

Using this Chapter with the Functions and Relations Course and the Functions Course

Functions and Relations (University)	
Students in this course must be prepared for the abstract mathematical concepts of the Geometry and Discrete Mathematics course, namely, inductive and deductive reasoning. To help prepare students for this course and to encourage them to solve complex problems in more than one way, consider the following sections:	
4.2.	Once students have mastered the numerical exercises, display some general optimal value problems, for example, find the dimensions of a rectangle, or a triangle, to be enclosed by P m of fencing so that the area of the rectangle is at a maximum.
4.3	In this section, students learn about the roots of a quadratic equation and evaluate the discriminant to determine the number of roots.
4.4	In preparation for the Discrete Mathematics strand, students in this course might benefit from examining the number of elements in each number set and how these elements might be counted.
4.5	Have students explore graphs of complex numbers in the complex plane (a version of the x - y plane), which will introduce them to graphs of vectors and vector addition, in preparation for the Geometry strand.
4.7	Using a graphing calculator, students explore the behaviour of functions near asymptotes. Students can investigate how close a function can get to an asymptote.
4.8 to 4.12	Students will have opportunities to develop strong skills in algebraic manipulation. The work with rational expressions will provide a sound basis for later work with mathematical induction. In section 4.12, you could introduce factorial notation and have students simplify general factorial expressions in preparation for later combinatorics work.

Functions (University/College)

Although students in the Functions course must learn about complex numbers, they do not need to do the complex number arithmetic in sections 4.5U or 4.10U. However, these students will need to emerge from this course with a sound knowledge of linear, quadratic, and rational functions and their graphs as a basis for further work with graphs, rates of change, and applications in the Advanced Functions and Introductory Calculus course. They will also need to algebraically manipulate equations as well as factor, if they are to be successful in calculating and applying derivatives. Be sure to challenge them with the problems provided throughout the chapter. To help prepare students for this course, consider the following sections:

4.2 For maximum and minimum values of quadratic functions, review first and second differences and how they relate to the shape of the graph and rates of change, using graphing calculators or spreadsheets.

4.3 Ensure that students make the connection between the graph of a function and the number of zeros. Ask students to sketch the graph of a function having three, four, or more zeros. When discussing cases where only one zero exists, introduce the concept of a tangent line. Solve some linear quadratic systems first with graphing software and then algebraically. Also spend time on the solution of quadratic inequalities, in preparation for curve analysis in grade 12.

4.6 and **4.7** Lay more groundwork for later curve analysis and work with derivatives. Allow students time to examine graphs and tables for a variety of reciprocal functions. Asymptotes will be new to students and the graphing calculator exploration in 4.7 is designed to provide insight into the behaviour of functions near asymptotes. It also offers the opportunity to discuss limiting values, in preparation for developing the derivative in grade 12.

4.8 This section provides more opportunities for students to understand asymptotes. Encourage students to graph some of the rational expressions in this section, the ones having only a single variable. If there is time, you might discuss discontinuities. Understanding asymptotes should help students to understand restrictions when dealing with rational expressions.

4.9 and **4.10** Students can polish their factoring skills working through the *Practise, Apply, Solve*, which will help prepare them for new factoring methods in grade 12.

4.11 and **4.12** Learning the algebraic methods in these sections will prepare students for finding and applying derivatives, as well as for analyzing functions and their graphs.