MATH 353: Engineering Mathematics III – Section 012

Spring 2014 (F.–J. Sayas) Lab # 1 February 14

Free advice, maybe good after all. Matlab has been used by hundreds of thousands of individuals for quite some time. Google can find the answer to questions like: how do I define a base 10 logarithm in Matlab? how do I plot a function of one variable in Matlab? You'll probably be redirected to the online help of Matlab, which contains useful examples.

Open Matlab and move to the Desktop or to a folder where you can find your work at the end of the day. Set up the `diary`. Type these two lines

```
>> format long
>> format compact
```

1. Generate the list of numbers

```
 3     6     9    12    15    18    21    24    27    30    33

-4   -4.5   -5   -5.5   ...   -10
```

2. Let me show you and example of how to manually plot a function

```
>> f = @(x) x.^2-3*x.*sin(x);
>> x = 0:0.01:6*pi;
>> plot(x,f(x))
```

   Copy it and run it. Can you figure out what we just did? Now repeat this for the function

$$h(x) = \frac{x^2 + 2x - 4}{x^4 + 1} \cos(x)$$

   plotted in $(-2, 2)$ using one hundred points at least.

3. Compare the values obtained by evaluation of the two mathematically identical functions

$$f(t) = (t+2)^3 - (t+1)^3 \qquad g(t) = 3t^2 + 9t + 7$$

   for $t = 10^9$. Which one seems to be closer to the exact value? Why?

4. How far can you go in the evaluation of the function

$$f(x) = x^x$$

   before the Matlab output is ∞?

5. Figure out how to use `fplot` to plot functions without evaluating them yourself and use it to get a plot of

$$\frac{1}{1+x^2}$$

in the interval $(-3, 3)$.

6. Guess work. Here's a function:

```
f = @(x) (x.^2+1).*(x>=1);
```

Can you write it in mathematical terms? (Hint. Figure out what `x>=1` does. You will need some kind of brackets to define the function.)

7. Use a single instruction to generate the list

$$1 \quad \frac{1}{2} \quad \frac{1}{3} \quad \cdots \quad \frac{1}{10}$$

(Hint. 1 over the list of numbers from 1 to 10.)

8. Give a good computational strategy to evaluate the function

$$\sqrt{x^2+1} - x$$

for very large values of x. (Hint. Multiply and divide by $\sqrt{x^2+1} + x$.)

9. Compare the functions

$$\frac{x^2}{x^2+1} \qquad \text{and} \qquad \frac{1}{1+\frac{1}{x^2}}$$

for $x = 10^{200}$. (Note that you can write this number as `1e200`, meaning 1×10^{200}.)