ME 3001 Lecture, Roots of Non-Linear Equations
A Brief Refresher in MATLAB

- **What is it?**
  - High Level programming language
    - language written in C++
    - Interactive Development Environment written in JAVA
    - Windows, Mac, and Linux compatable
  - *MAT*rix *LAB*oratory
  - *Technical Computing Language* - Mathworks
- **Why use it?**
  - A powerful tool for engineers, scientists, and students
    - optimized for floating point arithmetic and linear algebra
    - extensive library of mathematical functions and operations
    - specialized functions and operations
      - Aerospace
      - Robotics
      - Communications
      - Image/Signal Processing
      - Embedded Systems and Controls
    - ability to use *symbolic programming*
  - Ease of Access and Community
    - *Plug and Play*, it works out of the box
    - requires little or no programming experience to begin
    - online community for sharing code, *MATLAB Central*
- **Why Not?**

- **Review of some basic MATLAB**
  - **Useful Commands(type in Command Window)**

```
>> clear variables
>> clc
>> close all
>>
```

  - **Built-In MATLAB functions**
    - **Typical Mathematics Functions**
      - `sqrt()`
      - `exp()`
      - `log()`
      - `log2()`
      - `log10()`

* **Other Useful Functions**

  - `round()`
  - `floor()`
  - `int8()`
  - `sign()`
  - `mod()`
  - `rem()`
  - `fzero()`

* **The Built in Help**

  - `>> help fzero()`

    - use the help to get information about the built in functions

    - the full documentation is also available online

– **Constants**

Several useful constants are built into MATLAB.

* `pi`
* `i`
* `j`
* `inf`
* `NaN`

– **Random Numbers**

Sometime it is useful generate random data in MATLAB.

* `rand()`
* `randi()`

– **User Defined Functions**

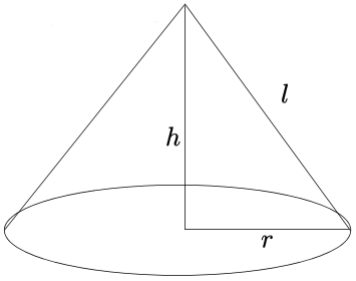
* We often write our own functions in MATLAB. To do this we must define the function in the function file.

* When we use a function we *call* the function.

* we can refer to a function with *handle operator*

• A Mechanical Design Problem

As an engineer you are asked to design a structure. The geometery of these structures is simple but certain properties are critical. Also you want to spend as little as possible on materials.



surface area, $s = \pi r l = \pi r\sqrt{h^2 + r^2}$

The first structure you are required to design is a cone with a surface area of exactly $100m^2$ to a tolerance of 0.1 m^2 and a height of exactly $1m$. Your goal is to find the radius in meters.

Write a program the uses the *Newton -Raphson* method to solve the problem. Verify and compare your answer with the *fzero* function.

- **REMINDER - Homework 1 is due Friday**

- **REMINDER - MATLAB script from today's lecture will be posted on ilearn.**