Solución:

El vector $\overrightarrow{P\prime}$ visto desde $O\prime$ es $\overrightarrow{P\prime} = \overrightarrow{P} - \overrightarrow{O\prime} = (-1,2,0) - (0,1,3) = (-1,1,-3)$

$$\overrightarrow{P\prime} = \lambda_1 \overrightarrow{A} + \lambda_2 \overrightarrow{B} + \lambda_3 \overrightarrow{C}$$

$$(-1,1,-3) = \lambda_1(3,-4,0) + \lambda_2(-4,0,3) + \lambda_3(-2,4,-4) \Longrightarrow \begin{cases} -1 = 3\lambda_1 - 4\lambda_2 - 2\lambda_3 \\ 1 = -4\lambda_1 + 0\lambda_2 + 4\lambda_3 \\ -3 = 0\lambda_1 + 3\lambda_2 - 4\lambda_3 \end{cases}$$

$$\Delta = \det \begin{bmatrix} 3 & -4 & -2 \\ -4 & 0 & 4 \\ 0 & 3 & -4 \end{bmatrix} = 52$$

$$\lambda_1 = \frac{\det \begin{bmatrix} -1 & -4 & -2 \\ 1 & 0 & 4 \\ -3 & 3 & -4 \end{bmatrix}}{\Delta} = \frac{38}{52} = \frac{19}{26}$$

$$\lambda_2 = \frac{\det \begin{bmatrix} 3 & -1 & -2 \\ -4 & 1 & 4 \\ 0 & -3 & -4 \end{bmatrix}}{\Delta} = \frac{16}{52} = \frac{4}{13}$$

$$\lambda_3 = \frac{\det \begin{bmatrix} 3 & -4 & -1 \\ -4 & 0 & 1 \\ 0 & 3 & -3 \end{bmatrix}}{\Delta} = \frac{51}{52}$$

Ya que están preguntando por las coordenadas hay que calcular la norma de los vectores

$$\left\{\begin{array}{c} \left\|\overrightarrow{A}\right\| = \sqrt{3^2+4^2} = 5 \\ \left\|\overrightarrow{B}\right\| = \sqrt{4^2+3^2} = 5 \\ \left\|\overrightarrow{C}\right\| = \sqrt{2^2+4^2+4^2} = 6 \end{array}\right. \Longrightarrow \left\{\begin{array}{c} \beta_1 = \lambda_1 \left\|\overrightarrow{A}\right\| = 5\frac{19}{26} = \frac{149}{26} \\ \beta_2 = \lambda_2 \left\|\overrightarrow{B}\right\| = 5\frac{4}{13} = \frac{69}{13} \\ \beta_3 = \lambda_3 \left\|\overrightarrow{C}\right\| = 6\frac{51}{52} = \frac{363}{52} \end{array}\right.$$

Finalmente $P_{ABC}\left(\dfrac{149}{26}, \dfrac{69}{13}, \dfrac{363}{52}\right)$

Resultado: $P_{ABC}\left(\dfrac{149}{26}, \dfrac{69}{13}, \dfrac{363}{52}\right)$