Supplemental Problems on the Rational Roots Theorem and Polynomial Long Division Solutions

1. (a) \((x - 4)x(x + 1)\)
   (b) \((x - 5)(x - 4)(x + 2)\)
   (c) \(-5(x - 1)(x + 1)(x + 2)\)
   (d) \((x - 5)(x - 3)(x - 2)(x + 4)\)
   (e) \(4(x - 5)(x - 4)(x - 3)\)
   (f) \(5(-3 + x)(2 + x)(4 + x)\)

2. \(f(x) = (x + 5)(x^4 + x^3 - 13x^2 - x + 12)\).

3. \(k(y) = (y - 2)(-2y^4 + 8y^3 + 12y^2 - 8y - 10)\).

4. (a) By the Rational Roots Theorem, the possible rational roots of \(h(x)\) are the factors of 3750705 (divided by the factors of 1, but these are still just the factors of 3750705). Since 3750705 is odd, 2 cannot be a factor, and so 2 cannot be a root.
   (b) The Rational Roots Theorem doesn’t say anything about whether \(\sqrt{2}\) is a root of \(h(x)\) because \(\sqrt{2}\) is not rational.