1. Consider the side-view of a perspective camera shown below: the image looks at the yz plane from the +x direction. The scene point at \((x, y, z)\) appears in the viewport at \((x_s, y_s, -d)\). Based on this view, calculate the value of \(y_s\), the y coordinate of the viewing ray’s intersection with the viewport, in terms of the pixel’s 3D coordinates \((x, y, z)\) and the camera’s focal length \(d\). Hint: no trig necessary! Try similar triangles.
2. Circle each of the 3D homogeneous points below that are equivalent to the point $\mathbf{x}$. 
\[
\mathbf{x} = [0, 2, 3, 1]^T
\]
\[
\begin{align*}
\mathbf{a} &= [0, 8, 12, 3]^T \\
\mathbf{b} &= [1, 4, 6, 2]^T \\
\mathbf{c} &= [0, 4, 6, 1]^T \\
\mathbf{d} &= [0, -200, -300, -100]^T
\end{align*}
\]

3. The identity matrix maps a point to itself. For points in $\mathbb{R}^4$, the identity matrix is a 4x4 matrix with ones on the diagonal and zeros everywhere else. For 3D homogeneous coordinates, there are multiple matrices that leave points unchanged up to equivalency after division by $w$. Describe the form of all possible identity matrices on 3D homogeneous coordinates.