

McGraw-Hill Ryerson

Pre-Calculus 12

Student Workbook

AUTHORS

Scott Carlson

B.Ed., B.Sc.

Golden Hills School Division No. 75

Alberta

Barbara Gajdos

B.Ed.

Calgary Catholic School District

Alberta

Andrea Hook

B.Sc., B.Ed.

Ottawa-Carleton District School Board

Ontario

Emily Kalwarowsky

B.Ed., B.Sc.

Northland School Division

Alberta

Antonietta Lenjosek

B.Sc., B.Ed.

Ottawa Catholic School Board

Ontario



Toronto Montréal Boston Burr Ridge, IL Dubuque, IA Madison, WI New York
San Francisco St. Louis Bangkok Bogotá Caracas Kuala Lumpur Lisbon London
Madrid Mexico City Milan New Delhi Santiago Seoul Singapore Sydney Taipei

**COPIES OF THIS BOOK
MAY BE OBTAINED BY
CONTACTING:**

McGraw-Hill Ryerson Ltd.

WEB SITE:

<http://www.mcgrawhill.ca>

E-MAIL:

orders@mcgrawhill.ca

TOLL-FREE FAX:

1-800-463-5885

TOLL-FREE CALL:

1-800-565-5758

**OR BY MAILING YOUR
ORDER TO:**

McGraw-Hill Ryerson
Order Department
300 Water Street
Whitby, ON L1N 9B6

Please quote the ISBN and
title when placing your order.

The **McGraw-Hill** Companies



**McGraw-Hill Ryerson
Pre-Calculus 12 Student Workbook**

Copyright © 2012, McGraw-Hill Ryerson Limited, a Subsidiary of The McGraw-Hill Companies. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of McGraw-Hill Ryerson Limited, or, in the case of photocopying or other reprographic copying, a licence from the Canadian Copyright Licensing Agency (Access Copyright). For an Access Copyright licence, visit www.accesscopyright.ca or call toll-free to 1-800-893-5777.

Any request for photocopying, recording, or taping of this publication shall be directed in writing to Access Copyright.

ISBN-978-0-07-073891-1

ISBN-0-07-073891-2

<http://www.mcgrawhill.ca>

1 2 3 4 5 6 7 8 9 10 MP 10 9 8 7 6 5 4 3 2 1

Printed and bound in Canada

Care has been taken to trace ownership of copyright material contained in this text. The publishers will gladly accept any information that will enable them to rectify any reference or credit in subsequent printings.

TI-84™ and TI-Nspire™ are registered trademarks of Texas Instruments.

PUBLISHER: Jean Ford

PROJECT MANAGER: Janice Dyer

DEVELOPMENTAL EDITORS: Kelly Cochrane, Jackie Lacoursiere, Susan Lishman,
Paul McNulty

MANAGER, EDITORIAL SERVICES: Crystal Shortt

SUPERVISING EDITOR: Jaime Smith

COPY EDITOR: Linda Jenkins, Red Pen Services

ANSWER CHECKER: Daniela Spiroska

EDITORIAL ASSISTANT: Erin Hartley

MANAGER, PRODUCTION SERVICES: Yolanda Pigden

PRODUCTION COORDINATOR: Scott Morrison

COVER DESIGN: Michelle Losier

ELECTRONIC PAGE MAKE-UP: APTARA

COVER IMAGE: © Bill Frymire/Masterfile

Acknowledgements

The publishers, authors, and editors of *McGraw-Hill Ryerson Pre-Calculus 12 Student Workbook* wish to extend their sincere thanks to the reviewers who contributed their time, energy, and expertise to the creation of this workbook. We are grateful for their thoughtful comments and suggestions.

John Agnew
University of Victoria
British Columbia

Steven Daniel
Department of Education,
Culture and Employment
Northwest Territories

Jessika Girard
Conseil Scolaire Francophone
No. 93
British Columbia

Karen Bedard
School District No. 22 (Vernon)
British Columbia

Ashley Dupont
St. Maurice School (Independent)
Manitoba

Marge Hallonquist
Elk Island Catholic Schools
Alberta

Lindsay Collins
South East Cornerstone School
Division No. 209
Saskatchewan

Janet Fedorvich
Alexis Nakota Sioux Nation
School (Independent)
Alberta

Jeni Halowski
Lethbridge School District No. 51
Alberta

Julie Cordova
St. James-Assiniboia School
Division
Manitoba

Carol Funk
School District No. 68 (Nanaimo/
Ladysmith)
British Columbia

Jason Harbor
North East School Division
No. 200
Saskatchewan

Contents

Chapter 1 Function Transformations.....	1
1.1 Horizontal and Vertical Translations.....	1
1.2 Reflections and Stretches.....	9
1.3 Combining Transformations	18
1.4 Inverse of a Relation	26
Chapter 1 Review.....	35
Chapter 1 Skills Organizer	38
Chapter 2 Radical Functions.....	39
2.1 Radical Functions and Transformations.....	39
2.2 Square Root of a Function.....	47
2.3 Solving Radical Equations Graphically	55
Chapter 2 Review.....	63
Chapter 2 Skills Organizer	65
Chapter 3 Polynomial Functions	66
3.1 Characteristics of Polynomial Functions....	66
3.2 The Remainder Theorem.....	78
3.3 The Factor Theorem	84
3.4 Equations and Graphs of Polynomial Functions	91
Chapter 3 Review.....	103
Chapter 3 Skills Organizer	108
Chapter 4 Trigonometry and the Unit Circle	109
4.1 Angles and Angle Measure.....	109
4.2 The Unit Circle	120
4.3 Trigonometric Ratios.....	129
4.4 Introduction to Trigonometric Equations..	138
Chapter 4 Review.....	145
Chapter 4 Skills Organizer	148
Chapter 5 Trigonometric Functions and Graphs.....	149
5.1 Graphing Sine and Cosine Functions.....	149
5.2 Transformations of Sinusoidal Functions	158
5.3 The Tangent Function.....	167
5.4 Equations and Graphs of Trigonometric Functions	175
Chapter 5 Review.....	183
Chapter 5 Skills Organizer	187
Chapter 6 Trigonometric Identities	188
6.1 Reciprocal, Quotient, and Pythagorean Identities.....	188
6.2 Sum, Difference, and Double-Angle Identities.....	197
6.3 Proving Identities	205
6.4 Solving Trigonometric Equations Using Identities	215
Chapter 6 Review	224
Chapter 6 Skills Organizer	228
Chapter 7 Exponential Functions.....	229
7.1 Characteristics of Exponential Functions	229
7.2 Transformations of Exponential Functions	238
7.3 Solving Exponential Equations	249
Chapter 7 Review	256
Chapter 7 Skills Organizer	259
Chapter 8 Logarithmic Functions.....	260
8.1 Understanding Logarithms	260
8.2 Transformations of Logarithmic Functions	267
8.3 Laws of Logarithms	275
8.4 Logarithmic and Exponential Equations	282
Chapter 8 Review.....	292
Chapter 8 Skills Organizer	296
Chapter 9 Rational Functions	297
9.1 Exploring Rational Functions Using Transformations.....	297
9.2 Analysing Rational Functions.....	305
9.3 Connecting Graphs and Rational Equations	314
Chapter 9 Review.....	321
Chapter 9 Skills Organizer	324
Chapter 10 Function Operations	325
10.1 Sums and Differences of Functions.....	325
10.2 Products and Quotients of Functions	335
10.3 Composite Functions	345
Chapter 10 Review	356
Chapter 10 Skills Organizer	363
Chapter 11 Permutations, Combinations, and the Binomial Theorem	364
11.1 Permutations	364
11.2 Combinations.....	374
11.3 The Binomial Theorem.....	383
Chapter 11 Review.....	390
Chapter 11 Skills Organizer	393
Answers.....	394

Overview

This McGraw-Hill Ryerson Pre-Calculus 12 Student Workbook is designed to complement the student resource.

Student Workbook Features for Students

- Each section begins with Key Ideas that summarize the concepts needed to complete the exercises.
- The sections continue with working examples that guide you through the skills needed to complete the exercises.
- The working examples often include references to the *Pre-Calculus 12* student resource. These references suggest that you compare the methods used to solve the examples, or review similar examples to help consolidate your understanding of the concepts.
- Exercises are organized into three sections: Practise, Apply, and Connect.
- A selection of questions in the exercise sections include references to similar questions in the *Pre-Calculus 12* student resource.
- A review of all sections is included at the end of each chapter.
- Each chapter includes a Skills Organizer that assists you in summarizing the important information in that chapter.
- Answers to all questions are provided at the back of the book.
- To access Study Checks for each chapter, which will help you identify what skills and concepts you need to reinforce, go to www.mhrprecalc12.ca and follow the links to the Student Workbook.

Student Workbook Features for Teachers

- For SMART Board™ lessons related to each topic, go to www.mhrprecalc12.ca and follow the links to the Student Workbook.

