5) a) $g \wedge (x, y) = (ax, y)$ for $g = \begin{pmatrix} a & b \\ 0 & 1 \end{pmatrix}$

i) $\{g \wedge (1,0)\} = \{(a, 0) : a \in \mathbb{R}, a \neq 0\}$.
$a \in \mathbb{R}$, and can take any value, so the orbit of $(1,0)$ is the x-axis, excluding origin (since $a \neq 0$)

ii) $g \wedge (0,1) = \{(0,1)\}$.
This is the only point produced by the action of G on $(0,1)$, so the orbit of $(0,1)$ is the point $(0,1)$

iii) $g \wedge (1,1) = \{(a, 1) : a \in \mathbb{R}, a \neq 0\}$.
$a \in \mathbb{R}$, and can take any value, so the orbit of $(1,1)$ is the line $y=1$, excluding $(0,1)$

$a, x, y \in \mathbb{R}$, so $(ax, y) \in \mathbb{R}^2$. The orbits of the action is the union of all the orbits of each point acted on by G, and the union of those orbits is $\mathbb{R}^2$.

OK, But what are these?!! — PTO 5/8

6) i) The condition for a point to be stabilized is $g \wedge (1,0) = (1,0)$, but $g \wedge (1,0) = (a, 0)$ from the definition of the action. For these two conditions to hold, $a = 1$.
Hence the stabilizer of $(1,0)$ is $\left\{\begin{pmatrix} 1 & b \\ 0 & 1 \end{pmatrix} : b \in \mathbb{R}\right\}$

ii) $g \wedge (0,1) = (0,1)$ and this is the condition; it is also the result.
Hence the stabilizer of $(0,1)$ is the whole of G
ie $\mathrm{Stab}(0,1) = \left\{\begin{pmatrix} a & b \\ 0 & 1 \end{pmatrix}\right\} = G$

iii) $g \wedge (1,1) = (1,1)$ (condition)
$g \wedge (1,1) = (a, 1)$ (result)
The condition and result, taken together means that $a = 1$. Hence
$\mathrm{Stab}(1,1) = \left\{\begin{pmatrix} 1 & b \\ 0 & 1 \end{pmatrix} : b \in \mathbb{R}\right\}$.

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