CSc 21200 – 2018 Spring
Homework 2
Due February 28^{th}, 2019

Name your implementation file as LastName(3 to 5 letters)_FirstNameInitial_HW1.cpp
Note: You can only use iostream, cassert, cmath, cstdio, and cstdlib.

Create a class called Point with the following:

1. Private members: x, y and z as double.
2. Write a default constructor and set the point to (0, 0, 0).
3. Write a constructor and set the point to user input, if z is not inputted, set it to 0.
4. Write a copy constructor.
5. Write the set functions for each individual member, x and y together, and x, y, and z together.
6. Write the get functions for each individual member.
7. Write a **member** function called print() that print out the point as (x, y, z)\n.
8. Write a **member** function called distance() that return the distance between the origin and the point.
9. Write a **member** function called distance(*param*) that return the distance between a pt2 and the point.
10. Write a **member** function called origin() that return true if the point is the origin.
11. Write a **member** function called line(*param*) that return true if pt2 is on the same line as the origin and the point. Otherwise, return false. Also return false if the origin and the point do NOT make a line.
12. Write a **member** function called cross(*param*) that return a point that is the cross product of a pt2 and the point.
13. Overload the addition (+) and the subtraction (-) operators.
14. Overload the output (<<) and input (>>) operators. The output should be (x, y, z)\n.
15. Write a **non-member** function called plane(*param*) that takes an array of exactly **three** points and a target point. Return true if the target point is on the plane created by the static array of three points. Otherwise, return false.

    To find the plane

    i. Find ***u*** and ***v*** where ***u*** is **pt2-pt1** and ***v*** is **pt3-pt1**.
    ii. Find the normal vector to the plane by using the cross product of ***u*** and ***v***.
    iii. Using the Point-Normal Form, the normal vector, and any of the three points, the equation of the plane is $a(x-x_0) + b(y-y_0) + (cz-z_0) = 0$, where <a, b, c> is the normal vector and P(x_0, y_0, z_0) is one of the three points. Thus, any points P(x, y, z) that satisfy this equation is on the plane.
16. Write a **non-member** function called square(*param*) that takes a static array of **unique** points and the size of the array. Return true if the array of points can create at least one square. Otherwise return false.
17. Write a **non-member** function called centroid(param) that takes a static array of points and the size of the array and return the centroid of the array of points. If there is no center, return the origins.