Examples of non-homomorphisms

	Non-homomorphism	Cases which 'work'	ϕ(identity) = identity?
1.	$\phi\colon (\mathbb{C}^*, \times) \to (\mathbb{C}, +)$ $z \mapsto z + \mathrm{Re}(z)$	$\phi(z_1 z_2) = \phi(z_1) + \phi(z_2)$ if $z_1 = z_2 = 2$	No
2.	$\phi\colon (\mathbb{C}^*, \times) \to (\mathbb{C}^*, \times)$ $z \mapsto z\mathrm{Re}(z)$	$\phi(z_1 z_2) = \phi(z_1)\phi(z_2)$ if $z_1 = z_2 = 1$	Yes
3.	$\phi\colon (\mathbb{C}^*, \times) \to (\mathbb{C}^*, \times)$ $z \mapsto e^{iz}$	$\phi(z_1 z_2) = \phi(z_1)\phi(z_2)$ if $z_1 = z_2 = 2$	No
4.	$\phi\colon (\mathbb{R}, +) \to (\mathbb{R}, +)$ $x \mapsto \sin(x)$	$\phi(x_1 + x_2) = \phi(x_1) + \phi(x_2)$ if $x_2 = n\pi$	Yes
5.	$\phi\colon (\mathbb{R}, +) \to (\mathbb{R}, +)$ $x \mapsto 2^x$	$\phi(x_1 + x_2) = \phi(x_1) + \phi(x_2)$ if $x_1 = x_2 = 1$	No
6.	$\phi\colon (\mathbb{R}^*, \times) \to (\mathbb{R}^*, \times)$ $x \mapsto 2^x$	$\phi(x_1 x_2) = \phi(x_1)\phi(x_2)$ if $x_1 = x_2 = 2$	No
7.	$\phi\colon (\mathbb{R}^*, \times) \to (\mathbb{R}, +)$ $x \mapsto x$	$\phi(xy) = \phi(x) + \phi(y)$ if $y = \frac{x}{x-1}$ eg $x = y = 2$	No
8.	G a group of matrices under multiplication $\phi\colon G \to G$ $A \mapsto A^2$	$\phi(AB) = \phi(A)\phi(B)$ if A, B commute	Yes
9.	G a group of matrices under addition $\phi\colon G \to (\mathbb{R}, +)$ $A \mapsto \det(A)$	$\phi(A + B) = \phi(A) + \phi(B)$ if $A = B = 0$ or $B = -A$ has an odd number of rows/columns	Yes
10.	$\phi\colon S(\triangle) \to S(\triangle)$ $g \mapsto g^{-1}$	$\phi(g_1 \circ g_2) = \phi(g_1) \circ \phi(g_2)$ if g_1, g_2 commute	Yes