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Homework 4

Q1) ⓐ $P(t) = -4x + y + 4 = 0 \rightarrow P(t) = -4x + y + 4h = 0$ in homog. coordinates

ⓑ homogeneous plane: $2x = 3h \rightarrow h = \frac{2}{3}x$

intersect. $-4x + y + 4h = 0$

$-4x + y + \frac{8}{3}x = 0 \rightarrow y = \frac{4}{3}x$. Choose $x = 1$: $\left[1, \frac{4}{3}, \frac{2}{3}\right]^T$ intersection

ⓒ Non-homogeneous intersection: $\left[1 / \frac{2}{3}, \frac{4}{3} / \frac{2}{3}\right] = \left[\frac{3}{2}, 2\right]$

Q2) ⓐ $(N\eta)^T MA = 0$ since MA is in the plane of the transformed triangle, so $(N\eta)^T MA = \eta^T A = 0$

$\eta^T N^T MA = \eta^T A \rightarrow$ This means $N^T M = I_4$, so $N^T = M^{-1}$, and $N = (M^{-1})^T$

ⓑ $n_2 = (MA - MB) \times (MA - MC)$

ⓒ n_2 could not be computed via $n_2 = Mn_1$. If M is a shear transformation then Mn_1 may not necessarily be the correct normal vector for the newly transformed plane. For example, if a plane is just the xy plane with $n_1 = [0,0,1,0]^T$ and $M = \begin{bmatrix} 1 & 0 & a & 0 \\ 0 & 1 & b & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$, then $Mn_1 = [a, b, 1]^T$.

This is incorrect because the sheared xy plane still has a normal vector of $[0,0,1]^T$.

ⓓ If ΔABC's origin was the world origin and M is a rotation about the world's axes, then the normal vector would be $n_2 = Mn_1$