Exam 2 Take-Home Part

Please hand in your assignment as a pdf of a Mathematica document. The due date is Monday, April 14 at class time. You can lose up to 5 points for lack of neatness and organization. I'm looking for proper labeling of the problems and sections, as well as making sure you don't have too much consecutive code, or output, without explanation.

1. Show all the steps to find the antiderivative of $e^x * \cos(x)$. This is an integral which takes a couple steps and uses a trick, so make sure you look up a source showing the trick. No, the answer is not just to ask Mathematica (though that's a fine double-check of your answer). The goal is a clear explanation.
2. We know that Mathematica has an antiderivative for $\sin(x^2)$, even though we normal humans don't have one.
    a. Find the exact value of the integral over the interval from 0 to 2. Then find the value to eight decimal places.
    b. Draw pictures of both $\sin(x^2)$ and its antiderivative on the same graph on that interval. Make at least two calculus comments which demonstrate which image is which.
    c. Give an approximation to that definite integral, by creating a piecewise function using five (or fewer) geometric or parabolic shapes to approximate $\sin(x^2)$.
        i. Call your approximating function Name[x], with your name.
        ii. Plot both $\sin(x^2)$ and Name[x] on the same graph.
        iii. Finally, show that your approximation is good by integrating (or numerically integrating) the absolute value of the difference between $\sin(x^2)$ and Name[x]. This total absolute error should be less than 0.05. Please note you must show the integral of the absolute value of the difference, not just the two integrals.
    d. Show the steps to using Integration by Parts to get an antiderivative of FresnelS(x). Be careful with your constants.
3. Using the error bound formulas from class, how many trapezoids would you need to use to achieve an error bound of less than 0.01 for the definite integral in problem 2? Show all your work.