it may be necessary to use several different domain intervals when studying computer plots.

4. On a separate piece of paper, prepare a brief written report giving explanations where requested and answering all the questions. Include all of the approximate solutions. Use complete sentences and use standard mathematical notation. Do **not** hand in a printout.

This assignment reinforces the fact that the exponential function, exp(x), will eventually exceed any power of x. It also illustrates the importance of scale when considering computer plots.