

Question 1

- a)** Describe what is meant by: scalars; vectors; affine space; reference frames.
- b)** What are the three main frames of reference used in computer graphics when working in three dimensions?
- c)** What transformations are required to convert between two reference frames?

Question 2

- a)** How are textures mapped onto objects in OpenGL?
- b)** What is the coordinate system for referencing points within a texture?
- c)** Texels usually do not map directly to pixels: what two filters must be defined
- d)** When texels are much smaller than a pixel, this can lead to undesirable artifacts, which can be solved using a technique called mip-mapping. Describe this technique.

Question 3

- a)** Give one advantage of back face culling
- b)** Give one advantage of hidden surface removal
- c)** What is used by OpenGL to determine the orientation of a triangle and whether it should be culled?
- d)** Which buffer is required to perform hidden surface removal?

Question 4

- a)** What are the two main differences between orthographic and perspective viewing?
- b)** Derive the perspective projection equations: start by drawing diagrams to illustrate your approach, then describe each step you take. (Most marks are given for the work you show)

Question 5

- a)** Give three examples of the types of light that can be defined in OpenGL.
- b)** Describe the difference between the lighting model used in a pipeline graphics system (such as OpenGL) and that used in a global rendering system (such as ray tracing).
- c)** Describe the difference between the Phong lighting model and the modified Phong lighting model, and give one reason why the modified version is used instead of the full version. Describe the vectors used in the modified Phong lighting model.