HW 1 **Due Date: July 14, 2023**

Each question is 3 points.

Instructions: Save your file as PDF and upload to canvas.

1) Identify three major differences between Apple Vision Pro and Meta Quest 3. You can search product specifications online. While they may be many differences, think about what could be key differences between the two products.

2) What do we use primitives to represent virtual models? What primitive is commonly used and why?

3) Canonical view transform uses T_{st} with the following formula:

$$T_{st} = \begin{bmatrix} \frac{2}{r-\ell} & 0 & 0 & -\frac{r+\ell}{r-\ell} \\ 0 & \frac{2}{t-b} & 0 & -\frac{t+b}{t-b} \\ 0 & 0 & \frac{2}{n-f} & -\frac{n+f}{n-f} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Describe what role the values on the first row-first column and third row-fourth column play in the chain of transformations?

4) Consider a triangle model in R^3 with vertices as (1,3,4), (8,-4,5), and (1,-2,-4). Find the new values of each vertex coordinate, if the triangle is first rotated along x, z, and y axis by 45, 30, and 60 degrees and then shifted along the x, y, and z directions by -1, -3, and 7 values?

5) Consider a point in 3D with values (3,5,7). What would be the coordinate of the point if it is inversely rotated along z axis by 30 degrees? Note that rotation along z axis is referred to as rolling.