Section 3.1: Quadratic Functions

• Understand the definition of a quadratic function $f(x) = ax^2 + bx + c$. Also understand vertex form: $f(x) = a(x - h)^2 + k$.
• Be able to use completing the square to put a quadratic function into vertex (standard) form.
• Be able to find the vertex and axis of symmetry of the graph of a quadratic function.
• Understand how to find the intercepts of the graph of a quadratic function and be able to graph the function in the xy-plane.
• Be able to solve basic applications using quadratic functions (including identifying whether the vertex is a maximum or minimum).

Section 3.2: Polynomial Functions

• Know how to use the degree of a polynomial and its leading coefficient to determine the end behavior of a polynomial function.
• Understand the definition of a root (or zero) of a polynomial function and be able to find the roots of a polynomial that factors.
• Know the definition of the multiplicity of a zero and how this is relates to the graph of the polynomial function near the related intercept.
• Know the intermediate value theorem and be able to apply it to show that a polynomial must have a zero between two given x-values.
• Understand the definition of a turning point of a polynomial. Also know the connection between the degree of a polynomial and the maximum number of roots and turning points in the graph of the polynomial.
• Be able to combine all these ideas in order to draw an accurate graph of a given polynomial function.

Section 3.3: Dividing Polynomials

• Understand how to carry out long division of polynomials. Also be able to express the remainder as a fraction, and be able to write the original polynomial as a product of polynomials plus the remainder.
• Understand how to carry out synthetic division in order to divide a polynomial by a linear factor.
• Understand the Remainder Theorem and be able to use synthetic division to evaluate a polynomial on a given input.
• Understand the Factor Theorem and be able to use synthetic division to find a linear factor of a polynomial.

Section 3.4, 3.5: The Real Zeros of a Polynomial Function, Complex Zeros

• Understand the Rational Root Theorem and be able to use it to create a list of possible rational factors of a given polynomial.
• Be able to use the Rational Root Theorem and synthetic division to find a zero of a polynomial and factor the original polynomial into a linear factor and a polynomial one degree smaller than the original polynomial.
• Know Descartes Rule of Signs, and be able to use it to help determine the number of positive and negative zeros of a polynomial.
• Understand the statement of the Fundamental Theorem of Algebra.
• Know that complex roots of a polynomial with real coefficients always come in pairs and that a polynomial of odd degree always has at least one real zero.
• Be able to combine the Rational Root Theorem, synthetic division, the Factor Theorem, and the Quadratic Formula to find all of the roots (both real and quadratic) of a polynomial.

Review Problems:
Chapter 3 pp. 385-387 # 2, 5, 8, 12, 13, 16, 21, 22, 24, 27, 28, 30, 31, 34, 35, 37, 38, 41, 42, 45, 49, 52, 53, 54, 56, 60, 61, 86, 91