Find a unit vector that is parallel to the xy-plane and perpendicular to the vector $4\hat{i} - 3\hat{j} + \hat{k}$

$4\hat{i} - 3\hat{j} + \hat{k} = (4, -3, 1)$

Let $\vec{u} = (u_1, u_2, u_3)$

If $\vec{a} \perp \vec{b}$, $\vec{a} \cdot \vec{b} = 0$

$(4, -3, 1) \cdot (u_1, u_2, u_3) = 0$

$4u_1 - 3u_2 + u_3 = 0$

$(u_1, u_2, u_3) \cdot (0, 0, 1) = 0$ ← Parallel to xy-plane means $\perp$ to $\hat{k}$

$1u_3 = 0$

$u_3 = 0$ ✓ Substitute into $4u_1 - 3u_2 + u_3 = 0$

$4u_1 - 3u_2 = 0$

$u_1 = \frac{3}{4}u_2$, and our vector becomes

$(\frac{3}{4}u_2, u_2, 0) =$

or, a simpler version → $u_2(\frac{3}{4}, 1, 0)$

Unit vector means a magnitude of 1.

$\frac{9}{16}u_2^2 + u_2^2 = 1$

$\frac{25}{16}u_2^2 = 1$

$u_2^2 = \frac{16}{25}$, $u_2 = \pm\sqrt{\frac{16}{25}}$

$u_2 = \frac{4}{5}$ or $u_2 = \frac{-4}{5}$