

# Portfolio 1 Submission Instructions

Please follow the submission instructions carefully. A failure to do so will result in mark deductions. Make sure you attempt all questions in Part A and Part B.

1. All questions must be submitted via Blackboard's MATLAB grader. Multiple attempts are allowed and your best score will be counted. After submitting an answer to the problem, your grade should appear in My Grades on Blackboard.
2. Solutions to all questions must also be presented within a single pdf document and submitted via blackboard. This is in case we need to look back over your code.
3. The submitted pdf should include your student number in its name (eg. n#####Portfolio1.pdf)
4. Code should be simple for your marker to understand (comment your code!).
5. Portfolio 1 is **due at 11:59pm Friday 16th August** and should be submitted through Blackboard. Late submissions will receive a mark of zero. If you make multiple submissions, the most recent on-time submission will be graded.

## Part A - Functions (8 Marks)

When Legolas the archer fires an arrow from his bow, its position can be described through the equations:

$$\begin{aligned}x &= x_0 + v_0 \cos(\theta)t \\ y &= y_0 + v_0 \sin(\theta)t - \frac{1}{2}gt^2\end{aligned}$$

where  $x_0$  is the initial x-position [m],  $y_0$  is the initial y-position [m],  $v_0$  is the initial velocity [m/s],  $\theta$  is the launch angle [degrees],  $g = 9.81 \text{ m/s}^2$  and  $t$  is time [s].

### Questions:

1. Create a function that determines the x and y position of an arrow given initial conditions and a time vector are provided as inputs. (2 marks)
2. Create a function that plots the position of an arrow in the x-y plane given initial conditions and a time vector are provided as inputs. The plot should have axis labels and a title. (2 marks)
3. Create a function that can determine range (landing distance) of an arrow, given initial conditions are provided as inputs. Assume the ground is at  $y = 0$ . (2 marks)
4. Create a function that determines the magnitude and direction (in degrees) of velocity of an arrow given initial conditions and a time vector are provided as inputs. (2 marks)

**Note:** For Q3 and Q4, you may use hand working to model equations that you enter into MATLAB, or you may use MATLAB in-built functions to solve instead.

## Part B - Conditional Statements (8 Marks)

Quality Motors Inc. is a company that manufactures motors. Their most popular product is a 12 V geared hobby motor, primarily due to its popularity amongst engineering students.

The pricing setup for the motor is provided below:

- The minimum order is 5.
- The motors are \$10 each for the first 10 purchased, then \$8 each for the next 90 purchased, then \$6 each for any remaining motors purchased.
- Delivery is \$20 (in total), but is free for orders of \$500 or more.

You have been tasked with writing some functions for Quality Motors Inc. to use for orders of this product.

### Questions:

1. Create a function that returns 1 if the customer inputs a valid number of motors to order and 0 if their number is invalid. Assume the customer could attempt to input any scalar value as an input.  
(2 marks)
2. Create a function that determines the total cost of the order, given the number of motors is provided as an input.  
(3 marks)
3. Create a function that determines the maximum number of motors a customer can purchase given their budget is provided as an input (Hint: you can use the `floor` function to round a number down).  
(3 marks)