MATH.2720 Introduction to Programming with MATLAB Exam # 2
Spring 2019

Due April 8. Please email your files to `stephen_pennell@uml.edu`

This is an exam, so the work you submit must be your own. Do not discuss this exam with anyone other than me.

Problem 1. (20 points)

Write a script file that will graph the surface given by $z = \sqrt{16 - x^2 - 2y^2}$ for $-2 \le x \le 2,\ -1 \le y \le 1$.

Problem 2. (20 points)

Write a function file **(not a script file)** that takes a positive number x and a number $a > 1$ as input and produces the value of $\log_a(x)$ as output. Your code should check whether x is positive and whether a is greater than 1. If not, the function should produce the MATLAB value NaN as output. (This stands for Not a Number.) **No output should be displayed within your function file.**

Hint: $\log_a(x) = \dfrac{\ln(x)}{\ln(a)}$.

Problem 3. (20 points)

Write a function file **(not a script file)** that takes a nonnegative integer N as input and produces two outputs: the number $S = \displaystyle\sum_{n=1}^{N} \frac{1}{n^2} = 1 + \frac{1}{4} + \frac{1}{9} + \cdots + \frac{1}{N^2}$ and the number $D = \left| S - \dfrac{\pi^2}{6} \right|$. **No output should be displayed within your function file.**

Problem 4. (20 points)

Write a script file **(not a function file)** that asks the user to enter his/her annual income (x) and then calculates the income tax owed (t) according to the following formula:

$$t = \begin{cases} 0 & \text{if } x \le 20000 \\ 0.1\,(x - 20000) & \text{if } 20000 \le x \le 50000 \\ 3000 + 0.2\,(x - 50000) & \text{otherwise} \end{cases}$$

For example, if $x = 45000$ then $t = 0.1\,(45000 - 20000) = 0.1\,(25000) = 2500$.

Problem 5. (20 points)

Write a script file **(not a function file)** that finds the degree 2 polynomial (the quadratic) that best fits the data points $(-2, 1), (-1, 0), (0, -1), (1, 3), (2, 5)$. In the same figure window, plot the data points using circles as markers ('o'), and plot the best-fit quadratic over the interval $[-2, 2]$ using a solid blue line.