Worksheet 23: Primitive roots of unity, field extensions

1. Let $p$ prime. What is the irreducible polynomial of the primitive $p$ th root of unity $\zeta_{p}:=e^{2 \pi i / p}$ over $\mathbb{Q}$ ?
2. What is the irreducible polynomial of $\zeta_{8}$ over $\mathbb{Q}$ ?
3. What is the irreducible polynomial of $\zeta_{8}$ over $\mathbb{Q}\left(\zeta_{3}\right)$ ?
