

**WIA1002 DATA STRUCTURE  
SEMESTER 2, SESSION 2024/2025**

**GROUP ASSIGNMENT (10%)**

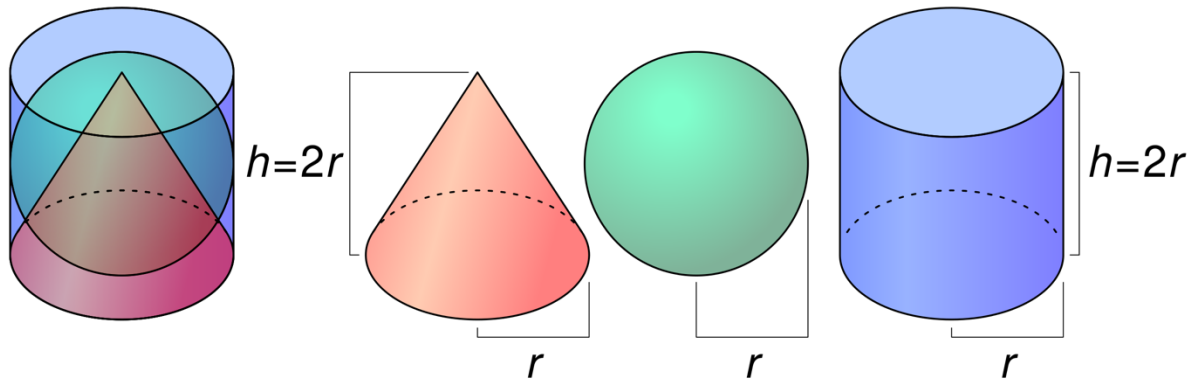
**1. Learning Objectives:**

By completing this assignment, students will:

- Implement classes for different 3D shapes: **Sphere**, **Cylinder**, and **Cone**.
- Calculate key properties like volume and surface area for each shape.
- Apply OOP principles in designing classes for different shapes.

**2. Problem:**

Figure 1: 3D Shapes



As shown in Figure 1, you are tasked with creating a Java program that calculates the **volume** and **surface area** for three different 3D shapes: **Sphere**, **Cylinder**, and **Cone**. The program should calculate and print the volume and surface area of each shape based on its respective dimensions, where **Volume (V)** is the amount of space the shape occupies and **Surface Area (A)** is the total area of the surface of the shape. Each shape will have specific formulas for calculating these properties, as follows:

- **Sphere:** A sphere has a radius  $r$ .
  - Volume:  $V = \frac{4}{3}\pi r^3$
  - Surface Area:  $A = 4\pi r^2$
- **Cylinder:** A cylinder has a radius  $r$  and height  $h$ .
  - Volume:  $V = \pi r^2 h$
  - Surface Area:  $A = 2\pi r^2 + 2\pi r h$
- **Cone:** A cone has a radius  $r$  and height  $h$ .
  - Volume:  $V = \frac{1}{3}\pi r^2 h$
  - Surface Area:  $A = \pi r(r + \sqrt{r^2 + h^2})$

### Requirements (10%):

1. Create the following classes, ***Sphere***, ***Cylinder*** and ***Cone***. Each class should have a method `calculateVolume()` to calculate the volume and `calculateSurfaceArea()` to calculate the surface area.
2. For each class, the constructor should accept the necessary dimensions, ***Sphere*** should accept only the radius *r*, while ***Cylinder*** and ***Cone***, should accept both the radius *r* and height *h*.
3. In the **`main()`** method, create an instance of each shape with specific dimensions (e.g., radius *r* = 5 for ***Sphere***, ***Cylinder*** and ***Cone***, height *h* = 10 for ***Cylinder*** and ***Cone***). Display the calculated **volume** and **surface area** for each shape and ensure that the volume and surface area are rounded to **4 decimal places**.

### Expected outputs

```
Sphere Volume: 523.5988
Sphere Surface Area: 314.1593
Cylinder Volume: 785.3982
Cylinder Surface Area: 471.2389
Cone Volume: 261.7994
Cone Surface Area: 254.1602
```