Problem Set 0 (Math warm-up)

Physical chemistry is a mathematical subject. You will be using skills that you learned in *all* of your math courses. You will also be learning some mathematical concepts that were probably not covered in your prerequisite courses.

This problem set is a warm-up exercise. It doesn't count toward your grade, and shouldn't take you very long. It is just here to shake out the cobwebs and remind you of some of the concepts you learned in CHEM 20262 (or similar courses).

1. Solve the following. Show your work and/or explain your answers.

   (a) $\frac{d}{dx}\left[\ln\left(1 - x^2\right)\right] =$

   (b) $\int_0^\pi \left(\cos t - \sin t\right) dt =$

   (c) $\int_{-10}^{10} x e^{-x^2} dx =$

   (d) $\frac{d^2}{dy^2} f(y) = -f(y)$

   $\qquad f(y) =$

   (e) $|1 + 2i|^2 =$

   (f) $e^{i\pi/4} =$

2. Extra Credit:

   (a) It is always a helpful skill to make a computer calculate something instead of doing it yourself. Write a short computer program to calculate factorials. You may use any programming language you wish (including high-level command languages for Matlab or Mathematica). One restriction: *Do not use a pre-defined factorial function.* Call your input N; your procedure should return $N!$ Submit the code of your program and some sample output as the answer to this problem.

   (b) At what values of N will your program fail?