

**Fall 2021, Math 620: Preliminary Problem Set 11**  
**Due: Thursday, November 4th, 2021**  
**Field Extensions**

**Preliminary problems.** These problems should be completed before discussion on Thursday.

(P1) Completely factor the following polynomials over the specified fields.

(a)  $x^3 - 1$  over  $\mathbb{Q}$  (should have 2 irreducible factors).

(b)  $x^5 + x^4 - x - 1$  over  $\mathbb{Q}$  (should have 4 irreducible factors).

(c)  $x^4 + 3x + 1$  over  $\mathbb{Z}_5$  (should have 2 irreducible factors).