1. Find the 4x4 homogeneous 3D transformation matrix that translates by $(3, 5, 2)$, rotates by 45 degrees about the Z-axis, and finally, scales by $(3, 1, 2)$.

2. Suppose you wish to apply the transformation in question 1 to the normal vectors in a 3-D model. What is the transformation matrix that needs to be applied to the normal vectors in order to preserve the normals' perpendicular orientation relative to the surface of the object?

3. A triangular face, which is part of a larger 3-D model, is defined by vertices at the points $(1, 0, 1), (3, 2, 4)$ and $(5, 3, 1)$

   (a) If the convention is vertices for front-facing triangles are provided anti-clockwise, find the surface normal of the triangle defined by these three vertices.

   (b) Explain why the normal vector at the vertices might not be set to the vector you found in part (a). What visual effect is this intended to produce?

4. Consider a scene with V vertices, N objects, and T triangles being rendered to a display with P pixels. Assuming a single fragment shader and no anti-aliasing, what is the upper bound of how many times the fragment shader will be run?

5. A bump/normal-mapped object can be made to appear bumpy when in fact the geometry is smooth. Given a bumpy-looking object, explain what characteristics can be used to determine whether the object has bumpy geometry or is making use of bump-mapping.

6. Explain why there are no colours lying outside of the curve formed by the pure colours in the CIE chromaticity diagram.