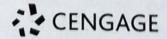


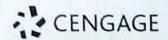
Ron Larson • Bruce H. Edwards

Calculus

Eleventh Edition

Ron Larson Bruce H. Edwards





Calculus, 11th Edition Ron Larson Bruce H. Edwards

Cover Image:

© PixelEmbargo/iStock/
Thinkstock

© 2019 Cengage Learning Asia Pte Ltd

This edition is reprinted for sale in the Philippines only.

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitalizing, taping. Web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

For product information and technology assistance, contact us at Cengage Learning Philippines Customer Support, 632-869-9660

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

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

ISBN: 978-981-48-3969-3

Cengage Learning Asia Pte Ltd 151 Lorong Chuan #02-08 New Tech Park Singapore 556741

Cengage Learning Asia Pte Ltd (Philippines Branch) Unit 1103, 11th Corporate Center 11th Avenue, corner Triangle Drive, North Bonifacio Bonifacio Global City, Taguig City Philippines 1634

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil and Japan. Locate your local office at www.cengage.com/global

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

Visit our website at www.cengageasia.com

Printed in the Philippines
Print Number: 03 Print Year: 2019

Contents

P	>	Prep	paration for Calculus	1
		P.1	Graphs and Models 2	
		P.2	Linear Models and Rates of Change 10	
		P.3	Functions and Their Graphs 19	
		P.4	Review of Trigonometric Functions 31	
			Review Exercises 41	
			P.S. Problem Solving 43	
1	D	Limi	ts and Their Properties	45
		1.1	A Preview of Calculus 46	
		1.2	Finding Limits Graphically and Numerically 52	
		1.3	Evaluating Limits Analytically 63	
		1.4	Continuity and One-Sided Limits 74	
		1.5	Infinite Limits 87	
			Section Project: Graphs and Limits of	
			Trigonometric Functions 94	
			Review Exercises 95	
			P.S. Problem Solving 97	
			per security department (150)	
2	>	Diffe	erentiation	99
		2.1	The Derivative and the Tangent Line Problem 100	
		2.2	Basic Differentiation Rules and Rates of Change 110	
		2.3	Product and Quotient Rules and Higher-Order	
			Derivatives 122	
		2.4	The Chain Rule 133	
		2.5	Implicit Differentiation 144	
			Section Project: Optical Illusions 151	
		2.6	Related Rates 152	
			Review Exercises 161	
			P.S. Problem Solving 163	
3	D	Appl	lications of Differentiation	165
		3.1	Extrema on an Interval 166	
		3.2	Rolle's Theorem and the Mean Value Theorem 174	
		3.3	Increasing and Decreasing Functions and	
			the First Derivative Test 181	
			Section Project: Even Fourth-Degree Polynomials 190	
		3.4	Concavity and the Second Derivative Test 191	
		3.5	Limits at Infinity 199	
		3.6	A Summary of Curve Sketching 209	
		3.7	Optimization Problems 219	
			Section Project: Minimum Time 228	
		3.8	Newton's Method 229	
		3.9	Differentials 235	
			Review Exercises 242	
			P.S. Problem Solving 245	

4	. D	- Inte	egration 248	24/
		4.1	Antiderivatives and Indefinite Integration 246	
		4.2	Area 258	
		4.3	Diomann Sillis alla Dellinto III-3	
		4.4	The Filmhamelia Theorem of Caronina	
			Section Project: Demonstrating the	
			Fundamental meeters	
		4.5	Integration by Substitution	
			Review Exercises 309	
			P.S. Problem Solving 311	
-	_	Log	arithmic, Exponential, and	
5		Oth	er Transcendental Functions	313
		5.1	The Natural Logarithmic Function: Differentiation 314	
		5.2	The Natural Logarithmic Function: Integration 324	
		5.3	Inverse Functions 333	
		5.4	Exponential Functions: Differentiation and Integration 342	
		5.5	Bases Other than e and Applications 352	
			Section Project: Using Graphing Utilities to	
			Estimate Slope 361	
		5.6	Indeterminate Forms and L'Hôpital's Rule 362	
		5.7	Inverse Trigonometric Functions: Differentiation 373	
		5.8	Inverse Trigonometric Functions: Integration 382	
		5.9	Hyperbolic Functions 390	
			Section Project: Mercator Map 399	
			Review Exercises 400	
			P.S. Problem Solving 403	
			white the bould have been self-	
6	D	Diffe	erential Equations	405
		6.1	Slope Fields and Euler's Method 406	
		6.2	Growth and Decay 415	
		6.3	Separation of Variables and the Logistic Equation 423	
		6.4	First-Order Linear Differential Equations 432	
			Section Project: Weight Loss 438	
			Review Exercises 439	
			P.S. Problem Solving 441	
7	N	App	lications of Integration	443
		7.1	Area of a Region Between Two Curves 444	
			Volume: The Disk Method 454	
		7.2	Volume: The Shell Method 465	
		7.3	Volumo: The Chem memor	
			Section Project: Saturn 473 Arc Length and Surfaces of Revolution 474	
		7.4	740 Longin and Carractor at the Carractor	
		7.5	Work 485	
			Section Project: Pyramid of Khufu 493	
		7.6	Moments, Centers of Mass, and Centroids 494	
		7.7	Fluid Pressure and Fluid Force 505	
			Review Exercises 511	
			P.S. Problem Solving 513	

8	D	Integ	gration Techniques and Improper Integrals	515
		8.1	Basic Integration Rules 516	
		8.2	Integration by Parts 523	
		8.3	Trigonometric Integrals 532	
			Section Project: The Wallis Product 540	
		8.4	Trigonometric Substitution 541	
		8.5	Partial Fractions 550	
		8.6	Numerical Integration 559	
		8.7	Integration by Tables and Other Integration Techniques	566
		8.8	Improper Integrals 572	
			Review Exercises 583	
			P.S. Problem Solving 585	
9	\triangleright	Infin	ite Series	587
_		9.1	Sequences 588	
		9.2	Series and Convergence 599	
		0.2	Section Project: Cantor's Disappearing Table 608	
		9.3	The Integral Test and p-Series 609	
		Property No.	Section Project: The Harmonic Series 615	
		9.4	Comparisons of Series 616	
		9.5	Alternating Series 623	
		9.6	The Ratio and Root Tests 631	
		9.7	Taylor Polynomials and Approximations 640	
		9.8	Power Series 651	
		9.9	Representation of Functions by Power Series 661	
		9.10	Taylor and Maclaurin Series 668	
			Review Exercises 680	
			P.S. Problem Solving 683	
10	1	Coni	cs, Parametric Equations, and	
U	D		r Coordinates	685
		10.1	Conics and Calculus 686	
		10.2	Plane Curves and Parametric Equations 700 Section Project: Cycloids 709	
		10.3	Parametric Equations and Calculus 710	
		10.4	Polar Coordinates and Polar Graphs 719	
			Section Project: Cassini Oval 728	
		10.5	Area and Arc Length in Polar Coordinates 729	
		10.6	Polar Equations of Conics and Kepler's Laws 738	
			Review Exercises 746	
			P.S. Problem Solving 749	

Constant of the second second

11	1	1/	tone and the Constitution of C	
11	1	vec	tors and the Geometry of Space	751
		11.1	Vectors in the Plane 752	,
		11.2	Space Coordinates and Vectors in Space 762	
		11.3		
		11.4	The Cross Product of Two Vectors in Space 779	
		11.5	Lines and Planes in Space 787	
			Section Project: Distances in Space 797	
		11.6	Surfaces in Space 798	
		11.7	Cylindrical and Spherical Coordinates 808	
			Review Exercises 815	
			P.S. Problem Solving 817	
			the full of parties at the control of the control o	
12	1	Vect	or-Valued Functions	
12				819
		12.1	Vector-Valued Functions 820	0.0
			Section Project: Witch of Agnesi 827	
		12.2	Differentiation and Integration of Vector-Valued	
			Functions 828	
		12.3	Velocity and Acceleration 836	
		12.4	Tangent Vectors and Normal Vectors 845	
		12.5	Arc Length and Curvature 855	
			Review Exercises 867	
			P.S. Problem Solving 869	
13	D	Func	tions of Several Variables	
13				871
		13.1	mile daddion to i dilctions of Several Variables 972	
		13.2	Limits and Continuity 884	
		13.3		
		13.4		
		13.5	Chain Rules for Functions of Several Variables 911	
		13.6	Directional Derivatives and Gradients 919	
		13.7	Tangent Planes and Normal Lines 931	
			Section Project: Wildflowers 939	
	Jan 1	13.8	Extrema of Functions of Two Variables 940	
		13.9	Applications of Extrema 948	
			Section Project: Building a Pipeline 955	
		13.10	Lagrange Multipliers 956	
			Review Exercises 964	
			P.S. Problem Solving 967	
			Jonne Carbonal Carbon	
11	1	Mult	iple Integration	
17		with	iple integration	969
		14.1	Iterated Integrals and Area in the Plane 970	
		14.2	Double Integrals and Volume 978	
		14.3	Change of Variables: Polar Coordinates 990	
		14.4	Center of Mass and Moments of Inertia 998	
			Section Project: Contact to	
		14.5	Surface Area 1006	
		14.6	Section Project: Surface Area in Polar Coordinates 1012 Triple Integrals and Applications 1013	
		14.7	Triple Integrals in Other Coordinates 1013	
			Triple Integrals in Other Coordinates 1024	
		14.8	Section Project: Wrinkled and Bumpy Spheres 1030	
			Change of Variables: Jacobians 1031 Review Exercises 1038	
			P.S. Problem Solving 1041	
			LIG. FIUDIEM SOLVING 1041	

15 ⊳	Vect	tor Analysis 1043
	15.1	Vector Fields 1044
	15.2	Line Integrals 1055
	15.3	Conservative Vector Fields and Independence of Path 1069
	15.4	Green's Theorem 1079
		Section Project: Hyperbolic and Trigonometric Functions 1087
	15.5	Parametric Surfaces 1088
	15.6	Surface Integrals 1098
		Section Project: Hyperboloid of One Sheet 1109
	15.7	Divergence Theorem 1110
	15.8	Stokes's Theorem 1118
		Review Exercises 1124
		P.S. Problem Solving 1127

16 ▷ Additional Topics in Differential Equations (Online)*

16.1 Exact First-Order Equations
 16.2 Second-Order Homogeneous Linear Equations
 16.3 Second-Order Nonhomogeneous Linear Equations
 Section Project: Parachute Jump
 16.4 Series Solutions of Differential Equations
 Review Exercises

Appendices

Appendix A: Proofs of Selected Theorems A2

Appendix B: Integration Tables A3

P.S. Problem Solving

Appendix C: Precalculus Review (Online)*

Appendix D: Rotation and the General Second-Degree Equation (Online)*

Appendix E: Complex Numbers (Online)*

Appendix F: Business and Economic Applications (Online)*

Appendix G: Fitting Models to Data (Online)*

Answers to All Odd-Numbered Exercises A7 Index A121

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

PHILIPPINE EDITION

This Edition is licensed for sale only in the Philippines. Circulation of this Edition outside of the Philippines is UNAUTHORIZED AND STRICTLY PROHIBITED.



For your lifelong learning solutions, visit www.cengage.com/custom Visit our website at www.cengageasia.com

