

Quiz (III)

Finished by 18:30 on 5/11

Paste the figures on a word, or PDF document and upload it with the m files.

Create a matlab script and change the filename to F7xxxxxxx_quiz3.m. Link all the programs to solve following problems to this script. Make sure once type the filename 'F7xxxxxxx_quiz3', the results of the following problems will pop-up automatically in order. Remember not to type any 'clear all', 'close all' command in any of the codes.

1. [F7xxxxxxx_quiz3_prob1.m & Figure 1] Plot the function $g(x) = \sin(2\pi x)$ in the interval $[-1, 1]$. Choose an appropriate number of points along the x axis and keep them for later use.
2. [F7xxxxxxx_quiz3_prob2.m & Figure 2] Calculate the derivative, $g'(x) = [\sin(2\pi x)]'$, on each point of Figure 1 using forward difference with 4 different h values 0.1, 0.01, 0.001, 0.0001. Plot all the derivatives from all the 4 different h values on the same figure including appropriate legends.
3. [F7xxxxxxx_quiz3_prob3.m & Figure 3] Since you know the exact answer of $g'(x)$, generate a semilog plot of the absolute error of each point for all h values from Figure 2. How does the error change with h?
4. [F7xxxxxxx_quiz3_prob4.m & Figure 4] Repeat 2 by using central difference.
5. [F7xxxxxxx_quiz3_prob5.m & Figure 5] Repeat 3 and explain how the error changes with h.
6. [F7xxxxxxx_quiz3_prob6.m & Figure 6] Given the function $f(x) = \frac{e^x - e^{-x}}{2}$. Try to find $f'(1)$ using backward difference and different step sizes of $h = 2^{-1}$ to 2^{-50} . Plot the absolute error versus h and estimate which h could give an optimal answer.
7. [F7xxxxxxx_quiz3_prob7.m & Figure 7] Repeat 6 by using central difference.

Note: The functions "loglog" and "hold on" may appear in your code. If you use both of them, make sure "hold on" appears only after "loglog" finishes plotting.

===== [Bonus]=====

8. [F7xxxxxxx_quiz3_prob8.m & Figure 8] Download "quiz3.mat" to your computer, and load it into matlab using "load('quiz3.mat')". The array T contains the time point corresponding to an object's vertical position recorded in Y-array. The unit of t and Y are seconds and cm respectively. Make a y-t plot to illustrate the temporal changes of the object.
9. [F7xxxxxxx_quiz3_prob9.m & Figure 9] Generate a $v_y - t$ plot based on prob.8, and explain how you do it.
10. [F7xxxxxxx_quiz3_prob10.m & Figure 10] Generate a $a_y - t$ plot based on prob. 8, and explain how you do it.
11. Based on this data, how can you find when the object reaches its highest position?