Since $b \neq 0$, b has an inverse b^{-1}.

$$a^2 + b^2 = 0 \quad \Rightarrow \quad \underbrace{a^2 b^{-1} \cdot b^{-1}}_{(ab^{-1})(ab^{-1})} + \underbrace{b \cdot b \cdot b^{-1} \cdot b^{-1}}_{1} = 0$$

So (2) fails with $x = ab^{-1}$.

#6: $i := (0,1)$; then $i \cdot i = (0,1)\cdot(0,1) = (0\cdot 0 - 1\cdot 1,\ 0\cdot 1 + 1\cdot 0) = (-1,0)$

so $i^2 = -1$ (the negative of the mult. identity)

$\mathbb{R}[i]$ is known as $\mathbb{C}$

$(a,0)$ is usually called	a	which makes sense, since all operations with $(*,0)$ work just as in $\mathbb{R}$ (we'll get this more formally later)
$(0,1)$	i	
$(0,b)$	bi	
(a,b)	$a+bi$	

The given rules are just the usual rules for multiplying complex numbers.

$\mathbb{R}[i]$ is a field since $x^2+1 \neq 0$ in $\mathbb{R}$ (see #5, end)

The calc' of the inverse in #5 ~~becomes~~ will look a bit more familiar if you know how to take reciprocals of complex numbers.

#7: One way to do it is to check all eight cases for an element x: ~~in A or~~ $\in A$ or $\notin A$

$\in B$ or $\notin B$

$\in C$ or $\notin C$