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Write your answers in the spaces provided.

No aids (books, notes, calculators, mobile phones, PDA's, music players, other electronic devices, etc.) are permitted.

1) How can you check if a point (x, y) is on the left or the right side of the directed line going from point (x_0, y_0) towards (x_1, y_1)?

2) Give an example of an orthogonal 3×3 matrix that is a rotation (of more than zero degrees), and an example of an orthogonal 3×3 matrix that is a reflection.

3) Why is it necessary to clip triangles against the near plane before the homogenization part of perspective projection?

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4) In terms of their viewing volumes what is the difference between perspective and orthographic projection?

5) Give an example where the Painter's Algorithm cannot be correct.

6) How are barycentric coordinates used in the Z-Buffer algorithm for rasterizing triangles?

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7) Construct a model-view matrix (either giving matrix entries, or a sequence of symbolic transformations such as `translate` etc.) for a camera at world-space location $(0, -4, 0)$ looking straight up.

8) Given one input triangle that is clipped against both the near and the far viewing planes, how many triangles might end up being rasterized?

9) How do we set up 3D translation (which is a vector addition) in terms of a matrix multiplication?

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10) What is back-face culling, and how do we do it?

11) What is the purpose of keeping a stack of model-view matrices, instead of just one?

12) What two problems can we run up against in rasterization when a pixel centre lies exactly on the common edge of two triangles?