

# FUNCTIONS

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# RECAP: WHAT MAKES A GOOD ENGINEER?

- Someone who works well in a team
  - Real world programming tasks can take thousands to millions of hours
- Someone who thinks a lot, works as little as possible
- Someone who writes code that is easy to understand
  - Documents code
  - Chooses good variable names
- Writes reusable code
  - M-files
  - Functions

# WHAT IS A FUNCTION?

- The following are functions
  - `sin()`, `cos()`, `sqrt()`, `plot()`, `pause()`, `log()`, etc.
- A function file is an m-file with **inputs and outputs**
  - Functions are declared in m-files
  - File extension still “.m”
  - Difference is in the header of m-files
- **Functions are modular**
  - Reuse a pattern of code on different input values

# WHY USE FUNCTIONS?

- What if you needed to calculate  $\sin(x) \cdot \cos(x) \cdot \tan(x)$  many times throughout your calculations?
  - Type it out every time
  - Create a function to compute it
- In mathematics, you may assign it a variable to shorten your writing
  - Functions can serve the same purpose

# FUNCTIONS: BEHIND THE SCENES

- We are all familiar with what  $\sin(x)$  is but...
  - Do you know what happens every time you hit the sine button on your calculator?
  - What equation is being solved?
  - How is it being solved?
  - Do you care??
- When we use functions, we are often only interested in the result
  - Functions are also known as black boxes

# FUNCTIONS AS BLACK BOXES

- Function analogy
  - Function = DVD player (function file)
  - Input = DVDs (supplied by m-file)
  - Output = Picture and audio (command window)
  
- Do you know exactly what happens in a DVD player?
  - Do you need to know?
  - Generally, you're just interested in the result

# FUNCTIONS AS BLACK BOXES

- Can you think about every single mechanism in your car WHILE you are driving?
  - You just need to provide an **input** to the car (pedal, gear stick, etc.)
  - Car provides an **output** by moving, turning, braking etc.
  - The internal details of the engine, gearbox, brakes, etc. are hidden from the driver, like a **black box**
- Engineers are paid to deal with large and complex problems
  - Functions let us break up a problem into smaller/manageable bits

- What are functions?
- What is the purpose of functions?
- Inputs  $\rightarrow$  function  $\rightarrow$  output
- Can a function receive multiple inputs and produce multiple outputs?