

9. Under multiplication modulo 4, 2 does not have an inverse. Under multiplication modulo 5, $\{1, 2, 3, 4\}$ is closed, 1 is the identity, 1 and 4 are their own inverses, and 2 and 3 are inverses of each other. Modulo multiplication is associative.

11. First observe that taking the entries modulo 11

$$\begin{bmatrix} 5 & -6 \\ -3 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 5 \\ 8 & 2 \end{bmatrix}. \text{ Also, modulo 11, the determinant of } \begin{bmatrix} 2 & 6 \\ 3 & 5 \end{bmatrix}$$

is $-8 = 3$. Finally, instead of dividing each entry of $\begin{bmatrix} 5 & 5 \\ 8 & 2 \end{bmatrix}$ by 3 we must multiply each entry by $3^{-1} \pmod{11} = 4$ and reduce modulo 11 to obtain $\begin{bmatrix} 9 & 9 \\ 10 & 8 \end{bmatrix}$.

32.

1	1	5	7	11
1	1	5	7	11
5	5	1	11	7
7	7	11	1	5
11	11	7	5	1

36. Observe that $xabx^{-1} = ba$ is equivalent to $xab = bax$ and this is true for $x = b$.

47. Since $a^2 = b^2 = (ab)^2 = e$, we have $aabb = abab$. Now cancel on left and right.