Assignment 1

Scalar Calculations

1. Start MATLAB. Open a new m-file a1.m
2. Use cells for each exercise/item (i.e., use %% ; for example %% Exercise 1. Notice the blank space after %% .).
3. After finishing, type `publish('a1','pdf')` to publish your m-file. Then submit the **pdf file** via BrightSpace.

1. (a) Choose two non-integer numbers a and b between -10 and 10. Then, use MATLAB to compute:

$A1 = a + b$, $A2 = \dfrac{a-b}{ab}$, $A3 = |a^2 - b^3|$, $A4 = e^{\frac{1}{|a|+|b|}}$,

$A5 = \ln(a^2 + |b|)$, $A6 = \log(10^{a-b})$, $A7 = \text{floor}(b)$.

(b) Use MATLAB to compute:

$B1 = \cos^2(45^\circ) + \sin^2(30^\circ)$, $B2 = \sin(1) - \tan(1)$,

$B3 = \arctan(1/2)$, $B4 = \arccos(-0.1)$, $B5 = e^{-3}$, $B6 = 12!$,

$x = \ln\left(\frac{7^8 - 8^7}{2e^7 - 1}\right)$, $y = \left(\arccos(0.5) + \frac{1}{2^5}\right)^{-2}$, $z = \pi \frac{5\sqrt{10} - 2e^2}{(\sqrt[3]{5}+1)^2} + xy$.

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2. The volume of a circular cylinder of height h and radius r is given by $V = \pi r^2 h$. A particular cylindrical tank is 10 m tall and has a radius of 5 m. You want to construct another cylindrical tank with volume 40 percent greater but having the same height. How large must its radius be? (Use MATLAB.)

3. Choose a nontrivial complex number $z = a + bi$. Then, use MATLAB to compute the conjugate, modulus, argument, and the real and imaginary parts of the complex number w given by

$$w = \frac{z^2 - z\bar{z} + 1}{2z\bar{z} + z^2}.$$

4. Execute the commands `1/2*i` and `1/2i`. Can you explain the difference between the two results?

5. The Richter scale is a measure of intensity of an earthquake. The energy E (in joules) released by the quake is related to the magnitude M on the Richter scale as follows: $E = 10^{4.4} 10^{1.5M}$. How much more energy is released by a magnitude 7.6 quake than a 5.6 quake?

6. The volume of a cube is given by $V = a^3$, where a is the length of each edge. Write a script that calculates the volume of the cube for $a = 1.23$ and print the result in a nice sentence format.

7. Create the (anonymous) function $f(x) = x - \cos^2(\pi x)\,\sin(\pi x)$. Find $f(1.5)$.

8. The formula for computing compounded investment is given by

$$x = x_0\left(1 + \frac{r}{100}\right)^n,$$

where x=accumulated amount, x_0=initial investment, r=rate of annual interest in percentage, and n=number of years. Define an anonymous function to compute x with (x_0, r, n) as the input. Using this function, compare the growth of a $\$10,000$ investment over a period of eight years earning an interest of 8% with that over a period of 10 years earning an interest of 6%.

9. Define a function called `mp` that calculates the mean value, sum, and product of five numbers. That is, the input is a list of five numbers a_1, a_2, a_3, a_4, a_5, and the output should be the mean value, sum, and product of these numbers. Using this function, calculate the mean value, sum, and product of the numbers $-3.4, 2.1, 3.7, 5, -10$.

10. The area and volume of a right circular cone are given by $A = \pi r(r + \sqrt{h^2 + r^2})$ and $V = \frac{1}{3}\pi r^2 h$, respectively, where r is the radius of the circular base and h is the height of the cone. Write a function (call it `cone`) that accepts the radius r and height h as inputs and calculates the area A and volume V as outputs. Using this function, calculate the area and volume of a cone with $r = 3$ and $h = 4$.