Math 206 Project 2
First Submission due Sunday 9 February 2014 at 6:00pm
Second Submission due Monday 10 February 2014 at 6:00pm
Third Submission due Wednesday 12 February 2014 at 6:00pm

Covers:

This project covers up through Chapter 15 of the tutorial.

What to Submit:

For this project you will need to create and submit a single script m-file called `project2.m` (all lower case!) which is marked up for publishing. This file should do all of the things requested in the problems below in the order specified. The answers should be placed into variables as specified. The marking up should be done in the following way:

Each command should be within its own section (use `%%`) and be preceded by a brief description (use `%`) describing what that particular command does in your own words using full sentences. Use bullets, numbered lines, boldface and italics in a way which helps your descriptions and makes your published m-file easier to read.

Grading Method:

Grading for this course is via is in three steps. Once the grading is done, a text file will be uploaded to ELMS containing the results.

1. First, an automated grading system will be run which will check both that your answers are correct and that you used the correct method of obtaining them. This is why it is important to assign your answers to the correct variable names and use the methods specified.
2. We will check the plots and loop output by hand.
3. We will publish this m-file and examine the result by hand.

If there are any unexpected errors then the project will automatically earn a grade of 0 so make sure you run your m-file through Matlab and check the output before submitting! Be very careful about making sure that any necessary symbolic variables are defined in your code. The assumption should be that we will run your m-file through a clear matlab process.

You do not need to number the problems in any way, just be sure to include them in your m-file in the order they are listed below.

The Problems:

1. Declare all symbolic variables you will need for the project. [4 pt]

2. The height of a tree in feet after t years is given by the function $h(t) = 100 - 100e^{-0.1t}$. Find the approximate rate of growth of the tree at $t = 15$. Assign the answer to `p2`. [5 pts]

3. Find the approximate concavity measurement (second derivative) of the function $f(x) = \sin\left(\frac{x^2-1}{2x-3}\right)$ at $x = 2$. Assign the answer to `p3`. [5 pts]

4. Evaluate $\int x^2 \ln x \; dx$ with `int`. Assign the answer to `p4`. [5 pts]

5. Use `int` to find the volume obtained when the area below $y = \exp(-2x)$ from $x = 0$ to $x = 2.2$ is rotated about the x-axis. Assign the answer to `p5`. [5 pts]

6. Use `int` to evaluate the integral whose result is the area between the functions $y = 9 - x^2$ and $y = 2x - 1$. How you find the interval of integration is up to you and is not part of this assignment but the interval should be exact. Assign the answer to `p6`. [10 pts]

7. If a population has mean 0 and standard deviation 1 and is normally distributed then the probability that a randomly chosen value is between 0.11 and 1.3 is given by $\int_{0.11}^{1.3} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2} dx$. Use `quad` to approximate this value. Assign the answer to `p7`. [10 pts]
   Note: You don't need to know anything about probability to do this problem. just integrate.

8. Solve the initial value problem $\frac{dy}{dt} + \frac{y}{t} = t^2$ with $y(2) = 5$. Assign the answer to `p8`. [10 pts]

9. Logistic population growth (exponential but eventually limited) is modeled by a function which satisfies the differential equation $y' = ky(L - y)$ where k is the growth rate and L is the limit. Use `dsolve` wrapped in `subs` to find the population after 10 years if an initial population of $y(0) = 70$ has growth rate $k = 0.00022$ and limit of $L = 3000$. Assign the answer to `p9`. [10 pts]

10. (a) Declare the function $f(x) = \frac{\sqrt{2x+3}}{x}$ symbolically. Use this declaration for all of the following: [5 pts]
    (b) Evaluate $f(2)$. Assign the answer to `p10b`. [5 pts]
    (c) Evaluate $f'(2)$. Assign the answer to `p10c`. [5 pts]
    (d) Evaluate $\int_1^3 xf(x) \; dx$. Assign the answer to `p10d`. [5 pts]

11. (a) Declare the function $g(x) = \sqrt{x^3 + 1}$ with a function handle. Use this declaration for all of the following: Note: Because of question (d) make sure you use `.*`, `./` and `.^` in all relevant parts for multiplication, division and exponents. [5 pts]
    (b) Evaluate $g(2)$. Assign the answer to `p11b`. [5 pts]
    (c) Evaluate $\left(\frac{g(x)}{x}\right)''(5)$. Assign the answer to `p11c`. [5 pts]
    (d) Use `quad` to approximate $\int_0^2 x^3 g(x) \; dx$. Assign the answer to `p11d`. [5 pts]

12. Plot $y = x^3 - 8x + 3$ using `ezplot`. [5 pts]

13. Plot the solution to the initial value problem $4u''(t) + \frac{1}{2}u(t) = 0$ with $u(0) = 3$ and $u'(0) = -1$ using `ezplot` wrapped around `dsolve` wrapped around the differential equation. [10 pts]

14. Use a three-line `for` loop with `disp` to print your full name five times. [10 pts]

15. (a) Assign `p15=[0,0,0,0,0,0]`.
    (b) Use a three-line `for` loop to find $\int_b^1 \frac{1}{x^3}\, dx$ for $b = \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, ..., \frac{1}{64}$. Each in turn should be assigned to an entry in `p15`. To do this, make your looping variable `i` and inside the loop you should assign your values with `p15(i)=...` [10 pts]

16. (a) Assign `p16=[0 0 0 0]`.
    (b) Define the function $g(x) = x^2\sqrt{4x+1}$ as a function handle. [5 pts]
    (c) Use a three-line `for` loop to find $g'(4)$, $g''(3)$, $g'''(2)$, $g''''(1)$. Each in turn should be assigned to an entry in `p16` just like the previous problem. [10 pts]

17. (a) Define a function handle for the function $f(x) = x^2$. [1 pts]
    (b) Define the variable `p17` to equal zero. [1 pts]
    (c) Use a three-line `for` loop to add each of the following to `p17` in the order given: $f(10)$, $f(9)$, ..., $f(2)$, $f(1)$. [12 pts]

18. (a) Define the variable $Y1 = 25$ and $Y2 = 50$. [2 pts]
    (b) Define the variable `p18` to equal zero. [2 pts]
    (c) Use a five-line `while` loop to first increase `p18` by $Y1 + Y2$ and then multiply both $Y1$ and $Y2$ by 0.7. Do this while the difference between $Y1$ and $Y2$ is greater than 1. [10 pts]