7. The splitting field of $x^8 - 1$ over $\mathbb{Q}$ is the same as the splitting field of $x^4 + 1$ over $\mathbb{Q}$, so a complete description is contained in Example 54.7. (This is the easiest way to answer the problem.)

9. **a.** ${s_1}^2 - 2s_2$ **b.** $\dfrac{s_1s_2 - 3s_3}{s_3}$

SECTION 55

3. **a.** 16 **b.** 400 **c.** 2160

5. 3^0

7. $\Phi_3(x)$ over $\mathbb{Z}_2$ is $x^2 + x + 1$.
$\Phi_8(x)$ over $\mathbb{Z}_3$ is $x^4 + 1 = (x^2 + x + 2)(x^2 + 2x + 2)$.

9. **a.** T **c.** F **e.** T **g.** T **i.** F

11. $\Phi_1(x) = x - 1$
$\Phi_2(x) = x + 1$
$\Phi_3(x) = x^2 + x + 1$
$\Phi_4(x) = x^2 + 1$
$\Phi_5(x) = x^4 + x^3 + x^2 + x + 1$
$\Phi_6(x) = x^2 - x + 1$

SECTION 56

1. No. Yes, K is an extension of $\mathbb{Z}_2$ by radicals.

3. **a.** T **c.** T **e.** T **g.** T **i.** F ($x^3 - 2x$ over $\mathbb{Q}$ gives a counterexample.)

APPENDIX

1. $\begin{bmatrix} 2 & 1 \\ 2 & 7 \end{bmatrix}$ **3.** $\begin{bmatrix} -3+2i & -1-4i \\ 2 & -i \\ 0 & -i \end{bmatrix}$

5. $\begin{bmatrix} 5 & 16 & -3 \\ 0 & -18 & 24 \end{bmatrix}$ **7.** $\begin{bmatrix} 1 & -i \\ 4-6i & -2-2i \end{bmatrix}$

9. $\begin{bmatrix} 8 & -8i \\ 8i & 8 \end{bmatrix}$ **11.** $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ **13.** -48