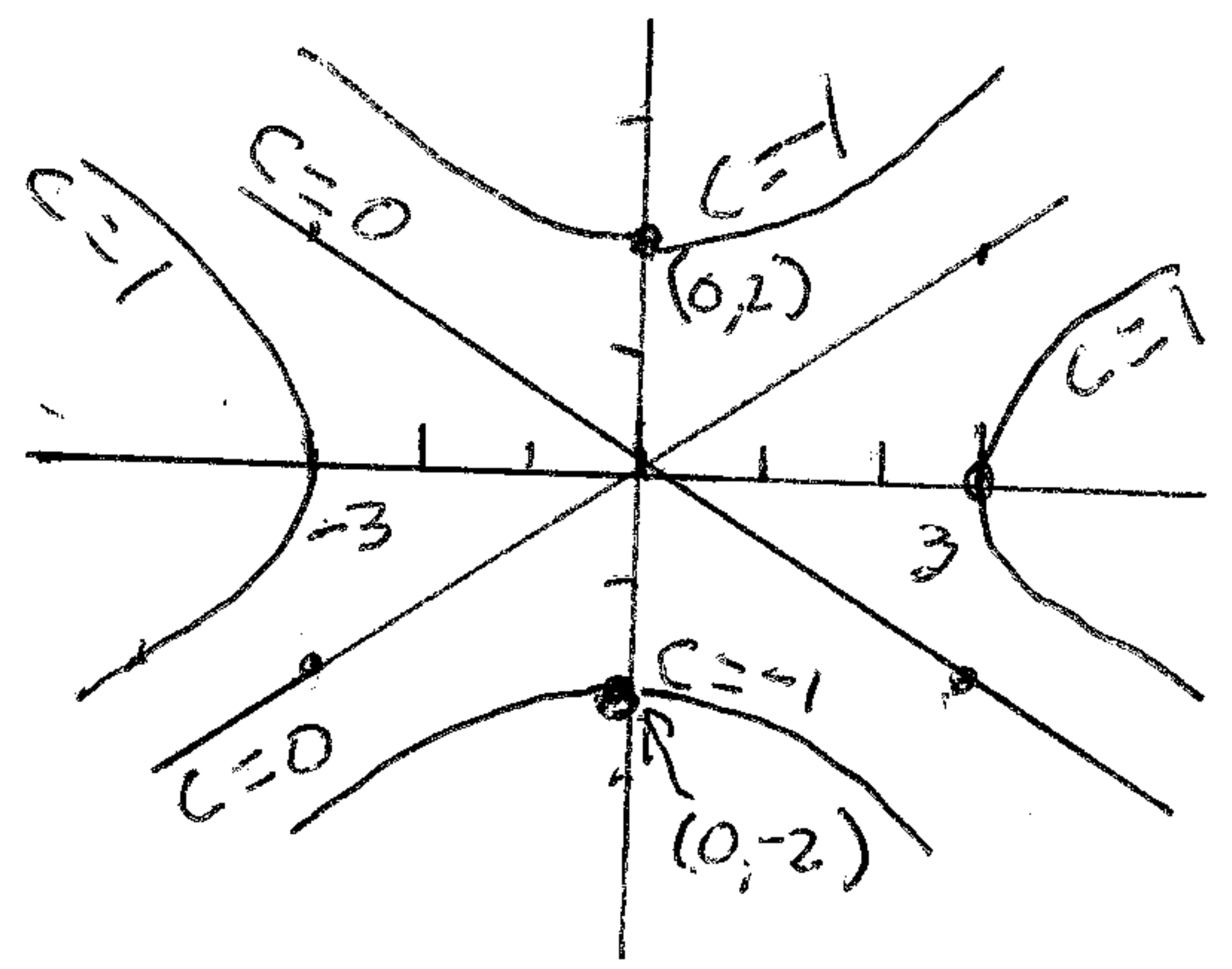
1.



$c=0$:

$$\frac{x^2}{9}=\frac{y^2}{4}$$

$$\frac{x}{3}=\pm\frac{y}{2}$$

$c=-1$: $\frac{y^2}{4}-\frac{x^2}{9}=1$

$c=1$: $\frac{x^2}{9}-\frac{y^2}{4}=1$

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2. $\boxed{(x+1)^2+y^2+(z-1)^2=4}$

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3. A point on the plane is $\boxed{(1,2,3)}$

A vector perpendicular to the plane is $\boxed{(1,-2,4)}$.

4.
$$\vec{u}\times\vec{v}=\begin{vmatrix}\vec{i} & \vec{j} & \vec{k}\\ 0 & 1 & -1\\ 1 & 0 & 1\end{vmatrix}=\vec{i}\begin{vmatrix}1 & -1\\ 0 & 1\end{vmatrix}-\vec{j}\begin{vmatrix}0 & -1\\ 1 & 1\end{vmatrix}+\vec{k}\begin{vmatrix}0 & 1\\ 1 & 0\end{vmatrix}$$
$$=1\vec{i}-(1)\vec{j}+(-1)\vec{k}=\boxed{(1,-1,-1)}.$$

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5. We first find two vectors in the plane and a normal to the plane. Vectors in the plane (i.e. parallel to the plane) are $(1,1,0)-(0,0,0)=(1,1,0)$ and $(0,1,1)-(0,0,0)=(0,1,1)$.

A normal to the plane is:
$$\begin{vmatrix}\vec{i} & \vec{j} & \vec{k}\\ 1 & 1 & 0\\ 0 & 1 & 1\end{vmatrix}=\vec{i}\begin{vmatrix}1 & 0\\ 1 & 1\end{vmatrix}-\vec{j}\begin{vmatrix}1 & 0\\ 0 & 1\end{vmatrix}+\vec{k}\begin{vmatrix}1 & 1\\ 0 & 1\end{vmatrix}=\vec{i}-\vec{j}+\vec{k},$$

so an equation for the plane is:

$$((x-0),(y-0),(z-0))\times(1,-1,1)=0,$$

that is,

$$\boxed{x-y+z=0}$$

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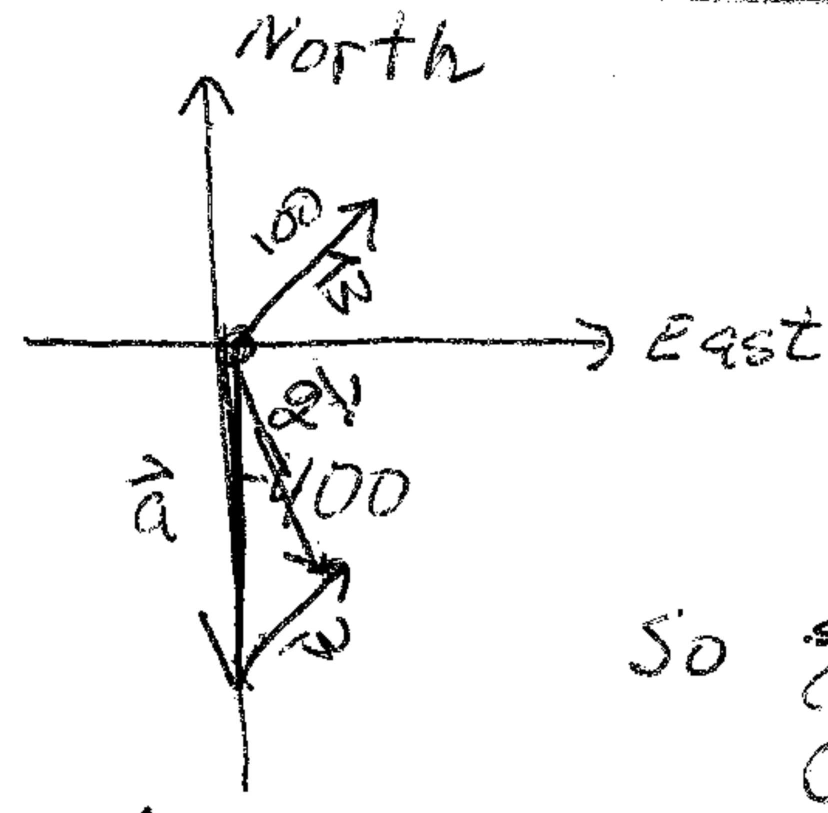

$\vec{g} = \vec{a} + \vec{w}$

$\vec{a} = (0, -400)$

$w = \left(100\frac{\sqrt{2}}{2}, 100\frac{\sqrt{2}}{2}\right) = (50\sqrt{2}, 50\sqrt{2})$

So $\vec{g} = (50\sqrt{2}, 50\sqrt{2} - 400) \approx (70.71, -329.28)$

Thus, the ground speed of the plane is ~~approximately~~ $\boxed{\|\vec{g}\| \approx 337 \text{ mph.}}$