

ALGEBRA & TRIG

10E

with
CalcChat[®] and **CalcView[®]**

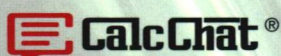
Ron Larson



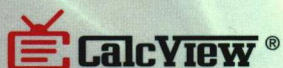
100% FREE

Internet Resources at *LarsonPrecalculus.com*

- **Videos** explaining the concepts of precalculus
- **Worked-Out Solution Videos** for all *Checkpoint* problems
- **Diagnostic Test** with grading to determine course readiness
- **Editable Spreadsheets** of the data sets in the text
- **Projects** for each chapter applying the concepts from the text



CalcChat.com offers you the solutions to the odd-numbered exercises from the text. When the solutions are not enough, you can chat with an online tutor for live help. Visit the website for the tutors' availability.



CalcView.com presents video solutions of selected exercises from the text. Watch precalculus instructors progress step-by-step through solutions, providing guidance to help you solve the selected exercise and others like it. Access the videos directly by scanning QR Codes®, or watch the videos at *CalcView.com*.



Ron Larson

ALGEBRA & TRIG

10E

ALGEBRA & TRIG

with **10E**
CalcChat[®] and CalcView[®]

Ron Larson

The Pennsylvania State University
The Behrend College

With the assistance of David C. Falvo

The Pennsylvania State University
The Behrend College



Algebra and Trig
with CalcChat and CalcView
Tenth Edition

Ron Larson

Product Director: Terry Boyle
Product Manager: Gary Whalen
Content Developer: Stacy Green
Associate Content Developer: Samantha Lugtu
Product Assistant: Katharine Werring
Media Developer: Lynh Pham
Marketing Manager: Ryan Ahern
Content Project Manager: Jennifer Risden
Manufacturing Planner: Doug Bertke
Production Service: Larson Texts, Inc.
Photo Researcher: Lumina Datamatics
Text Researcher: Lumina Datamatics
Illustrator: Larson Texts, Inc.
Text Designer: Larson Texts, Inc.
Cover Designer: Larson Texts, Inc.
Front Cover Image: betibup33/Shutterstock.com
Back Cover Image: Dragonfly22/Shutterstock.com
Compositor: Larson Texts, Inc.

© 2018, 2014 Cengage Learning

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced or distributed in any form or by any means, except as permitted by U.S. copyright law, without the prior written permission of the copyright owner.

For product information and technology assistance, contact us at
Cengage Learning Customer & Sales Support, 1-800-354-9706.

For permission to use material from this text or product,
submit all requests online at **www.cengage.com/permissions**.

Further permissions questions can be emailed to
permissionrequest@cengage.com.

Library of Congress Control Number: 2016944976

Student Edition:

ISBN: 978-1-337-27117-2

Loose-leaf Edition:

ISBN: 978-1-337-29153-8

Cengage Learning

20 Channel Center Street
Boston, MA 02210
USA

Cengage Learning is a leading provider of customized learning solutions with employees residing in nearly 40 different countries and sales in more than 125 countries around the world. Find your local representative at **www.cengage.com**.

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

To learn more about Cengage Learning Solutions, visit **www.cengage.com**.

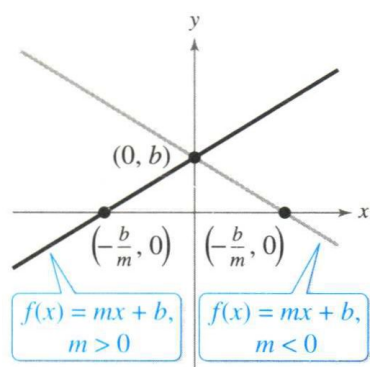
Purchase any of our products at your local college store or at our preferred online store **www.cengagebrain.com**.

QR Code is a registered trademark of Denso Wave Incorporated

GRAPHS OF PARENT FUNCTIONS

Linear Function

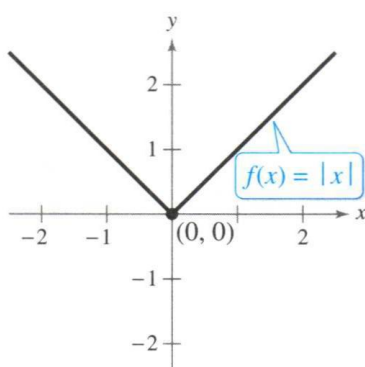
$$f(x) = mx + b$$



Domain: $(-\infty, \infty)$
 Range ($m \neq 0$): $(-\infty, \infty)$
 x-intercept: $(-b/m, 0)$
 y-intercept: $(0, b)$
 Increasing when $m > 0$
 Decreasing when $m < 0$

Absolute Value Function

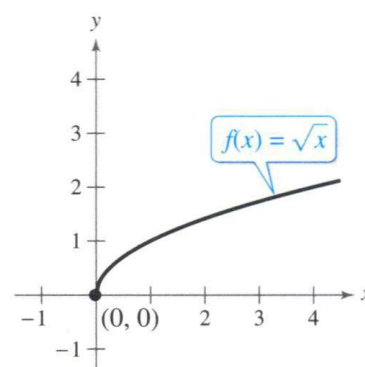
$$f(x) = |x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$



Domain: $(-\infty, \infty)$
 Range: $[0, \infty)$
 Intercept: $(0, 0)$
 Decreasing on $(-\infty, 0)$
 Increasing on $(0, \infty)$
 Even function
 y-axis symmetry

Square Root Function

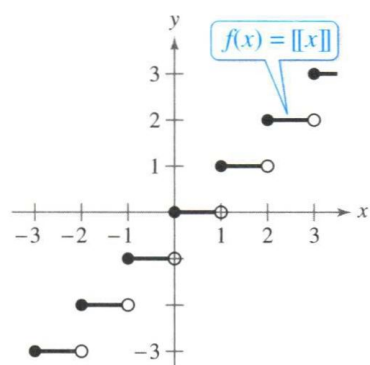
$$f(x) = \sqrt{x}$$



Domain: $[0, \infty)$
 Range: $[0, \infty)$
 Intercept: $(0, 0)$
 Increasing on $(0, \infty)$

Greatest Integer Function

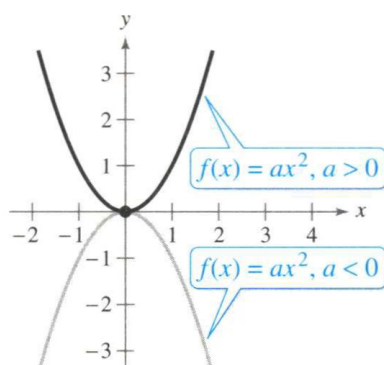
$$f(x) = \llbracket x \rrbracket$$



Domain: $(-\infty, \infty)$
 Range: the set of integers
 x-intercepts: in the interval $[0, 1)$
 y-intercept: $(0, 0)$
 Constant between each pair of consecutive integers
 Jumps vertically one unit at each integer value

Quadratic (Squaring) Function

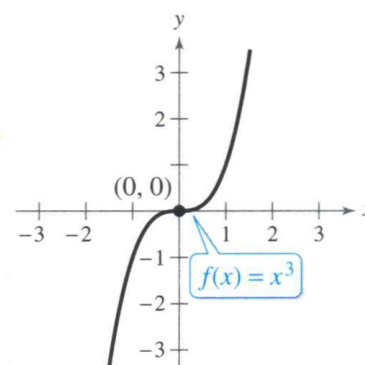
$$f(x) = ax^2$$



Domain: $(-\infty, \infty)$
 Range ($a > 0$): $[0, \infty)$
 Range ($a < 0$): $(-\infty, 0]$
 Intercept: $(0, 0)$
 Decreasing on $(-\infty, 0)$ for $a > 0$
 Increasing on $(0, \infty)$ for $a > 0$
 Increasing on $(-\infty, 0)$ for $a < 0$
 Decreasing on $(0, \infty)$ for $a < 0$
 Even function
 y-axis symmetry
 Relative minimum ($a > 0$),
 relative maximum ($a < 0$),
 or vertex: $(0, 0)$

Cubic Function

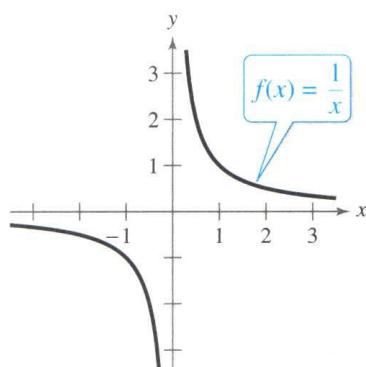
$$f(x) = x^3$$



Domain: $(-\infty, \infty)$
 Range: $(-\infty, \infty)$
 Intercept: $(0, 0)$
 Increasing on $(-\infty, \infty)$
 Odd function
 Origin symmetry

Rational (Reciprocal) Function

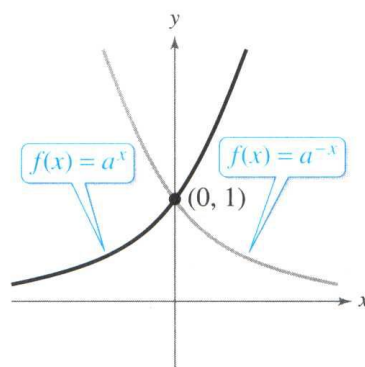
$$f(x) = \frac{1}{x}$$



Domain: $(-\infty, 0) \cup (0, \infty)$
 Range: $(-\infty, 0) \cup (0, \infty)$
 No intercepts
 Decreasing on $(-\infty, 0)$ and $(0, \infty)$
 Odd function
 Origin symmetry
 Vertical asymptote: y -axis
 Horizontal asymptote: x -axis

Exponential Function

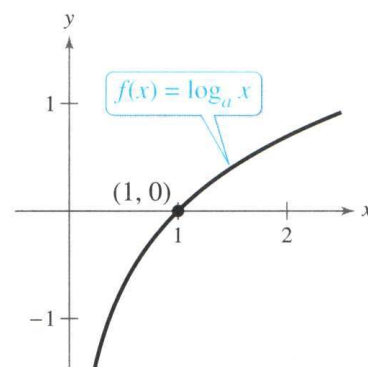
$$f(x) = a^x, a > 1$$



Domain: $(-\infty, \infty)$
 Range: $(0, \infty)$
 Intercept: $(0, 1)$
 Increasing on $(-\infty, \infty)$
 for $f(x) = a^x$
 Decreasing on $(-\infty, \infty)$
 for $f(x) = a^{-x}$
 Horizontal asymptote: x -axis
 Continuous

Logarithmic Function

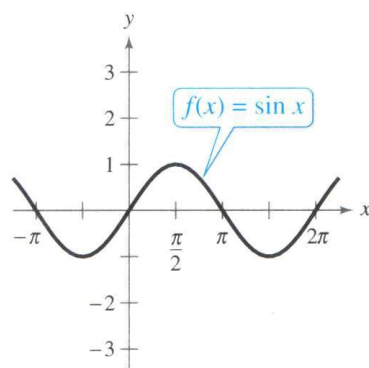
$$f(x) = \log_a x, a > 1$$



Domain: $(0, \infty)$
 Range: $(-\infty, \infty)$
 Intercept: $(1, 0)$
 Increasing on $(0, \infty)$
 Vertical asymptote: y -axis
 Continuous
 Reflection of graph of $f(x) = a^x$
 in the line $y = x$

Sine Function

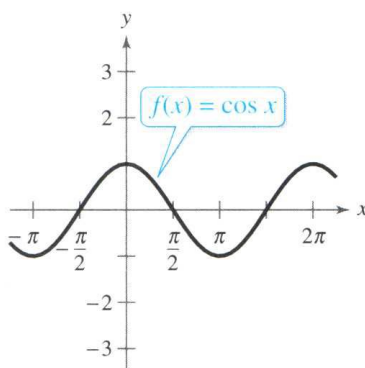
$$f(x) = \sin x$$



Domain: $(-\infty, \infty)$
 Range: $[-1, 1]$
 Period: 2π
 x -intercepts: $(n\pi, 0)$
 y -intercept: $(0, 0)$
 Odd function
 Origin symmetry

Cosine Function

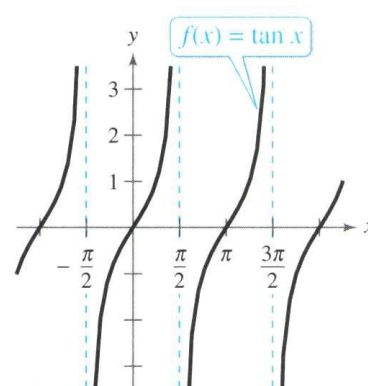
$$f(x) = \cos x$$



Domain: $(-\infty, \infty)$
 Range: $[-1, 1]$
 Period: 2π
 x -intercepts: $(\frac{\pi}{2} + n\pi, 0)$
 y -intercept: $(0, 1)$
 Even function
 y -axis symmetry

Tangent Function

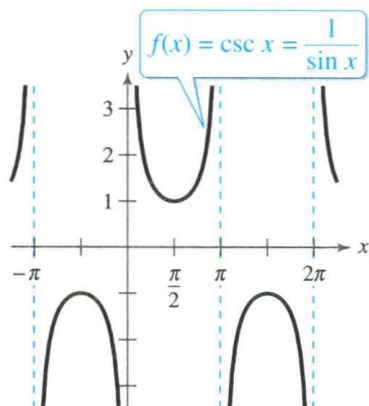
$$f(x) = \tan x$$



Domain: all $x \neq \frac{\pi}{2} + n\pi$
 Range: $(-\infty, \infty)$
 Period: π
 x -intercepts: $(n\pi, 0)$
 y -intercept: $(0, 0)$
 Vertical asymptotes:
 $x = \frac{\pi}{2} + n\pi$
 Odd function
 Origin symmetry

Cosecant Function

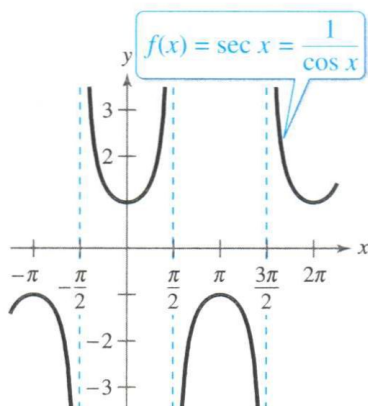
$$f(x) = \csc x$$



Domain: all $x \neq n\pi$
 Range: $(-\infty, -1] \cup [1, \infty)$
 Period: 2π
 No intercepts
 Vertical asymptotes: $x = n\pi$
 Odd function
 Origin symmetry

Secant Function

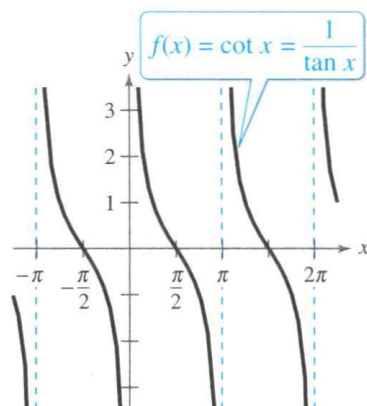
$$f(x) = \sec x$$



Domain: all $x \neq \frac{\pi}{2} + n\pi$
 Range: $(-\infty, -1] \cup [1, \infty)$
 Period: 2π
 y-intercept: $(0, 1)$
 Vertical asymptotes:
 $x = \frac{\pi}{2} + n\pi$
 Even function
 y-axis symmetry

Cotangent Function

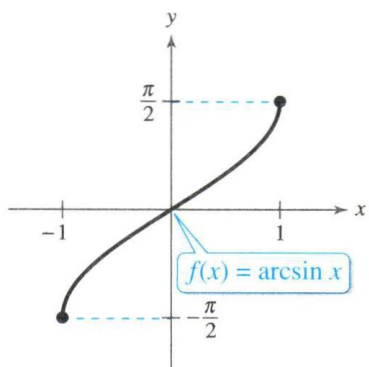
$$f(x) = \cot x$$



Domain: all $x \neq n\pi$
 Range: $(-\infty, \infty)$
 Period: π
 x-intercepts: $(\frac{\pi}{2} + n\pi, 0)$
 Vertical asymptotes: $x = n\pi$
 Odd function
 Origin symmetry

Inverse Sine Function

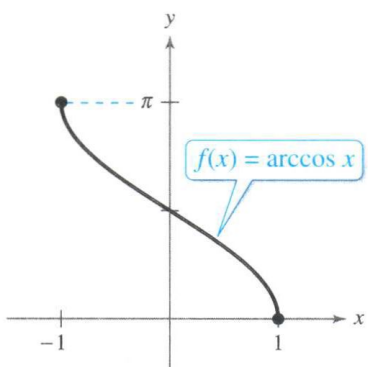
$$f(x) = \arcsin x$$



Domain: $[-1, 1]$
 Range: $[-\frac{\pi}{2}, \frac{\pi}{2}]$
 Intercept: $(0, 0)$
 Odd function
 Origin symmetry

Inverse Cosine Function

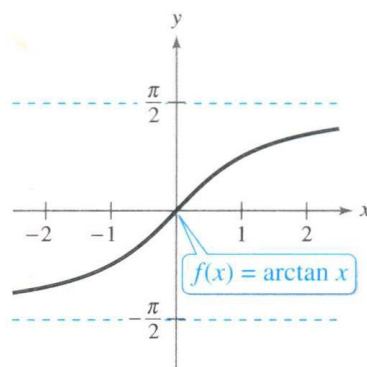
$$f(x) = \arccos x$$



Domain: $[-1, 1]$
 Range: $[0, \pi]$
 y-intercept: $(0, \frac{\pi}{2})$

Inverse Tangent Function

$$f(x) = \arctan x$$



Domain: $(-\infty, \infty)$
 Range: $(-\frac{\pi}{2}, \frac{\pi}{2})$
 Intercept: $(0, 0)$
 Horizontal asymptotes:
 $y = \pm\frac{\pi}{2}$
 Odd function
 Origin symmetry

Preface

Welcome to *Algebra & Trig*, Tenth Edition. We are excited to offer you a new edition with even more resources that will help you understand and master algebra and trigonometry. This textbook includes features and resources that continue to make *Algebra & Trig* a valuable learning tool for students and a trustworthy teaching tool for instructors.


Algebra & Trig provides the clear instruction, precise mathematics, and thorough coverage that you expect for your course. Additionally, this new edition provides you with **free** access to three companion websites:

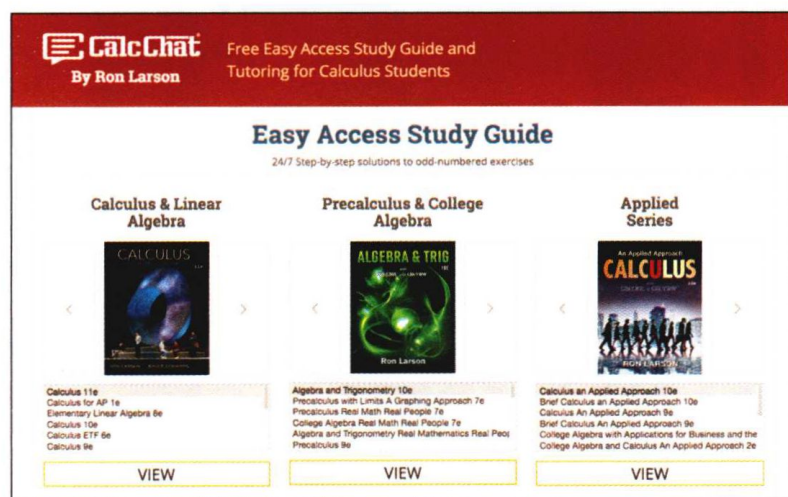
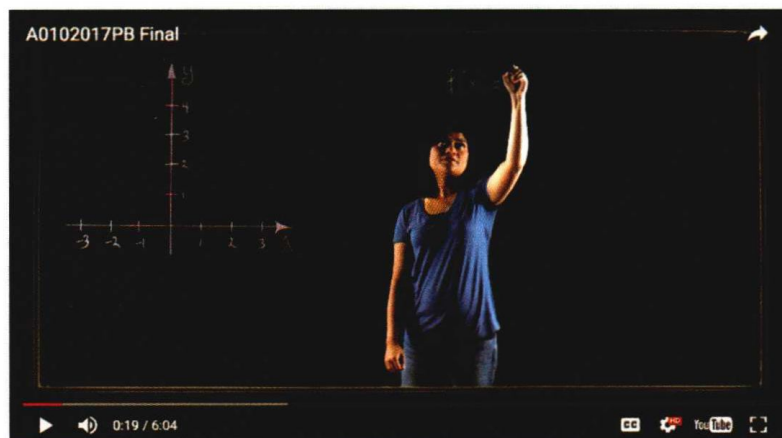
- **CalcView.com**—video solutions to selected exercises
- **CalcChat.com**—worked-out solutions to odd-numbered exercises and access to online tutors
- **LarsonPrecalculus.com**—companion website with resources to supplement your learning

These websites will help enhance and reinforce your understanding of the material presented in this text and prepare you for future mathematics courses. CalcView® and CalcChat® are also available as free mobile apps.

Features

NEW CalcView®

The website *CalcView.com* contains video solutions of selected exercises. Watch instructors progress step-by-step through solutions, providing guidance to help you solve the exercises. The CalcView mobile app is available for free at the Apple® App Store® or Google Play™ store. The app features an embedded QR Code® reader that can be used to scan the on-page codes  and go directly to the videos. You can also access the videos at *CalcView.com*.



UPDATED CalcChat®

In each exercise set, be sure to notice the reference to *CalcChat.com*. This website provides free step-by-step solutions to all odd-numbered exercises in many of our textbooks. Additionally, you can chat with a tutor, at no charge, during the hours posted at the site. For over 14 years, thousands of students have visited this site for help. The CalcChat mobile app is also available as a free download at the Apple® App Store® or Google Play™ store and features an embedded QR Code® reader.

REVISED **LarsonPrecalculus.com**

All companion website features have been updated based on this revision, plus we have added a new Collaborative Project feature. Access to these features is free. You can view and listen to worked-out solutions of Checkpoint problems in English or Spanish, explore examples, download data sets, watch lesson videos, and much more.

NEW **Collaborative Project**

You can find these extended group projects at *LarsonPrecalculus.com*. Check your understanding of the chapter concepts by solving in-depth, real-life problems. These collaborative projects provide an interesting and engaging way for you and other students to work together and investigate ideas.

**REVISED** **Exercise Sets**

The exercise sets have been carefully and extensively examined to ensure they are rigorous and relevant, and include topics our users have suggested. The exercises have been reorganized and titled so you can better see the connections between examples and exercises. Multi-step, real-life exercises reinforce problem-solving skills and mastery of concepts by giving you the opportunity to apply the concepts in real-life situations. Error Analysis exercises have been added throughout the text to help you identify common mistakes.

Table of Contents Changes

Based on market research and feedback from users, Section 8.5, The Complex Plane, has been added. In addition, examples on finding the magnitude of a scalar multiple (Section 8.3), multiplying in the complex plane (Section 8.6), using matrices to transform vectors (Section 10.2), and further applications of 2×2 matrices (Section 10.5) have been added.

Chapter Opener

Each Chapter Opener highlights real-life applications used in the examples and exercises.

Section Objectives

A bulleted list of learning objectives provides you the opportunity to preview what will be presented in the upcoming section.

Side-By-Side Examples

Throughout the text, we present solutions to many examples from multiple perspectives—algebraically, graphically, and numerically. The side-by-side format of this pedagogical feature helps you to see that a problem can be solved in more than one way and to see that different methods yield the same result. The side-by-side format also addresses many different learning styles.

Remarks

These hints and tips reinforce or expand upon concepts, help you learn how to study mathematics, caution you about common errors, address special cases, or show alternative or additional steps to a solution of an example.

EXAMPLE 6 Finding the Domain of a Composite Function

Find the domain of $f \circ g$ for the functions

$$f(x) = x^2 - 9 \quad \text{and} \quad g(x) = \sqrt{9 - x^2}.$$

Algebraic Solution

Find the composition of the functions.

$$\begin{aligned} (f \circ g)(x) &= f(g(x)) \\ &= f(\sqrt{9 - x^2}) \\ &= (\sqrt{9 - x^2})^2 - 9 \\ &= 9 - x^2 - 9 \\ &= -x^2 \end{aligned}$$

The domain of $f \circ g$ is restricted to the x -values in the domain of g for which $g(x)$ is in the domain of f . The domain of $f(x) = x^2 - 9$ is the set of all real numbers, which includes all real values of g . So, the domain of $f \circ g$ is the entire domain of $g(x) = \sqrt{9 - x^2}$, which is $[-3, 3]$.

Graphical Solution

Use a graphing utility to graph $f \circ g$.

From the graph, you can determine that the domain of $f \circ g$ is $[-3, 3]$.

Checkpoint Audio-video solution in English & Spanish at LarsonPrecalculus.com

Find the domain of $f \circ g$ for the functions $f(x) = \sqrt{x}$ and $g(x) = x^2 + 4$.

Checkpoints

Accompanying every example, the Checkpoint problems encourage immediate practice and check your understanding of the concepts presented in the example. View and listen to worked-out solutions of the Checkpoint problems in English or Spanish at *LarsonPrecalculus.com*.


Technology

The technology feature gives suggestions for effectively using tools such as calculators, graphing utilities, and spreadsheet programs to help deepen your understanding of concepts, ease lengthy calculations, and provide alternate solution methods for verifying answers obtained by hand.

Historical Notes

These notes provide helpful information regarding famous mathematicians and their work.

Algebra of Calculus


Throughout the text, special emphasis is given to the algebraic techniques used in calculus. Algebra of Calculus examples and exercises are integrated throughout the text and are identified by the symbol .

Summarize

The Summarize feature at the end of each section helps you organize the lesson's key concepts into a concise summary, providing you with a valuable study tool.

Vocabulary Exercises

The vocabulary exercises appear at the beginning of the exercise set for each section. These problems help you review previously learned vocabulary terms that you will use in solving the section exercises.

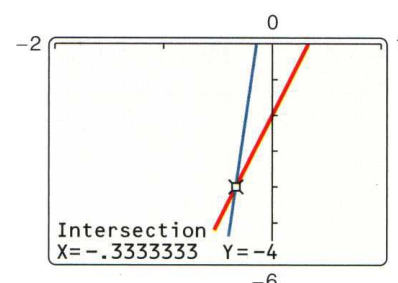
 **TECHNOLOGY** You can use a graphing utility to check that a solution is reasonable. One way is to graph the left side of the equation, then graph the right side of the equation, and determine the point of intersection. For instance, in Example 2, if you graph the equations


$$y_1 = 6(x - 1) + 4 \quad \text{The left side}$$

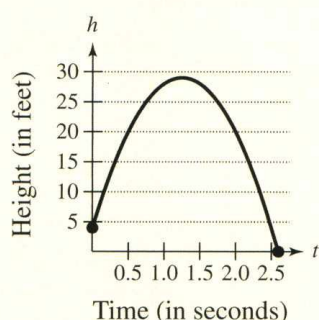
and

$$y_2 = 3(7x + 1) \quad \text{The right side}$$

in the same viewing window, they intersect at $x = -\frac{1}{3}$, as shown in the graph below.



-  **92. HOW DO YOU SEE IT?** The graph represents the height h of a projectile after t seconds.



- Explain why h is a function of t .
- Approximate the height of the projectile after 0.5 second and after 1.25 seconds.
- Approximate the domain of h .
- Is t a function of h ? Explain.

How Do You See It?

The How Do You See It? feature in each section presents a real-life exercise that you will solve by visual inspection using the concepts learned in the lesson. This exercise is excellent for classroom discussion or test preparation.

Project

The projects at the end of selected sections involve in-depth applied exercises in which you will work with large, real-life data sets, often creating or analyzing models. These projects are offered online at *LarsonPrecalculus.com*.

Chapter Summary

The Chapter Summary includes explanations and examples of the objectives taught in each chapter.

Acknowledgments

I would like to thank the many people who have helped me prepare the text and the supplements package. Their encouragement, criticisms, and suggestions have been invaluable.

Thank you to all of the instructors who took the time to review the changes in this edition and to provide suggestions for improving it. Without your help, this book would not be possible.

Reviewers of the Tenth Edition

Gurdial Arora, *Xavier University of Louisiana*
Russell C. Chappell, *Twinsburg High School, Ohio*
Darlene Martin, *Lawson State Community College*
John Fellers, *North Allegheny School District*
Professor Steven Sikes, *Collin College*
Ann Slate, *Surry Community College*
John Elias, *Glenda Dawson High School*
Kathy Wood, *Lansing Catholic High School*
Darin Bauguess, *Surry Community College*
Brianna Kurtz, *Daytona State College*

Reviewers of the Previous Editions

Timothy Andrew Brown, *South Georgia College*; Blair E. Caboot, *Keystone College*; Shannon Cornell, *Amarillo College*; Gayla Dance, *Millsaps College*; Paul Finster, *El Paso Community College*; Paul A. Flasch, *Pima Community College West Campus*; Vadas Gintautas, *Chatham University*; Lorraine A. Hughes, *Mississippi State University*; Shu-Jen Huang, *University of Florida*; Renyetta Johnson, *East Mississippi Community College*; George Keihany, *Fort Valley State University*; Mulatu Lemma, *Savannah State University*; William Mays Jr., *Salem Community College*; Marcella Melby, *University of Minnesota*; Jonathan Prewett, *University of Wyoming*; Denise Reid, *Valdosta State University*; David L. Sonnier, *Lyon College*; David H. Tseng, *Miami Dade College—Kendall Campus*; Kimberly Walters, *Mississippi State University*; Richard Weil, *Brown College*; Solomon Willis, *Cleveland Community College*; Bradley R. Young, *Darton College*

My thanks to Robert Hostetler, The Behrend College, The Pennsylvania State University, and David Heyd, The Behrend College, The Pennsylvania State University, for their significant contributions to previous editions of this text.

I would also like to thank the staff at Larson Texts, Inc. who assisted with proofreading the manuscript, preparing and proofreading the art package, and checking and typesetting the supplements.

On a personal level, I am grateful to my spouse, Deanna Gilbert Larson, for her love, patience, and support. Also, a special thanks goes to R. Scott O'Neil. If you have suggestions for improving this text, please feel free to write to me. Over the past two decades, I have received many useful comments from both instructors and students, and I value these comments very highly.

Ron Larson, Ph.D.
Professor of Mathematics
Penn State University
www.RonLarson.com

ALGEBRA & TRIG

with

10E

CalcChat[®] and CalcView[®]

Contents

P	▷ Prerequisites	1
P.1	Review of Real Numbers and Their Properties	2
P.2	Exponents and Radicals	14
P.3	Polynomials and Special Products	26
P.4	Factoring Polynomials	34
P.5	Rational Expressions	41
P.6	The Rectangular Coordinate System and Graphs	51
	Chapter Summary	60
	Review Exercises	62
	Chapter Test	65
	Proofs in Mathematics	66
	P.S. Problem Solving	67
1	▷ Equations, Inequalities, and Mathematical Modeling	69
1.1	Graphs of Equations	70
1.2	Linear Equations in One Variable	81
1.3	Modeling with Linear Equations	90
1.4	Quadratic Equations and Applications	100
1.5	Complex Numbers	114
1.6	Other Types of Equations	121
1.7	Linear Inequalities in One Variable	131
1.8	Other Types of Inequalities	140
	Chapter Summary	150
	Review Exercises	152
	Chapter Test	155
	Proofs in Mathematics	156
	P.S. Problem Solving	157
2	▷ Functions and Their Graphs	159
2.1	Linear Equations in Two Variables	160
2.2	Functions	173
2.3	Analyzing Graphs of Functions	187
2.4	A Library of Parent Functions	198
2.5	Transformations of Functions	205
2.6	Combinations of Functions: Composite Functions	214
2.7	Inverse Functions	222
	Chapter Summary	231
	Review Exercises	233
	Chapter Test	235
	Cumulative Test for Chapters P–2	236
	Proofs in Mathematics	238
	P.S. Problem Solving	239

3	▷ Polynomial Functions	241
3.1	Quadratic Functions and Models	242
3.2	Polynomial Functions of Higher Degree	251
3.3	Polynomial and Synthetic Division	264
3.4	Zeros of Polynomial Functions	273
3.5	Mathematical Modeling and Variation	287
	Chapter Summary	298
	Review Exercises	300
	Chapter Test	304
	Proofs in Mathematics	305
	P.S. Problem Solving	307
4	▷ Rational Functions and Conics	309
4.1	Rational Functions and Asymptotes	310
4.2	Graphs of Rational Functions	318
4.3	Conics	327
4.4	Translations of Conics	341
	Chapter Summary	350
	Review Exercises	352
	Chapter Test	355
	Proofs in Mathematics	356
	P.S. Problem Solving	357
5	▷ Exponential and Logarithmic Functions	359
5.1	Exponential Functions and Their Graphs	360
5.2	Logarithmic Functions and Their Graphs	371
5.3	Properties of Logarithms	381
5.4	Exponential and Logarithmic Equations	388
5.5	Exponential and Logarithmic Models	398
	Chapter Summary	410
	Review Exercises	412
	Chapter Test	415
	Cumulative Test for Chapters 3–5	416
	Proofs in Mathematics	418
	P.S. Problem Solving	419
6	▷ Trigonometry	421
6.1	Angles and Their Measure	422
6.2	Right Triangle Trigonometry	434
6.3	Trigonometric Functions of Any Angle	445
6.4	Graphs of Sine and Cosine Functions	457
6.5	Graphs of Other Trigonometric Functions	468
6.6	Inverse Trigonometric Functions	478
6.7	Applications and Models	488
	Chapter Summary	498
	Review Exercises	500
	Chapter Test	503
	Proofs in Mathematics	504
	P.S. Problem Solving	505

7 ▷ Analytic Trigonometry **507**

- 7.1 Using Fundamental Identities 508
- 7.2 Verifying Trigonometric Identities 515
- 7.3 Solving Trigonometric Equations 522
- 7.4 Sum and Difference Formulas 534
- 7.5 Multiple-Angle and Product-to-Sum Formulas 541
- Chapter Summary** 550
- Review Exercises** 552
- Chapter Test** 554
- Proofs in Mathematics** 555
- P.S. Problem Solving** 557

8 ▷ Additional Topics in Trigonometry **559**

- 8.1 Law of Sines 560
- 8.2 Law of Cosines 569
- 8.3 Vectors in the Plane 576
- 8.4 Vectors and Dot Products 589
- 8.5 The Complex Plane 598
- 8.6 Trigonometric Form of a Complex Number 605
- Chapter Summary** 614
- Review Exercises** 616
- Chapter Test** 619
- Cumulative Test for Chapters 6–8** 620
- Proofs in Mathematics** 622
- P.S. Problem Solving** 625

9 ▷ Systems of Equations and Inequalities **627**

- 9.1 Linear and Nonlinear Systems of Equations 628
- 9.2 Two-Variable Linear Systems 638
- 9.3 Multivariable Linear Systems 650
- 9.4 Partial Fractions 662
- 9.5 Systems of Inequalities 670
- 9.6 Linear Programming 680
- Chapter Summary** 689
- Review Exercises** 691
- Chapter Test** 695
- Proofs in Mathematics** 696
- P.S. Problem Solving** 697

10 ▷ Matrices and Determinants **699**

- 10.1 Matrices and Systems of Equations 700
- 10.2 Operations with Matrices 713
- 10.3 The Inverse of a Square Matrix 728
- 10.4 The Determinant of a Square Matrix 737
- 10.5 Applications of Matrices and Determinants 745
- Chapter Summary** 758
- Review Exercises** 760
- Chapter Test** 764
- Proofs in Mathematics** 765
- P.S. Problem Solving** 767

11 ▷ Sequences, Series, and Probability**769**

- 11.1 Sequences and Series 770
- 11.2 Arithmetic Sequences and Partial Sums 780
- 11.3 Geometric Sequences and Series 789
- 11.4 Mathematical Induction 798
- 11.5 The Binomial Theorem 808
- 11.6 Counting Principles 816
- 11.7 Probability 826
- Chapter Summary** 838
- Review Exercises** 840
- Chapter Test** 843
- Cumulative Test for Chapters 9–11** 844
- Proofs in Mathematics** 846
- P.S. Problem Solving** 849

▷ Appendices**Appendix A: Errors and the Algebra of Calculus A1****Appendix B: Concepts in Statistics (online)***

- B.1 Representing Data
- B.2 Analyzing Data
- B.3 Modeling Data

Alternative Version of Chapter P (online)*

- P.1 Operations with Real Numbers
- P.2 Properties of Real Numbers
- P.3 Algebraic Expressions
- P.4 Operations with Polynomials
- P.5 Factoring Polynomials
- P.6 Factoring Trinomials

Answers to Odd-Numbered Exercises and Tests A9

Index A115

Index of Applications (online)*

*Available at the text-specific website www.cengagebrain.com