Matlab Homework 3c

The same requirements as for homework 2c apply. In addition, from now on any final answer must be printed out neatly using 'fprintf'. (Intermediate results may still be printed out using Matlab's default 'VARIABLE=VALUE' compact format unless it says otherwise.)

1. Continuing the problem of homework 2, we no longer want to assume a priori that $k = 0.5$. So, create a function 'drumFreqEq' that can be used with 'fzero' to find the drum frequencies satisfying the equation above. The function should take in values for ω and k and for whatever these values are, return the error in the frequency equation. Your function should be well commented; compare the posted lecture notes of lesson 2. Include its listing in hw3.pdf as in the previous homework. In your hw2.m file, issue a 'help drumFreqEq' command, and verify that it tells you what this function does, what its input arguments are, and what it returns to whoever or whatever uses it.

   Use this function to find the accurate values for ω_n for $n = 1$ to 4 if $k = 0.5$. And also use it to find the same values if $k = 2$. Print all these out in the format:

   ```
   Frequencies for k = 1.1
   Frequency 1: approximate: 12.1234567, exact: 12.1234567
   Frequency 2: approximate: 12.1234567, exact: 12.1234567
   ```

   The value of k must be printed with Matlab's default number of digits. The values of n must be printed using integer format with two print positions so that $n = 10$ to 99 would not produce misalignment. The frequencies must be formatted as shown, with 7 digits behind the point, and so that values up to 999.9999999 do not produce misalignment.

2. We measured a function f that, "unknown to us," is exactly equal to $f_{\text{exact}}(t) = \sin(t)$. We did nine measurements at equally spaced times from -3.2 to 3.2. Determine what the measured f-values would have been. Plot the exact solution at 200 points from -5 to 5 as a black dashed line, and the nine measured data as black crosses, in the same plot. Your horizontal axis should go from -5 to 5. Use title "Measured and Exact", axis labels "t" and "f", and curve labels "Exact" and "Measured". Evaluate the linear and spline interpolated f-values at times -5, -3, -1, 1, 3, and 5. Print the obtained values and their errors out in the format

   ```
   At t =  1:
   the linear interpolate is  0.123, with error 0.12ENN;
   the spline interpolate is  0.123, with error 0.12ENN;
   the error in the spline is 12.1 times smaller.
   ```

   The lines and numbers must line up as shown, so the formats must allow for the negative sign of some of the times and interpolates, as shown. (To get the errors, take the absolute value of the difference between interpolated and exact.)

3. Next add the linear and spline interpolates at the 100 plot points to the same plot as before, with their labels. Use red for the linear interpolate, blue for the spline one.