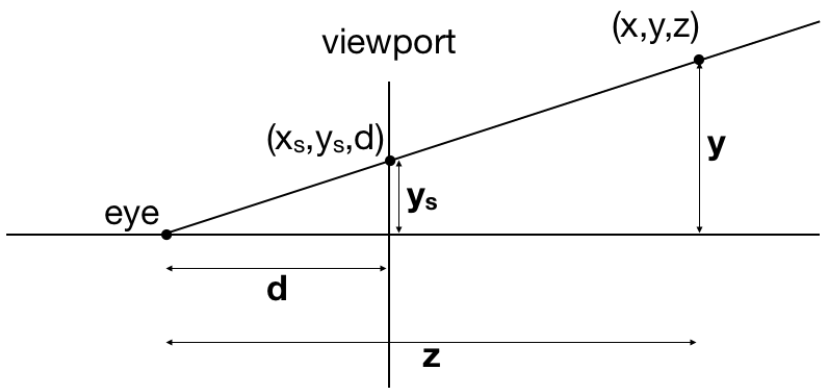
CSCI 480 / 580 – February 11, 2020 – Perspective Projection

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.



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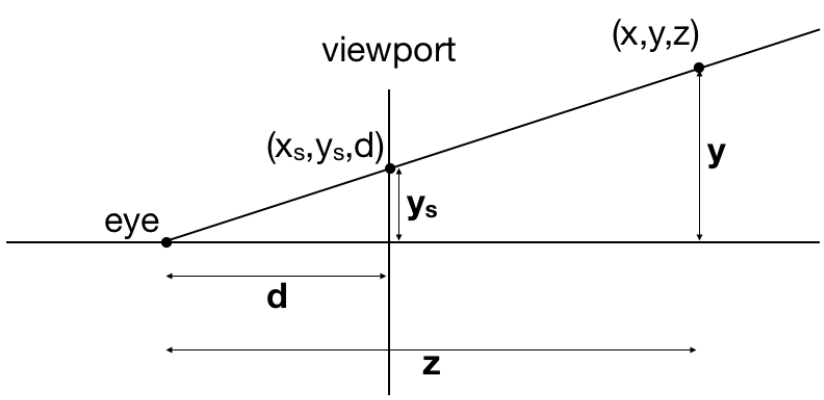

2. Circle each of the 3D homogeneous points below that are equivalent to the point **x.**

$$\mathbf{x} = [0, 2, 3, 1]^T$$

$$\mathbf{a} = [0, 8, 12, 3]^T$$
$$\mathbf{b} = [1, 4, 6, 2]^T$$
$$\mathbf{c} = [0, 4, 6, 1]^T$$
$$\mathbf{d} = [0, -200, -300, -100]^T$$

3. The identity matrix maps a point to itself. For points in 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.

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