

TRANSITION GUIDE FOR *CALCULUS NINTH EDITION* BY LARSON, EDWARDS (PART I)

General Changes to *Calculus Ninth Edition*

- The Chapter Openers have been revised. The graphing overview of the chapter is picked up from Calc 8e. The thought-provoking question about a selected real-life application from the chapter has been updated. A new description of what concept(s) will be covered in the chapter, including a bulleted list of concept(s) per section, has been added.
- The *Open Explorations* have been renamed *CAS Investigations* and are available for Maple and Mathematica.
- The in-text appendices are Appendix A *Proofs of Selected Theorems* and Appendix B *Integration Tables*.
- Added proofs to Appendix A of Theorems 1.11, 3.7, 5.1 (proof that natural logarithmic function is one-to-one), 5.10 (property 2), and 5.16 ($\arcsin u$ and $\arccos u$).
- Chapter 16 *Additional Topics in Differential Equations* (formerly Appendix C) is available online. The chapter has been heavily revised and the following material has been added.
 - Chapter opener
 - General notes
 - Explorations
 - Technology note
 - For Further Information
 - Biographical note
 - CAS Investigations
 - Graphs or additional explanation to some examples
 - Many new exercises
 - Capstone exercises
 - Writing About Concepts exercises
 - Putnam Exam Challenge
 - Section Project
 - Review Exercises
 - P.S. Problem Solving
- The appendices that are available on the website that accompanies this text are Appendix C *Precalculus Review*, Appendix D *Rotation and the General Second-Degree Equation*, and Appendix E *Complex Numbers*.

- A *Capstone* exercise has been added to each section. The instructor should be able to incorporate this exercise with a review of the material taught in the lesson. The exercise covers several of the concepts discussed in the section.
- The exercise sets have been carefully and extensively examined to ensure they are rigorous and cover all the topics users have suggested. Many new skill exercises, as well as many new challenging exercises have been added.
- All data in the examples and exercise sets have been updated.

Chapter-by-Chapter Changes to *Calculus Eighth Edition*

Chapter P Preparation for Calculus

- Section P.1: Rewrote Example 3 to show test for symmetry with respect to the y -axis and to the origin
- Section P.3: Definition of polynomial function rewritten per Bruce Edwards (change was first made in ETF 4e).

Chapter 1 Limits and Their Properties

- Section 1.1: To reduce clutter on first page of section, moved biographical note to fourth page of the section
- Section 1.1: Rewrote first paragraph on section's first page for clarity
- Section 1.1: On section's first page, replaced third bulleted item with new precalc/calculus example.
- Section 1.2: Rewrote Example 3 to include the definition of absolute value. Also rewrote this example's conclusion to clarify why the limit does not exist.
- Section 1.3: Added text noting that the Squeeze Theorem is also known as the Sandwich Theorem or the Pinching Theorem.
- Section 1.4: Added text noting that the limit from the right is also called a right-hand limit. Added text noting that the limit from the left is also called a left-hand limit.
- Section 1.4: Added text noting that the volume V is approximated.
- Section 1.4: A proof for Theorem 1.11 was added in Appendix A.
- Section 1.4: A proof for Theorem 1.12 was added after its statement.
- Section 1.4: Theorem 1.13, $f(a) \neq f(b)$ was added to the hypothesis.
- Section 1.5: Example 1 was extensively rewritten. Old parts (a) and (d) have been deleted, parts (b) and (c) are now parts (a) and (b), respectively. An analytical solution for each part has been added, followed by the previously used graphical solution.

Chapter 2 Differentiation

- Section 2.1: Redrew Figure 2.4 for clarity
- Section 2.1: Changed Technology note after Example 5 to explain that you can use the point-slope form to find the equation of the tangent line
- Section 2.1: For the list after Theorem 2.1 and its proof, added a note to the second point to "(see Example 6)."
- Section 2.2: For Figure 2.14, replaced caption with the NOTE that used to appear in the minor column on the same page
- Section 2.2: Added a new note in the minor column near Theorem 2.3; the note refers to Section 2.1, Example 7 to illustrate a function that is defined at a value c but is not differentiable at c
- Section 2.3: Inserted a sentence at the end of the first page of the section that the proof of the Product Rule for more than two factors is left as an exercise
- Section 2.5: After Example 6, added a sentence that this example will be studied further in Section 5.6
- Section 2.5: Example 7 has been revised to also ask for the evaluation of the derivative at the point $(-3, 4)$
- Section 2.6: Exploration before Example 1, rewrote first sentence to clarify that we are talking about the height of the water level
- Section 2.6: Figure 2.36 has been redrawn for clarity
- Section 2.6: After Example 4, added a note similar to the one after Example 6
- Section 2.6: Figure 2.38 has been redrawn for clarity (added labels)

Chapter 3 Applications of Differentiation

- Section 3.1: In Definition of Extrema, added that absolute minimum or absolute maximum are also called global minimum or global maximum
- Section 3.1: Page 165, rewrote second sentence to clarify that we are discussing a continuous function
- Section 3.1: In Definition of Relative Extrema, added that relative minimum and relative maximum are also called local minimum and local maximum, respectively
- Section 3.1: Rewrote paragraph before Definition of a Critical Number to note that "Notice in the definition that the critical number c has to be in the domain of f , but c does not have to be in the domain of f' ."
- Section 3.2: Example 3, added in middle of solution that the function satisfies the conditions of the Mean Value Theorem
- Section 3.3: In proof of Theorem 3.6, changed the intervals that f is decreasing and increasing on from opened to closed
- Section 3.4: In the paragraph before Theorem 3.7, added a reference that a proof for Theorem 3.7 is in Appendix A

- Section 3.7: Example 1, near the end, added that to maximize V , find the critical numbers on the interval $(0, \sqrt{108})$
- Section 3.9: To give it more emphasis, the tangent line approximation now is in a blue-shaded box
- Section 3.9: In paragraph before Example 7, added a sentence that the given formula is equivalent to the tangent line approximation given earlier in the section

Chapter 4 Integration

- Section 4.1: Rewrote second half of proof of Theorem 4.1 for clarity
- Section 4.1: In the Notation for Antiderivatives subsection, added another callout to the last equation to clarify the meaning of $F(x)$
- Section 4.1: Added a study tip near Example 5 to remind students that they can check their answers by differentiating
- Section 4.2: For the limit shown after Example 2, added simplification steps
- Section 4.2: Replaced Figure 4.5 with new figure showing area of triangle
- Section 4.3: In subsection Definite Integrals, rewrote first three paragraphs and Definition of Definite Integral for clarity. Added to Theorem 4.4 that the integral of f exists. Added a STUDY TIP near Theorem 4.4 that more convenient methods for integrating will be learned later and that the limit method will be used now.
- Section 4.4: Added a subsection on the Net Change Theorem, including new Examples 9, 10; Figures 4.36, 4.37; and Theorem 4.12
- Section 4.4: Rewrote the proof of Theorem 4.9 for clarity
- Section 4.5: On the first page of the section, deleted the STUDY TIP from the minor column; the EXPLORATION was moved after Example 2
- Section 4.6: First page of section, rewrote 3rd sentence of 1st paragraph for clarity

Chapter 5 Logarithmic, Exponential, and Other Transcendental Functions

- Section 5.1: Deleted note on logarithms in minor column near Theorem 5.2, and put the text in the BIOGRAPHICAL NOTE on Napier (1st page of section)
- Section 5.1: Deleted NOTE in minor column near Theorem 5.1
- Section 5.1: For Theorem 5.1, the proof that f is one-to-one is now given in Appendix A
- Section 5.1: Rewrote some of the steps in Example 6 for clarity
- Section 5.2: After Example 4, rewrote paragraph so that it is a statement and deleted one of the antiderivatives
- Section 5.2: In the Guidelines for Integration, add "long division" to Step 3
- Section 5.2: Before Integrals of the Six Basic Trigonometric Functions, added a sentence noting that the proofs of $\cot u$ and $\csc u$ are left as exercises
- Section 5.3: In Example 3, rewrote beginning of solution to clarify why f is increasing and therefore is strictly monotonic, thus f must have an inverse function

- Section 5.4: Added sentence to Theorem 5.10 that the proof of the second property is given in Appendix A
- Section 5.5: Before Example 1, added a sentence explaining the meaning of half-life
- Section 5.5: After definition of Logarithmic Function of Base a , before the list of logarithmic properties, added a sentence noting that x and y are positive numbers and n is rational
- Section 5.6: Before Theorem 5.16, added a sentence stating that proofs for $\arcsin u$ and $\arccos u$ are given in Appendix A, the rest are left as exercises
- Section 5.6: Deleted paragraph after Theorem 5.16
- Section 5.8: Second page of section, first paragraph, replaced *addition of ordinates* with "adding the corresponding y -coordinates of"

Chapter 6 Differential Equations

- Section 6.1: In first paragraph of section, added a sentence restating the definition of a differential equation.
- Section 6.1: Before Example 3, added to the sentence describing slope fields that they "can be helpful in getting a visual perspective of the directions of the solutions of a differential equation."
- Section 6.2: In the discussion about radioactive decay before Example 3, added a sentence stating that "The rate of decay is proportional to the amount present."
- Section 6.2: In Example 3, added clarification about how $y = 5$ is obtained.
- Section 6.2: In Example 4, added that " y is continuous whereas the number of flies is discrete."
- Section 6.3: In Example 1, added to comment on general solution that " $C = \pm e^{C_1}$ ".
- Section 6.3: In Example 3, added a sentence at the end of the solution explaining the domain of x .
- Section 6.3: For the definition of homogeneous differential equation, added that n is an integer.
- Section 6.3: In Example 7, added two sentences at the end of the solution noting that the horizontal asymptote is the carrying capacity and that you will learn more about this concept later in the section.
- Section 6.3: Figure 6.18, added a caption to clarify what is shown in the figure.
- Section 6.4: Changed the order of the objectives so that solving a Bernoulli differential equation is now taught last in this section.
- Section 6.4: In Example 3, added a sentence explaining why the absolute value signs can be dropped.
- Section 6.4: In discussion about $F = ma$ before Example 5, added a comment that " a is acceleration."
- Section 6.4: In Example 5, added a comment that " $C = e^{-bC_1}$ ".

Chapter 7 Applications of Integration

- Section 7.1: Before Figure 7.4, the minor column note was rewritten and added as the last sentence in the paragraph preceding the figure.
- Section 7.4: Moved the "For Further Information" note from minor column near Example 2 to minor column near the definition of arc length.

Chapter 8 Integration Techniques, L'Hôpital's Rule, and Improper Integrals

- Section 8.1: In the Study Tip in the minor column near Example 3, the last sentence was rewritten for clarity.
- Section 8.2: In Guidelines for Integration by Parts, added a sentence stating "that dv always includes the dx of the original integrand."
- Section 8.2: Moved the "For Further Information" note from minor column near Example 2 to minor column near Example 3.
- Section 8.2: Moved Note from minor column near Example 5 into major column before Example 5.
- Section 8.2: In Example 5, added another solution step. Before, we did "Integrate and divide by 2" in one step. We now have a step for "Integrate", and a separate step showing "Divide by 2."
- Section 8.3: In Example 3, added comments explaining each step of the solution.

Chapter 9 Infinite Series

- Section 9.1: After Theorem 9.1, added a Note that the "The converse of Theorem 9.1 is not true (see Exercise 138)."
- Section 9.1: In proof of Theorem 9.5, we state that the proof for a nonincreasing sequence is similar. A note has been added to see Exercise 139, where students are asked to complete this proof.
- Section 9.2: In the definitions of Convergent and Divergent Series, added comment that $S = \sum_{n=1}^{\infty} a_n$.
- Section 9.2: Theorem 9.7, added that $\sum a_n$ and $\sum b_n$ are convergent series and A , B , and c are real numbers.
- Section 9.5: Example 3, changed example title to When the Alternating Series Test Does Not Apply.
- Section 9.6: Removed the Exploration near Theorem 9.17 and rewrote as the Capstone exercise.
- Section 9.6: Example 1, replaced last sentence of solution to give a better explanation of why the series converges.

- Section 9.6: Moved Note from minor column near Example 4 to major column after Theorem 9.18.

Chapter 10 Conics, Parametric Equations, and Polar Coordinates

- Section 10.1: In the discussion about Conic Sections, added a sentence at the end stating that "For information about rotating second-degree equations in two variables, see Appendix E."
- Section 10.1: In Example 1, the equation in the direction line was rewritten and the comment in Step 1 of the solution now says "Write" instead of "Rewrite".
- Section 10.1: After Theorem 10.3, the NOTE header was removed and the first sentence was made standard text. The second sentence is now the caption for Figure 10.9.
- Section 10.1: In the list of the eccentricities of the planets, Pluto has been removed.
- Section 10.4: Figure 10.44, changed graph generated by Derive to generated by Mathematica.

Chapter 11 Vectors and the Geometry of Space

- Section 11.1: Moved the information from the Note in the minor column near Example 2 to the paragraph before Example 1.
- Section 11.1: In the first procedure on converting directed line segments to component form, we added text noting that "from the Distance Formula you can see" what that the length (or magnitude) of a vector is.
- Section 11.1: Figure 11.33, added symbol showing the direction of north.
- Section 11.3: Example 4, changed vectors and updated the rest of the example. Figure 11.30 redrawn to reflect changes and to more clearly show the vectors and their initial points.
- Section 11.5: Rewrote part of Theorem 11.12 for clarity.
- Section 11.6: Rewrote the definition of Quadratic surface to clearly state that the equation is in three variables and that the equation given is the general form.
- Section 11.7: In Example 3, we now say "elliptic" instead of "double-napped."

Chapter 12 Vector-Valued Functions

- Section 12.1: In Example 4, the numerator in the fraction for the $\mathbf{k}$ -component (and in previous steps) has been factored so that the restriction on t 's domain is easier to determine.
- Section 12.2: Rewrote Example 1, which shows differentiation of a vector-valued function. Added the corresponding parametric and rectangular equations, plus a graph of the position function and its derivative when $t = 1$.

- Section 12.2: Theorem 12.2, changed f to w in the first sentence and in properties 3 and 6 to avoid confusion (f is associated with the i -component of $\mathbf{r}$).
- Section 12.4: Example 2, changed the direction line to give the point.

Chapter 13 Functions of Several Variables

- Section 13.6: Redrew Figure 13.48 for clarity.
- Section 13.6: Example 8, added new Figure 13.54.
- Section 13.7: Redrew Figure 13.62 for clarity.

Chapter 14 Multiple Integration

- Section 14.2: Added a new subsection on finding the average value of a function over a region.
- Section 14.2: Added new definition box, Average Value of a Function over a region.
- Section 14.2: Added new Example 6, Finding the Average Value of a Function.
- Section 14.2: Added new Figure 14.23.
- Section 14.3: In Note after Theorem 14.3, added a sentence to remind students to not omit the extra factor of r in the integrand when using the integral given in the theorem.
- Section 14.6: Example 3, clarified in the solution that Figure 14.56 is the solid region Q . Added a sentence highlighting the change in the order of integration. Deleted the " $V =$ " step (we're not finding volume here).
- Section 14.7: Example 1, after the " $V =$ " step, added an integral that shows the changes in the limits of integration after using symmetry before doing the integration shown in the next step.
- Section 14.8: In Example 2, the transformation T is now displayed before mapping several values of x and y .
- Section 14.8: Theorem 14.5 was rewritten for clarity.
- Section 14.8: At the end of the proof of Theorem 14.5, the conclusion of the hypothesis is restated.

Chapter 15 Vector Analysis

- Section 15.1: The definition of Vector Field has been rewritten for clarity.
- Section 15.1: The function used in the gradient example after the Vector Field definition has been changed.
- Section 15.1: A sentence was added noting the components of the vector field in space example that appears after the Vector Field definition
- Section 15.1: In the sentence on when a vector field is continuous, the vector field $\mathbf{F}$ is given in component form and the words "only if" have been added.

- Section 15.1: The Note before Example 5 has been rewritten to include a definition of simply connected in the plane and also gives a forward reference to Figure 15.26.
- Section 15.1: A Note was added near Theorem 15.2 to give a definition of simply connected in space and also gives a forward reference to Section 15.4.
- Section 15.1: Theorem 15.3 was renamed "Divergence and Curl."
- Section 15.4: Rewrote sentence before Theorem 15.8 for clarity.
- Section 15.6: Updated Technology note after Example 3 to use Maple.
- Section 15.7: Added a Note near the proof of Theorem 15.12 stating that "This proof is restricted to a simple solid region. The general proof is best left to a course in advanced calculus."
- Section 15.8: Rewrote parts of Example 2 for clarity.