

# Unit\_4 Integration

Content Area: **Mathematics**  
Course(s):  
Time Period: **Marking Period 4**  
Length: **15 weeks**  
Status: **Published**

## **Brief Summary of Unit**

---

Students will solve integrals for polynomial, rational, radical, exponential, logarithmic and trigonometric integrands. Students will work with both definite and indefinite integrals. The focus of the indefinite integrals will be initial value problems with a connections to position (velocity) problems and economic (marginal) problems. The focus for definite integrals will be on the Fundamental Theorem of Calculus.

## **Standards**

---

Students will analyze geometric designs which connects to various cultures. Embracing the diversity within society incorporates the following:

### Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

### Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

### New Jersey Diversity and Inclusion Law

In accordance with New Jersey's Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.  Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
MA.9-12.III.A.2	Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval: the integral of $f'(x)dx = f(b) - f(a)$ on the interval $[a, b]$
MA.9-12.III.A.3	Basic properties of definite integrals (examples include additivity and linearity)
MA.9-12.III.B	Applications of integrals
MA.9-12.III.C	Fundamental Theorem of Calculus
MA.9-12.III.C.1	Use of the Fundamental Theorem to evaluate definite integrals
MA.9-12.III.C.2	Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined
MA.9-12.III.D.1	Antiderivatives following directly from derivatives of basic functions
MA.9-12.III.D.2	Antiderivatives by substitution of variables (including change of limits for definite integrals)
MA.9-12.III.E.1	Finding specific antiderivatives using initial conditions, including applications to motion along a line
MA.9-12.III.E.2	Solving separable differential equations and using them in modeling (including the study of the equation $y' = ky$ and exponential growth)
MA.9-12.III.F	Numerical approximations to definite integrals
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

- Students will discover how integrals are used in economic analysis
- Students will discover how integrals are used in physics applications

## Essential Questions

---

- How is an anti derivative (integral) related to limits and derivatives?
- What does an anti derivative represent?
- What is the result of the integration of a rate of change?

## Essential Understandings

---

- How area under a curve can be estimated by the sums of the rectangles, where volume of a solid comes from rotating those rectangles about the x-axis to create circles.
- How can the graphing calculator assist in finding a definite integral?
- How can we use "u" substitution to integrate?
- How do the six trigonometric derivative rules correspond to integration rules?
- How do we apply the General Exponential Rule of integration?
- How do we apply the General Logarithmic Rule of Integration?
- How is integration used to find the area between graphs?
- How is integration used to find the volume of solids of revolution?
- What are the basic rules of integration?
- What is an integral (anti derivative) and how is it calculated?
- What is the difference between an indefinite and a definite integral?
- What is the Fundamental Theorem of Calculus?

## Students Will Know

---

- Basic rules of integration (constant rule, constant multiple rule, sum/difference rule, simple power rule)
- Chain rule integration ("u" substitution)
- Different functions can have the same derivative due to the constant value.
- Exponential and Logarithmic Integral Rules
- For each trigonometric differentiation rule, there is a corresponding integration rule.
- How integrals are used to find the volume of a solid of revolution including both the disc and washer method.
- How integration is used in marginal analysis
- How integration is used to find the area bounded by two graphs
- How the midpoint rule is used to approximate an integral.
- How to evaluate a definite integral

- How to evaluate an indefinite integral.
- Proper notation for integration
- The derivative and integral are inverse operations.
- The Fundamental Rule of Calculus allows to find the area under a curve over a closed interval.
- The process to solve an initial value problem
- Why the value of "C" is necessary in initial value problems.

## **Students Will Be Skilled At**

---

- Applying integration to deriving position functions and economic functions.
- Applying the chain rule ("u" substitution) in integration.
- Evaluating a definite integral as the limit of a sum using the midpoint rule.
- Evaluating definite integrals algebraically and with graphing calculator.
- Evaluating definite integrals involving trigonometric functions
- Evaluating indefinite integrals involving trigonometric functions.
- Evaluating indefinite integrals.
- Finding the area of a region bounded by two graphs through integration.
- Integrating exponential functions
- Integrating logarithmic functions
- Use the Disc and Washer Method to find the volume of a solid.
- Using the Fundamental Theorem of Calculus to find the area under a curve.

## **Evidence/Performance Tasks**

---

### Assessments

- **Formative:** Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
  - **Summative:** Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
  - **Benchmark:** IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
  - **Alternative Assessments:** Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL
- Answer essential questions
  - Class discussion of daily topic
  - Classwork and homework that assess the essential questions

- Graded Do Now assessments that reflect student understanding of class notes and homework.
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations (problems of the week)

## **Learning Plan**

---

- Antiderivatives and indefinite integrals
- Area bounded by two graphs
- Chain Rule Integration
- Definite Integrals
- Fundamental Theorem of Calculus
- Integration of exponential functions
- Integration of trigonometric functions
- Integrations of logarithmic functions
- Midpoint Rule
- Volumes of solids of revolution

## **Materials**

---

[Core Book List](#) including AP Calculus Larson 12E

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Teacher created activities
- Teacher created notes

## **Suggested Strategies for Modifications**

---

[Possible accommodations/modification for CP Calculus](#)

