

## ENGR 1204 Programming Languages in Engineering

### MATLAB Lab 4 (Function)

The objective of this exercise is to minimize the total surface area of a cylindrical metal can for a given volume, and compare that area to that of a sphere of equal volume. Assume that the volume is equal to  $\pi \approx 3.1416$ .

For this exercise, first create two user function files:

cylinder.m	Inputs – radius, height	Outputs – volume, area
sphere.m	Input – radius	Outputs – volume, area

Next create a MATLAB program (script .M file) to perform the following steps:

For cylinder:

- (1) Display table headings for cylinder radius, height, volume and area
- (2) For radius values of 0.5 to 1 in steps of 0.02
  - Compute the height resulting in constant volume
  - Call cylinder.m to calculate and return cylinder volume and area
  - Display the results formatted to 4 significant figures.

For sphere:

- (3) Calculate and display the sphere radius for a volume of  $\pi$ .
- (4) Call sphere.m to calculate, return and display sphere volume and area.

Compare the minimum cylinder area to the sphere's area.

### Formulas

Cylinder:     $\text{volume} = \pi r^2 h$      $\text{area} = \underset{\text{(sides)}}{2 \pi r h} + \underset{\text{(top)}}{\pi r^2} + \underset{\text{(bottom)}}{\pi r^2} = 2 \pi r (r + h)$

Sphere:     $\text{volume} = (4/3) \pi r^3$      $\text{area} = 4 \pi r^2$