1) Use MATLAB's `integral` function to integrate the definite integrals below. For each case you should compute the relative error.

   a) (2 pts) $\int_{-1}^{2} e^x \sin(x)\, dx.$

   b) (3 pts) $\int_{0}^{\frac{8\pi}{7}} \cos(20x)\, dx.$

   You should set up your integrand function in the form $\cos(rx)$ and send in the 20 as the parameter r.

2) (6 pts) Previously in class we saw that there is a huge difference in the anti-derivatives of

$$\frac{1}{x^5}$$

and

$$\frac{1}{x^5+1}.$$

Use the `integral` function to compute $\displaystyle\int_1^3 \frac{1}{x^5+1}\, dx.$

   a) Use the Wolfram Alpha site to compute this definite integral (don't have the site compute the anti-derivative; instead include the limits of integration in your request to the site). Do you get any error messages when you do this?

   b) Why is it difficult to assess the accuracy of the MATLAB `integral` function using the answer given by the Wolfram site?

   c) Use Maple or Mathematica to obtain (at least) a 17 digit exact value for the integral. How accurate is MATLAB's integral function?

   d) Use Simpson's Rule and $n = 20$ to approximate the integral. How accurate is Simpson's Rule?

3) (4 pts) Load the data file hw23.dat into MATLAB using

```
load hw23.dat
x = hw23(:,1);
y = hw23(:,2);
```

Integrate the data in this table using the trapezoidal rule, Simpson's Rule and the spline technique from Section 2.1 of the course notes. The exact value of this integral is $2\sinh(\pi) - 2\pi\cosh(\pi)$. Which of the three techniques gives the most accurate answer?

4) (8 pts) Consider the integral

$$I(r) = \int_{-2}^{2} x^2 e^{-rx} + (x-2)e^{rx}\, dx.$$

Generate a vector of r values from 0 to 2 using

```
r = linspace(0,2,11)';
```

Then generate a table of values for the integral above as a function of r. Use your table and an appropriate spline to estimate the value of the integral for $r = 1.5$. What is the relative error in your approximation? To get the exact value here, use the technique at the end of the first set of integral notes. Assign values of a and b, then substitute these into the expression for the anti-derivative (which you can get from the Wolfram Alpha site). Subtract these two to get the exact value.