1. Dummit and Foote Problems 1 and 2 on page 48.

2. How many homomorphisms $\mathbb{Z} \to \mathbb{Z}/3\mathbb{Z}$ are there? How many homomorphisms $\mathbb{Z}/3\mathbb{Z} \to \mathbb{Z}$ are there? Justify your answers briefly.

3. Consider the additive group $\mathbb{Z}^2$, pictured as the lattice points in the Cartesian plane. Draw pictures of the following subgroups of $\mathbb{Z}^2$:
   
   (a) $\langle (2, 1), (0, 1) \rangle$
   (b) $\langle (1, 1), (-1, 1) \rangle$
   (c) $\langle (2, 1), (1, 1) \rangle$

4. Let $(a, b), (c, d) \in \mathbb{Z}^2$. Prove that $\langle (a, b), (c, d) \rangle = \mathbb{Z}^2$ if and only if
   \[
   \det \begin{pmatrix} a & c \\ b & d \end{pmatrix} = \pm 1.
   \]

5. Does $\mathbb{R}$ have any subgroups isomorphic to $\mathbb{Z}^2$? Prove your answer.

6. Does $\mathbb{Q}$ have any subgroups isomorphic to $\mathbb{Z}^2$? Prove your answer.

7. Dummit and Foote problems 2 and 11 on page 60.