**2018-2019**

**Question 2 (a) Describe all roles of matrices in the graphics pipeline. (6) Marks**

* World Transformations
  + Translations
  + Rotation
  + Scaling
* Viewing
  + Camera Setup
* Projection
  + Aspect Ratio, Field of View, etc.

Each instance of a model will be effectively stored as the matrices, which are used to place/view the model. All these matrices are composed (multiplied) to produce a single matrix representation of the instance of the model.

**(b) The following 3D Cartesian co-ordinates describe a face of a mesh.**   
(3,4,5) - (8,2,6) - (1,-2,-3)   
**(i) Derive the matrix for rotation by 30 degrees about the point (1,-2,-3) and the z axis. (6 Marks)**

Rotate About (1,-2,-3) and the z axis by 30.  
Step 1;  
Translate (1,-2,-3) to (0,0,0)

Step 2;  
Rotate by 30 degress about the z axis

Step 3;  
Translate back

Compose…

**(ii) Use the matrix derived in part (i) to transform the above triangle. (3 Marks)**

**(iii) Derive a projection matrix which will project to the plane z = -1, you may assume no normalisation occurs. (3 Marks)**

**(iv) Use the projection matrix to project the image of the triangle calculated in part (ii) (2 Marks)**

**(v) Explain the use of Homogeneous Co-ordinates at this stage. (3 Marks)**

IN homogenous points (x,y,z,w) can be interpreted as the divisor iw (x,y,z,w) represents the 3d Cartesian point (x/w,y/x,z/w)  
So if we project the point () to () we effectively project to the Cartesian point () which is the projection of the point () to the plane z = -1

**(vi) Plot the image of the projected triangle on graph paper. (2 Marks)**

**Homgenous**(x/w, y/w, z/w, w).Translations cannot be done without them.  
Projections need a divisor like in fractions.