Function Transformations

1

General Outcome

Develop algebraic and graphical reasoning through the study of relations.

Specific Outcomes

RF2 Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations.

RF3 Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.

RF4 Apply translations and stretches to the graphs and equations of functions.

RF5 Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the:

- x-axis
- y-axis
- line $y = x$.

RF6 Demonstrate an understanding of inverses of relations.

By the end of this chapter, students will be able to:

Section	Understanding Concepts, Skills, and Processes
1.1	✓ compare the graphs of a set of functions of the form $y = f(x - h)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effect of h
	✓ compare the graphs of a set of functions of the form $y - k = f(x - h)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effects of h and k
	✓ write the equation of a function whose graph is a vertical and/or horizontal translation of the graph of the function $y = f(x)$
1.2	✓ demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the x-axis and y-axis
	✓ demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations
1.3	✓ sketch the graph of the function $y - k = af(b(x - h))$ for given values of a, b, h, and k, given the graph of the function $y = f(x)$, where the equation of $y = f(x)$ is not given
	✓ write the equation of a function given its graph, which is a translation and/or stretch of the graph of the function $y = f(x)$
1.4	✓ sketch the graph of the inverse relation, given the graph of a relation
	✓ determine if a relation and its inverse are functions
	✓ determine the equation and sketch the graph of the inverse relation, given the equation of a linear or quadratic relation

Assessment	Supporting Learning
Assessment *for* Learning	
Method 1: Use the introduction on page 4 in *Pre-Calculus 12* to activate students' prior knowledge about the skills and processes that will be covered in this chapter. **Method 2:** Have students develop a journal entry to explain what they personally know about transformations, including vertical and horizontal translations, reflections and stretches, and inverses of relations.	• Have students update their list of what they need to work on and keep track of the skills and processes that need attention. • Students who require activation of prerequisite skills may wish to complete **BLM 1–1 Chapter 1 Prerequisite Skills**. This material is on the Teacher CD of this Teacher's Resource and mounted on the www.mcgrawhill.ca/school/learningcentres book site.
Assessment *as* Learning	
As students work on each section in Chapter 1, have them keep track of any problems they are having.	• As students complete each section, have them review the list of items they need to work on and check off any that have been handled. • Encourage students to write definitions for the Key Terms in their own words, including reminder tips that may be helpful for review throughout the chapter. • Encourage students to write examples of their own in their notebook or math portfolio. Students should have an example for each method that is covered in the chapter.
Assessment *for* Learning	
BLM 1–1 Chapter 1 Prerequisite Skills This master provides a review of prerequisite skills needed for the chapter.	• Use the Prerequisite Skills blackline master to provide additional opportunities for students to demonstrate their readiness for the chapter material.

Chapter 1 Planning Chart

Section/ Suggested Timing	Prerequisite Skills	Materials/Technology	Teacher's Resource Blackline Masters	Exercise Guide	Assessment			Web Link
					Assessment *as* Learning	Assessment *for* Learning	Assessment *of* Learning	www.mcgrawhill.ca/school/learningcentres
Chapter Opener • 45–60 min (TR page 7)			BLM 1–1 Chapter 1 Prerequisite Skills BLM U1–1 Unit 1 Project Checklist					• careers of physicists and related educational programs
1.1 Horizontal and Vertical Translations • 60–90 min (TR page 8)	Students should be familiar with • function notation • absolute values • graphing linear and quadratic functions and identifying key characteristics • working with equations, including writing the same equation in different forms and solving	• grid paper • ruler	Master 3 Centimetre Grid Paper BLM 1–2 Section 1.1 Extra Practice	**Essential:** #1–3, 5, 6, 8, 10–12 **Typical:** #5, 7–12, 13 or 14, C1, C2, C4 **Extension/Enrichment:** #15–19, C2–C4	TR pages 10, 12	TR pages 11, 12		• information or videos showing horizontal and vertical translations
1.2 Reflections and Stretches • 90–120 min (TR page 13)	Students should be familiar with • graphing on the coordinate grid • creating tables of values • symmetry, lines of reflection, and rotations	• grid paper • ruler • graphing technology • Mira™	Master 3 Centimetre Grid Paper BLM 1–3 Section 1.2 Extra Practice	**Essential:** #1–6, 8–10 **Typical:** #1–5, 7–13, C1–C5 **Extension/Enrichment:** #12, 13–16, C1–C5	TR pages 15, 18	TR pages 17, 18		• information or videos of reflections and stretches • information and applications for GOCE. Scroll down to see the latest mission results.
1.3 Combining Transformations • 90–120 min (TR page 19)	Students should be familiar with • order of operations • mapping points	• grid paper • ruler	Master 3 Centimetre Grid Paper BLM 1–4 Section 1.3 Extra Practice	**Essential:** #1–7, 9, two of 10–14 **Typical:** #1–12, C1, C3 **Extension/Enrichment:** #15–18, C1–C4	TR pages 21, 24	TR pages 23, 24		• information on combining transformations
1.4 Inverse of a Relation • 60–90 min (TR page 25)	Students should be familiar with • reciprocals and inverses • opposite operations • solving equations	• grid paper • ruler • Mira™	Master 3 Centimetre Grid Paper BLM 1–5 Section 1.4 Extra Practice	**Essential:** #1, 2–8, 10–12 **Typical:** #2–7, 9–11, 13–15, one of 16–18, C1–C4 **Extension/Enrichment:** #15, 19–21, C2–C4	TR pages 27, 30	TR pages 28, 30		
Chapter 1 Review and Practice Test • 60–90 min (TR page 31)		• graphing technology • grid paper • ruler	Master 3 Centimetre Grid Paper BLM 1–2 Section 1.1 Extra Practice BLM 1–3 Section 1.2 Extra Practice BLM 1–4 Section 1.3 Extra Practice BLM 1–5 Section 1.4 Extra Practice BLM 1–6 Chapter 1 Study Guide BLM 1–7 Chapter 1 Test BLM 1–8 Chapter 1 BLM Answers	Have students do at least one question related to any concept, skill, or process that has been giving them trouble. **Chapter 1 Review minimum:** #1, 4–7, 9, 10, 12–17 Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Chapter 1 Practice Test minimum:** #1–12		TR page 32	TR page 32 BLM 1–7 Chapter 1 Test	