Do the following exercises from Judson:
Chapter 4, Section 4.4: 7, 11, 14, 22 (b), (d); 30

Exercises not from the text:

1. Find all generators of the cyclic group $G = \langle g \rangle$ if:

   (a) $|g| = 18$ (b) $|G| = \infty$

2. Let $G = \langle g \rangle$ with $|g| = 24$. List all of the generators for the unique subgroup of G of order 8.

3. In each case determine whether G is cyclic.

   (a) $G = U(12)$ (b) $G = U(11)$

4. Let $|g| = 18$ in a group G. Compute:

   (a) $|g^8|$ (b) $|g^5|$ (c) $|g^3|$

5. In each case find all the subgroups of $G = \langle g \rangle$ and draw the lattice diagram.

   (a) $|g| = p^2$, where p is prime.
   (b) $|g| = p^3$, where p is prime.
   (c) $|g| = pq$, where p and q are distinct primes.
   (d) $|g| = p^2q$, where p and q are distinct primes.

6. Let $|g| = 40$. List all of the elements of $\langle g \rangle$ that have order 10.

7. Prove that $H = \left\{ \begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix} \middle| \, n \in \mathbb{Z} \right\}$ is a cyclic subgroup of $\mathrm{GL}_2(\mathbb{R})$.