8. All of the following objects are groups. Which of these groups are cyclic groups? Explain each answer.

(a) $\mathbb{Z}_3 \times \mathbb{Z}_3$

Not cyclic

Every element has order 3 or less

(a,b) + (a,b) + (a,b) = (0,0)

(b) $\mathbb{Z}_2 \times \mathbb{Z}_3$

Cyclic

(iii) is a generator

(c) The subgroup $\{e^n \mid n \in \mathbb{Z}\}$ of $(\mathbb{R}^*, \times)$.

cyclic

(e is a generator)

(d) The subgroup $<(1234), (13)(24)>$ of $S_4$.

cyclic

(1234) is a generator. Note $(1234)^2 = (13)(24)$