# Lab 7

## Due: Tuesday, November 24

# 1 Implementing User-defined types

Download the `CartesianVector` class (here). Write a program which prompts the user for three numbers $x, y$ and $z$. Use an instance of the `CartesianVector` class to convert this vector to spherical coordinates, and print the result to the user.

# 2 Extending Class Functionality

Add a member function called `toCylindrical()` to the `CartesianVector` class which converts the cartesian vector to *cylindrical* coordinates:

$$\rho = \sqrt{x^2 + y^2}$$
$$\phi = \arctan(y/x)$$
$$z = z$$

# 3 Write your own class

Write a class to model an $RC$ circuit. The class should include the following member variables:

- emf

- capacitance

- resistance

And should include the following member functions:

- Include a constructor so that the values of the three member variables can be passed upon object creation

- `double getTimeConstant()` calculate the time constant (resistance $\times$ capacitance) and return it as a double

- `double getCurrent(double t)` calculate the current given a time value, using the relationship $I(t) = \frac{\varepsilon}{R} e^{-t/RC}$

- `double getCapacitorCharge(double t)` calculate the charge on the capacitor given an time value $(Q(t) = C\varepsilon \left(1 - e^{-t/RC}\right)$ )