MECH-6024, MECH-5124
Computational Methods in Additive Manufacturing I
Assignment 1 (100 points)
To be worked on individually. Do not consult with others.
Due on February 6th, 2020 – Thursday (In Class)
Note: Show all detailed calculations and workings.

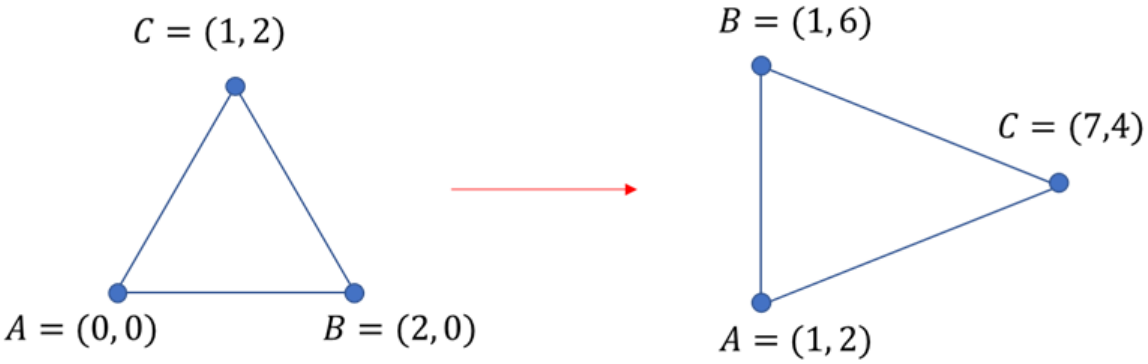
1. Find the equation of a plane passing through point **A = (2, 3, 4)** and having a normal vector **N = (1, 1, 3)**. Find the distance of this plane from a point on the origin **P = (0, 0, 0)** and also find the closest point on this plane to the origin. (10pts)

2. Given two skew lines:
Points on line 1: **A = (1, 2, 3)** and **B = (2, 1, 2)**
Points on line 2: **C = (1, 3, 4)** and **D = (4, 4, 1)**
Find the shortest distance between lines 1 and 2. (15pts)

3. Determine whether or not a line defined by equation **Q = (2, 3, 4) + λ (1, 2, 2)** intersects with a triangle formed by three points **F = (0, 0, 0)**, **G = (-2, -1, 1)**, and **H = (1, -3, -2)** (20pts)

4. Calculate the area **A** of a triangle formed by three points:
B = (1, 0, -1), **C = (-4, -2, 1)**, and **D = (-2, 5, 3)**
Then calculate the perpendicular distance **H** of point **P = (3, -2, 5)** from the plane on which this triangle lies.
Finally, calculate the volume **V** of the tetrahedron (i.e. pyramid) formed with base **BCD** and tip **P**.
Notice how this series of calculations is the same as a scalar triple product divided by 6. (20pts)

5. Describe a series of transformations which can be applied to result in the figure on the right shown below (not drawn to scale.) Using the same types of transformations but in a different order, create a new series of transformations which results in the figure on the right side. Make sure that A and B are not swapped. (15pts)



6. Determine the 4x4 transformation matrix for revolving +30 degrees about the line defined by
Q = (2, 3, 4) + λ (1, 2, 2)
Assume that positive rotation follows right hand rule with the thumb along the increasing **λ** direction of this line.
Then apply this transformation to three points **A = (1, 2, 3)**, **B = (2, 1, 2)**, and **C = (1, 3, 4)** using a single matrix multiplication operation. (20pts)