

## Math 6140: Homework 10

1. 14.2: 3, 8, 11, 28, 31

2. Let  $\mathbb{F}_q$  be the finite field with  $q$  elements. Let

$$I_q(d) = \{f(x) \in \mathbb{F}_q[x] \mid f(x) \text{ monic, irreducible, and } \deg(f(x)) = d\}.$$

(a) Show that

$$dI_q(d) = \#\{\alpha \in \mathbb{F}_{q^d} \mid \mathbb{F}_{q^d} = \mathbb{F}_q(\alpha)\}.$$

(b) Show that if  $p$  is any prime number, then

$$I_q(p) = \frac{q^p - q}{p}.$$

(c) Compute a formula for  $I_q(100)$ .

3. 14.3: 5, 7, 17 (you may use 12–16 without proof)