Topic: MATLAB review. Anonymous function handles. Error definitions. Iteration using a while loop

Read: Chapter 3: 3.1 (omit 3.1.3), 3.5
Chapter 4: introduction through 1st paragraph of §4.2; 1st para of §4.3& §4.4

Codes should have proper documentation for full credit. Remember to press **Cntl C** if your computer becomes unresponsive

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Handwork problem: (Hand calculations using calculator)

HW1_1 The Maclaurin series expansion of arctan(x) is shown below

$$\arctan(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{1+2n} x^{1+2n} = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \frac{x^9}{9} - \cdots$$

Starting from the simplest version $arctan(x) = x$, add terms one at a time to estimate arctan(0.75). After each term is added, calculate the true and approximate relative errors. Use your calculator for finding the 'true' value. Retain 5 decimal places in your calculations. Present your results in a tabular form like the one in Example 4.1 in your book. Continue your calculations until you achieve 2 significant figures accuracy.

Present your hand calculations legibly on a clean sheet of paper and upload a clear image of your work using link 'HW1-1 handwork image'. Also enter your results for this question in 'HW1_1 Quiz' on Blackboard. You will be allotted 1 hour for completion of the quiz. Make sure the calculations are complete before you start the quiz. Please read all other information and instructions on Bb before starting the quiz.

Coding problem: (publish as pdf and submit on Bb)

HW1_2 If a hot liquid in a container is left to cool, its temperature will gradually approach room temperature. The temperature of the liquid is expected to follow the mathematical model $T = A + B\, e^{mt}$,
where A=30 C, B=40 C, m= $-0.276\ \text{min}^{-1}$
The following data was also obtained in an experiment studying this phenomenon.

time (t, min)	0.5	3	7	11	15
temperature (T, C)	85	48	35	33	31

In the same figure window, plot the data points along with the mathematical model. Include labels & title. Use `fplot` to plot the model (should be a continuous plot), and `plot` for the data points (should be discrete point plot).

HW1_3 problem **3.13/4.1**

The 'divide and average' method, an old-time iterative method for approximating the square root of any positive number *a,* can be formulated as $x = \frac{x + a/x}{2}$. Write a MATLAB code (script) to find the square root of 15 correct to 4 significant figures and use an `fprintf` statement to write your final answer to the screen.

Hints:

1. Note that a=15 in this case as you are trying to find the square root of 15. Start with an initial value of x. An intelligent initial guess can be x=a/2.

2. Use a while loop to calculate the updated value of x according to the above iterative formula $x = \frac{x + a/x}{2}$
For example, if you start with x=a/2, i.e., x=7.5 initially, then the next updated value of x calculated by your code inside the while loop should be $x = \frac{x + a/x}{2}$ = (7.5+ 15/7.5)/2=4.75. Thus, at this stage the current value of x is 4.75 and the old value of x is 7.5. Accordingly calculate the relative error, e_a to properly construct a while loop.

3. Implement the stopping condition for 4 sig figs accuracy and display the last updated value of x as your final answer after you come out of the while loop.