



# **COURSE DESCRIPTION**

In this course, students will develop an understanding of Calculus concepts such as derivatives, integration, area, volume, polynomial approximations, and series and explore practical applications using technology. The goal of this course is to successfully prepare students take the AP Calculus BC exam.

# What will students learn in this course?

Key Concepts	Standards (Students will)
	SEMESTER 1
	Find the limits of functions graphically, numerically, and analytically
Functions,	Understand the continuity of a function
Graphs, and	Discuss one-sided limits
Limits	Use limits to find limits at infinity and infinite limits
	Analyze planar curves including parametric, polar, and vector form.
	Use and apply the definition of the derivative
	Understand basic rules of differentiation, including trig, parametric, polar, and vector functions
Differentiation	Apply the product and quotient rules to differentiate functions.
Differentiation	Make connections between position, velocity, and acceleration
	Understand the difference between instantaneous and average rate of change.
	Analyze planar curves in vector form, including velocity and acceleration
	Apply the chain rule to differentiate functions.
Differentiation	Understand basic rules of differentiation, including exponential, logarithmic, parametric, polar, and
Continued	vector functions Analyze planar curves in parametric, polar, and vector form, including velocity and acceleration
	Apply rules of differentiation to implicit equations.
	Calculate areas using the rectangular approximation methods.
	Use Riemann Sums with uneven subintervals.
	Use the definite integral as a limit of Riemann Sums.
	Use technology to calculate the definite integral.
	Understand the Mean Value Theorem for Integrals and Average Value Theorem
Definite Integrals	Understand basic rules of antidifferentiation, including trig, logarithmic, exponential, parametric,
	polar, and vector functions
	Apply the technique of substitution, integration by parts, and partial fractions to antidifferentiate
	functions
	Use the Fundamental Theorem of Calculus to find the derivative of an integral Use the definite integral as a limit of Trapezoid Sums
Differential	Construct and analyze slope fields
Equations &	Determine numerical solutions of differential equations using Euler's method
Mathematical Modeling	Solve separable and logistic differential equations
Wodeling	Apply differential equations to real-life problems

	SEMESTER 2
	Determine the area between curves and the area enclosed by intersecting curves with respect to x
	Determine the area between curves and the area enclosed by intersecting curves with respect to y
Applications of	Determine the area bounded by polar curves
Definite Integrals	Calculate the volume of a solid using Disk and Washer Method
	Calculate the volume of a solid using Cross Sections
	Find the length of a curve, including a curve given in parametric form
L'Hôpital's Rule and Improper	Apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series
Integrals	Apply the technique of improper integrals as limits of definite integrals
	Understand the concept of series as a sequence of partial sums as converging or diverging with motivating examples
	Use Taylor polynomial approximation with graphical demonstration of convergence
	Manipulate Taylor series centered at <i>x</i> = <i>a</i> including substitution, differentiation, and the formation of new series from known series
Infinite Series	Identify and use the Maclaurin series centered at $x = a$ for the functions $e^x$ , sin x, cos x, and $1/(1-x)$
	Use Lagrange error bound for Taylor polynomials
	Determine radius and interval of convergence of power series
	Understand the convergence of geometric, harmonic, and alternating series
	Determine appropriate tests for convergence, including ratio, n <sup>th</sup> term, integral, and comparison tests

# How will we know students have learned it?

Grade	A – Advanced/ Exemplary	B – Proficient	C – Basic	D – Needs Improvement	E – Not Passing	I – Incomplete
Scale	4.0-5.0	3.0-3.9	2.0-2.9	1.0-1.9	0.1-0.9	Redo

	Semester 1		Semester 2	
	Functions, Graphs, and Limits	5%	Applications of Definite Integrals	30%
	Differentiation	12.5%	L'Hôpital's Rule and Improper Integrals	20%
Key	Differentiation Continued	12.5%	Infinite Series	30%
Concepts Weights	Applications of Derivatives	20%	AP Exam Review	20%
	Definite Integrals	20%	AP Calculus Exam	
	Differential Equations & Mathematical Modeling	10%		
	AP Calculus Practice Exam			

#### Within each unit, assignments will be graded according to the following weights:

	Common unit Assessments (Comprehensive unit exams; 1 per unit)	60%
Assignment Categories	Interim Classroom Assessments (Quizzes, projects; 2-3 per unit)	30%
categories	Formative Assignments (Homework, In-class assignments, etc.; varies)	10%

Formative assignments are 10% in each unit because students should not be unduly penalized for mistakes during the learning process. The grade is primarily based on mastery of standards, and mastery is demonstrated on assessments.

Course Requirements	<ul> <li>What must every student pass to earn credit on this course?</li> <li>All students must pass each unit with a 1.0.</li> <li>What must every student complete to earn credit in the course?</li> <li>Every student must take the practice AP Exam at the end of semester 1.</li> <li>Ever student must take the AP Calculus Exam in May.</li> <li>What other requirements must every student meet?</li> <li>Every student must meet weekly with their study groups.</li> </ul>
	Every student must meet weekly with their study groups. Every student must either: participate in Mathletes, perform peer tutoring or receive tutoring from teacher.

Students who do not meet these requirements will receive an "I" (incomplete) for the semester. If requirements are not met within three weeks after the semester, the student will earn a grade of E.

The College Board has instituted a new \$40 unused student exam fee. This fee will be applied to a student's District 201 financial account balance when:

- o A student drops an AP Class after November 15<sup>th</sup>
- A student does not take an exam(s) during the identified testing period (May 6<sup>th</sup> 17<sup>th</sup>) or late testing period (May 22<sup>nd</sup> 24<sup>th</sup>)
- o Please note that the \$40 unused student exam fee is per class.

## **Homework Rubric**

0	1	2	3	4	5
more than 2	2 homework	1 homework	all homework	all homework	all homework
homework assignments missing or incomplete for the Unit	assignments missing or incomplete for the Unit	assignment missing or incomplete for the Unit	assignments for the Unit completed	assignments accurately completed for the Unit	assignments accurately completed with proper notation for the Unit

*Missing Assignment* – student did not complete for discussion that day *Incomplete Assignment* – student did not attempt ALL problems

Participation in weekly Study Groups are part of the Homework grade. Failure to complete a study group for a week will result in 0.5 deduction from the Homework grade.

## Study Groups: U and US in Calculus

Doing well in Calculus is a team effort; there is both you and us in Calculus. You will meet once each week with a study group until the AP Exam in May. Each week ends on Fridays at 2:05pm (end of 5<sup>th</sup> hour). You may meet for a minimum of either one hour before/after school or for 2 half-hours during supervision. You can always choose to meet for more time.

The total number of students in your study group should be 3 to 5, including you. Meeting in your study group will count as a homework assignment. Group members must be of the same course (all AB or all BC), but AB groups can invite BC students to visit their group to give extra help. BC students are encouraged to find out if AB groups need help.

You do not have to meet with the same students each week. Your goal should be to find a group that fits right.

Each time you meet, you will need to fill out the study group form found at <u>https://forms.gle/TLaPe3njD7HkUafG7</u> or at <u>www.mathkanection.com</u> on the AP Calculus AB or BC home page. You must log your study group session when your study group meets. End your study group session 5 minutes early to fill out the study group form. *Late submissions will NOT be accepted.* 

#### **Assessment Rubric**

Each question on a test or quiz will be given a value from 0-5

0	1	2	3	4	5
No work or no	Major error in	Minor error in	Computation	Error in	Proper
relevant	relevant	relevant	error	notation	notation used
Calculus work	Calculus work	Calculus work			throughout
					problem

#### **AB Part of Summer Work Rubric**

	5	4	3	2	1	0
Part I	Completed all	Not completed on-				
	topics on-time	time OR missing				
	with 100%	with 86-99%	with 75-85%	with 61-74%	with 50-60%	topics OR less than
	success on topics	50% success on topics				
Part II	Completed all	Not completed on-				
	topics on-time	time OR missing				
	with 100%	with 86-99%	with 75-85%	with 61-74%	with 50-60%	topics OR less than
	success on topics	50% success on topics				
Part III	Completed all	Not completed on-				
	topics on-time	time OR missing				
	with 100%	with 86-99%	with 75-85%	with 61-74%	with 50-60%	topics OR less than
	success on topics	50% success on topics				

# What will we do when students aren't learning?

## Extra Help

Students who are not passing the course are expected to seek extra help. Further, any student who wants to improve his or his or her performance and grade is encouraged to ask for support, as well. AP review sessions will be available second semester.

\* Room 351 from 7am-8:40am (8:40am-9:28am on late start days) & 3:10pm-5pm (except when Mathletes meet)

## \* ADDITIONAL RESOURCES

In addition to Ms. Kane's and your classmates' help, the following are a sample of websites that you should utilize to help you understand Calculus.

www.mathkanection.com – Ms. Kane's website hs.saplinglearning.com/ibiscms/login/ -- Online textbook www.khanacademy.org – do you have Ms. Kane as your coach? www.patrickjmt.com – helpful math videos www.wolframalpha.com – help for solving problems https://myap.collegeboard.org/ -- AP Classroom

#### Calculus Re-do Policy

Students are eligible and **expected** to re-do tests that do not meet or exceed standards. Students will be provided one opportunity for re-do on a given item.

Students must request a re-do after receiving the graded assignment. The requirements that must be met prior to re-do:

- All Questions on Original Test must have been attempted (no problems left blank).
- Student must have accurately completed all homework assignments for the Unit.
- Students must attend weekly study group sessions for the Unit.
- Student must have completed all Quizzes in a timely manner. (if absent on day of a Quiz, the student must have taken the Quiz on the day he/she returned to school)
- Student must schedule and attend a help session at least two days before the redo to study for the re-do.
- Re-dos will be taken at specified time, one week after the original assessment was returned.

The maximum grade earned shall be full credit, given the original item is submitted on time with full effort.

## **District Re-Do Policy:**

J. Sterling Morton High School District 201 holds high standards for student achievement. To maintain high expectations and provide support for all students to meet them, the district enforces a redo policy for student work that does not meet or exceed standards.

Students are eligible and expected to redo required assignments that do not have a score above 1.0. Formative and Interim assignments not considered required may be eligible for redo only at the teacher's discretion.

If not already required by the teacher, students must request a redo within one week after receiving the graded assignment from the teacher. The teacher will communicate to the student any requirements that must be met prior to the redo (i.e. after-school tutoring, extra practice assignments, etc.), as well as the deadline for submission. Redo deadlines are described below.

In cases other than common assessments, teachers may provide an alternative assignment for students to demonstrate mastery of the standards.

- A redo for a required assignment can be completed until the last day of the month following the month of its due date. It will not be accepted after this date (Refer to chart).
- If a required assignment is not redone, the original score of the assignment will be given.
- If a required assignment is not attempted by the redo deadline, the score will be "I" for the assignment and the semester.

Note: If a required assignment is due during the month of November/April the Redo window closes the last full day of school ahead of Final Exams. If a required assignment is due during the final month of the semester the redo window closes the last day of Incomplete Lab.

Redo Window Example: Teacher A communicates to their class the due date for a required assignment is September 26, 2023. Once the required assignment is collected/given, a student eligible for a Redo has until October 31, 2023 to complete the Redo.

#### **Redo Deadlines:**

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Month Assigned	Close Date
August/September	October 31 <sup>st</sup>
October	November 30 <sup>th</sup>
November	December 22 <sup>nd</sup>
December	January 13 <sup>th</sup> (incomplete lab)
January	February 28 <sup>th</sup>
February	March 31 <sup>st</sup>
March	April 30 <sup>th</sup>
April	May 24 <sup>th</sup>
Мау	June 16 <sup>th</sup> (Incomplete lab)

# What will we do when students have already learned it?

Students who master the standards before the end of the unit will be offered enrichment assignments or projects to extend their learning. Students who decline are expected to complete required unit assignments and assessments.

# Procedures

- Students are expected to inquire about missed learning/assignments immediately upon return from an absence.
- Daily participation is expected.
- Field Trips are a reward for reaching educational expectations. Earning an A,B, or C in an Honors Course is expected; AP Calculus BC is an honors course. Therefore, students who are not earning an A,B, or C will not be approved to go on Field Trips.
- Parents and students are strongly encouraged to use Skyward Family Access to be informed on students' progress.
- Parent Liaison Contact Information: Mr. Joshua Galvan 708-780-4000 ext. 2009 or JoshuaGalvan@jsmorton.org
- Students are expected to have the following materials:
  - o Textbook: Calculus for the AP Course, Sullivan & Miranda <u>hs.saplinglearning.com/ibiscms/login/</u>
  - Binder: for notes, homework, quizzes, tests
  - Pencils & Erasers
  - Graphing Calculator (TI-Nspire CX or TI-Nspire CAS)

# **CLASS EXPECTATION**

Learn as best as you can every minute of every day and encourage others to do the same.

# Calculus BC Functions, Graphs, and Limits

Standard	5	4	3	2	1	0
Find the limits of functions graphically, numerically, and analytically	Student can find limits accurately and justify with perfect notation.	Student can find limits accurately and justify.	Student can find limits accurately.	Student can find limits using all 3 methods.	Student can find the limit in 2 of the 3 methods.	Student makes no attempt or limited attempt to find a limit.
Understand the continuity of a function	With perfect notation, student finds left- handed limit, right- handed limit, and function value all with accuracy and justification.	Student finds left- handed limit, right- handed limit, and function value all with accuracy and justification.	Student finds left- handed and right- handed limits and function value accurately.	Student finds left- handed and right- handed limits and function value.	Student finds left- handed limit, right- handed limits or function value.	Student makes no attempt or limited attempt to find a limit.
Discuss one-sided limits	Student can find limits accurately and justify with perfect notation.	Student can find limits accurately and justify.	Student can find limits accurately.	Student can find limits using all 3 methods.	Student can find the limit in 2 of the 3 methods.	Student makes no attempt or limited attempt to find a limit.
Use limits to find limits at infinity and infinite limits	Student can find limits accurately and justify with perfect notation.	Student can find limits accurately and justify.	Student can find limits accurately.	Student can find limits using all 3 methods.	Student can find the limit in 2 of the 3 methods.	Student makes no attempt or limited attempt to find a limit.
Analyze planar curves including parametric, polar, and vector form	Student can analyze planar curves including parametric, polar and vector form accurately and justify with perfect notation.	Student can analyze planar curves including parametric, polar and vector form accurately and justify.	Student can analyze planar curves including parametric, polar and vector form accurately.	Student can analyze planar curves using all 3 forms.	Student can analyze planar curves in 2 of the 3 forms.	Student makes no attempt or limited attempt to analyze planar curves including parametric, polar, and vector form

# Calculus BC Differentiation

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	parametric, polar,		, 0				· · · · ·
	and vector form,	-		•			
		accurately and justify	accurately and justify.	acceleration accurately.			including velocity and
and acceleration acceleration.		with perfect notation.					acceleration.

	Student can apply rules	Student can apply rules	Student can apply rules	Student can apply rules	Student can apply	Student makes no
	of differentiation to	of differentiation to	of differentiation to	of differentiation to	rules of differentiation	attempt or limited
Apply rules of	implicit equations,	implicit equations,	implicit equations,	implicit equations,	to implicit equations.	attempt to apply rules of
differentiation to	including the product,	including the product,	including the product,	including the product,		differentiation to implicit
implicit equations.	quotient, and chain rules	quotient, and chain rules	quotient, and chain	quotient, and chain		equations.
	accurately and justify	accurately and justify.	rules accurately.	rules.		
	with perfect notation.					

# Calculus BC Applications of Derivatives

Standard	5	4	3	2	1	0
Understand the Extreme and Mean Value Theorems	Student uses correct notation, function values and perfect justification for both theorems.	Student uses correct function values and perfect justification for both theorems.	Student uses correct function values and justifies for both theorems.	Student can use the Extreme and Mean Value Theorems.	Student can use the Extreme or Mean Value Theorem.	Student attempts to use non-Calculus methods or no attempt.
Determine extrema and increasing/decreasi ng behavior of a function	Student perfectly identifies critical points to determine extrema and intervals of increasing/decreasing with correct notation.	Student uses critical points to determine extrema and intervals of increasing/decreasing with notation.	Student uses critical points to determine extrema and intervals of increasing/decreasing.	Student uses critical points to determine extrema or intervals of increasing/decreasing.	Student can find critical points and determine intervals.	Student attempts to use non-Calculus methods or no attempt.
Use the 2 <sup>nd</sup> derivative test to determine extrema	Student can find limits accurately and justify with perfect notation.	Student can find limits accurately and justify.	Student can find limits accurately.	Student can find limits using all 3 methods.	Student can find the limit in 2 of the 3 methods.	Student makes no attempt or limited attempt to find a limit.
Use the 2 <sup>nd</sup> derivative to determine concavity	Student can find limits accurately and justify with perfect notation.	Student can find limits accurately and justify.	Student can find limits accurately.	Student can find limits using all 3 methods.	Student can find the limit in 2 of the 3 methods.	Student makes no attempt or limited attempt to find a limit.
Solve optimization problems	Student accurately solves using the derivative with perfect explanation and units.	Student accurately solves using the derivative with perfect explanation.	Student accurately solves using the derivative.	Student finds the derivative accurately to attempt to solve.	Student finds the derivative to attempt to solve.	Student attempts to use non-Calculus methods or no attempt.
Calculate linear approximations	Student accurately calculates the equation of the tangent line and uses it to approximate with perfect notation and justification.	Student accurately calculates the equation of the tangent line and uses it to approximate with justification.	Student accurately calculates the equation of the tangent line and uses it to approximate.	Student accurately calculates the equation of the tangent line.	Student calculates the equation of the tangent line.	Student makes no or limited attempt.
Solve related rate problems	Student accurately solves using the derivative with perfect explanation and units.	Student accurately solves using the derivative with perfect explanation.	Student accurately solves using the derivative.	Student finds the derivative accurately to attempt to solve.	Student finds the derivative to attempt to solve.	Student attempts to use non-Calculus methods or no attempt.

# Calculus BC Definite Integrals

Standard	5	4	3	2	1	0
Calculate areas using the rectangular approximation methods.	Student can calculate areas using the left, right, and midpoint rectangular approximation methods accurately and justify	Student can calculate areas using the left, right, and midpoint rectangular approximation methods accurately and justify.	Student can calculate areas using the left, right, and midpoint rectangular approximation methods accurately.	Student can calculate areas using the left, right, and midpoint rectangular approximation.	Student can calculate areas using the left and right rectangular approximation methods.	Student makes no attempt or limited attempt to calculate areas using the rectangular approximation methods
Use Riemann Sums with uneven subintervals.	with accurate notation. Student can use left, right, and midpoint Riemann Sums with uneven subintervals accurately and justify with accurate notation.	Student can use left, right, and midpoint Riemann Sums with uneven subintervals accurately and justify.	Student can use left, right, and midpoint Riemann Sums with uneven subintervals accurately.	Student can use left, right, and midpoint Riemann Sums with uneven subintervals.	Student can use left and right Riemann Sums with uneven subintervals.	Student makes no attempt or limited attempt to use left and right Riemann Sums with uneven subintervals.
Use the definite integral as a limit of Riemann Sums.	Student can write and evaluate the definite integral as a limit of Riemann Sums accurately and justify with accurate notation.	Student can write and evaluate the definite integral as a limit of Riemann Sums accurately and justify.	Student can write and evaluate the definite integral as a limit of Riemann Sums accurately.	Student can write accurately and evaluate the definite integral as a limit of Riemann Sums.	Student can write and evaluate the definite integral as a limit of Riemann Sums.	Student makes no attempt or limited attempt to write and evaluate the definite integral as a limit of Riemann Sums.
Use technology to calculate the definite integral.	Student can use technology to calculate the definite integral, including trig functions, accurately and justify with accurate notation.	Student can use technology to calculate the definite integral, including trig functions, accurately and justify.	Student can use technology to calculate the definite integral, including trig functions, accurately.	Student can use technology to calculate the definite integral, including trig functions.	Student can use technology to calculate the definite integral.	Student makes no attempt or limited attempt to use technology to calculate the definite integral.
Understand the Mean Value Theorem for Integrals and Average Value Theorem	Student uses correct notation, function values and perfect justification for both theorems.	Student uses correct function values and perfect justification for both theorems.	Student uses correct function values and justifies for both theorems.	Student can use the Mean Value Theorem for Integrals and the Average Value Theorem.	Student can use the Mean Value Theorem for Integrals or the Average Value Theorem.	Student attempts to use non-Calculus methods or no attempt.
Understand basic rules of antidifferentiation, including trig, logarithmic, and exponential, parametric, polar and vector functions	Student can find the antiderivative using the basic rules of antidifferentiation, including trig, logarithmic, and exponential functions accurately and justify with perfect notation.	Student can find the antiderivative using the basic rules of antidifferentiation, including trig, logarithmic, and exponential functions accurately and justify.	Student can find the antiderivative using the basic rules of antidifferentiation, including trig, logarithmic, and exponential functions accurately.	Student can find the antiderivative using the basic rules of antidifferentiation, including trig, logarithmic, and exponential functions.	Student can use the basic rules of antidifferentiation, including trig, logarithmic, or exponential functions.	Student makes no attempt or limited attempt to find the antiderivative using basic rules of antidifferentiation, including trig, logarithmic, and exponential functions.

Apply the technique of substitution to antidifferentiate functions	Student can apply the technique of substitution to antidifferentiate functions accurately and justify with perfect notation.	Student can apply the technique of substitution to antidifferentiate functions accurately and justify.	Student can apply the technique of substitution to antidifferentiate functions accurately.	Student can apply the correct substitution and the technique of substitution to antidifferentiate functions.	Student can recognize the correct substitution needed to antidifferentiate functions.	Student makes no attempt or limited attempt to apply the product, quotient, or chain rules to differentiate functions.
Use the Fundamental Theorem of Calculus to find the derivative of an integral	Students uses the Fundamental Theorem of Calculus to find the derivative of an integral accurately and justify with perfect notation.	Students uses the Fundamental Theorem of Calculus to find the derivative of an integral accurately and justify.	Students uses the Fundamental Theorem of Calculus to find the derivative of an integral accurately.	Students can recognize that the derivative of an integral are inverse operations and uses the Fundamental Theorem of Calculus to find the derivative of an integral	Students can recognize that the derivative of an integral are inverse operations.	Students makes no attempt or limited attempt to use the Fundamental Theorem of Calculus to find the derivative of an integral
Use the definite integral as a limit of Trapezoid Sums	Student can use the definite integral as a limit of Trapezoid Sums accurately and justify with accurate notation.	Student can use the definite integral as a limit of Trapezoid Sums accurately and justify.	Student can use the definite integral as a limit of Trapezoid Sums accurately.	Student can use the definite integral as a limit of Trapezoid Sums.	Student can recognize the definite integral as a limit of Trapezoid Sums	Student makes no attempt or limited attempt to use the definite integral as a limit of Trapezoid Sums

## Calculus BC Differential Equations & Mathematical Modeling

Standard	5	4	3	2	1	0
Construct and analyze slope fields	Student can construct and analyze slope fields accurately and justify	Student can construct and analyze slope fields accurately and justify.	Student can construct and analyze slope fields accurately.	Student can construct and analyze slope fields.	Student can construct or analyze slope fields	Student can construct and analyze slope fields accurately.
Determine numerical solutions of differential equations using	with accurate notation. Student can determine numerical solutions of differential equations using Euler's method accurately and justify	Student can determine numerical solutions of differential equations using Euler's method accurately and justify.	Student can determine numerical solutions of differential equations using Euler's method accurately.	Student can determine numerical solutions of differential equations using Euler's method.	Student can use numerical solutions of differential equations using Euler's method.	Student makes no attempt or limited attempt to determine numerical solutions of differential equations
Euler's method Solve separable differential equations	with proper notation. Student can solve separable differential equations accurately and justify with accurate notation.	Student can solve separable differential equations accurately and justify.	Student can solve separable differential equations accurately.	Student can separate and antiderive a separable differential equation.	Student can separate a separable differential equation.	using Euler's method. Student makes no attempt or limited attempt to separate a separable differential equation
Apply differential equations to real- life problems	Student can apply differential equations to real-life problems accurately and justify with accurate notation.	Student can apply differential equations to real-life problems accurately and justify.	Student can apply differential equations to real-life problems accurately.	Student can separate and antiderive a separable differential equation in a real-life problem.	Student can separate a separable differential equation in a real-life problem.	Student makes no attempt or limited attempt apply differential equations to real-life problems accurately.

## Calculus BC Applications of Definite Integrals

Standard	5	4	3	2	1	0
	Student can determine	Student can determine	Student can determine	Student can determine	Student can recognize	Student makes no
Determine the area	the area between curves	the area between curves	the area between	the area between curves	the area between	attempt or limited
between curves	and the area enclosed	and the area enclosed	curves and the area	and the area enclosed	curves and the area	attempt to determine
and the area	by intersecting curves	by intersecting curves	enclosed by	by intersecting curves	enclosed by	the area between
enclosed by	with respect to x	with respect to x	intersecting curves with	with respect to x.	intersecting curves	curves and the area
intersecting curves	accurately and justify	accurately and justify.	respect to x accurately.		with respect to x.	enclosed by
with respect to x	with accurate notation.					intersecting curves
						with respect to x.
	Student can determine	Student can determine	Student can determine	Student can determine	Student can recognize	Student makes no
Determine the area	the area between curves	the area between curves	the area between	the area between curves	the area between	attempt or limited
between curves	and the area enclosed	and the area enclosed	curves and the area	and the area enclosed	curves and the area	attempt to determine
and the area	by intersecting curves	by intersecting curves	enclosed by	by intersecting curves	enclosed by	the area between
enclosed by	with respect to y	with respect to y	intersecting curves with	with respect to y.	intersecting curves	curves and the area
intersecting curves	accurately and justify	accurately and justify.	respect to y accurately.		with respect to y.	enclosed by
with respect to y	with accurate notation.					intersecting curves
. ,						with respect to y.
	Student can determine	Student can determine	Student can determine	Student can determine	Student can recognize	Student makes no
Determine the area	the area bounded by	the area bounded by	the area bounded by	the area bounded by	the area bounded by	attempt or limited
bounded by polar	polar curves accurately	polar curves accurately	polar curves accurately.	polar curves.	polar curves	attempt to determine
curves	and justify with proper	and justify.				the area bounded by
	notation.					polar curves.
	Student can calculate	Student can calculate	Student can calculate	Student can calculate	Student can calculate	Student makes no
Calculate the	the volume of a solid	the volume of a solid	the volume of a solid	the volume of a solid	the volume of a solid	attempt or limited
volume of a solid	using Disk and Washer	using Disk and Washer	using Disk and Washer	using Disk and Washer	using Disk or Washer	attempt to calculate
using Disk and	Methods accurately and	Methods accurately and	Methods accurately.	Methods.	Methods.	the volume of a solid
Washer Method	justify with accurate	justify.				using Disk or Washer
	notation.					Methods
Calculate the	Student can calculate	Student can calculate	Student can calculate	Student can calculate	Student can recognize	Student makes no
volume of a solid	the volume of a solid	the volume of a solid	the volume of a solid	the volume of a solid	the volume of a solid	attempt or limited
using Cross	using Cross Sections	using Cross Sections	using Cross Sections	using Cross Sections.	using Cross Sections	attempt to calculate
Sections	accurately and justify	accurately and justify.	accurately.			the volume of a solid
Sections	with accurate notation.					using Cross Sections.
	Student can find the	Student can find the	Student can find the	Student can find the	Student can find the	Student makes no
Find the length of a	length of a curve,	length of a curve,	length of a curve,	length of a curve,	length of a curve.	attempt or limited
curve, including a	including a curve given	including a curve given	including a curve given	including a curve given		attempt to find the
curve given in	in parametric form	in parametric form	in parametric form	in parametric form.		length of a curve,
parametric form	accurately and justify	accurately and justify.	accurately.			including a curve given
	with proper notation.					in parametric form.

## Calculus BC L'Hôpital's Rule and Improper Integrals

Standard	5	4	3	2	1	0
Apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series	Students can apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series accurately and justify with perfect notation.	Students can apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series accurately and justify.	Students can apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series accurately.	Students can apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series.	Students can apply L'Hôpital's Rule.	Students make no attempt or limited attempt to apply L'Hôpital's Rule, including its use in determining limits and convergence of improper integrals and series.
Apply the technique of improper integrals as limits of definite integrals	Students can apply the technique of improper integrals as limits of definite integrals accurately and justify with perfect notation.	Students can apply the technique of improper integrals as limits of definite integrals accurately and justify.	Students can apply the technique of improper integrals as limits of definite integrals accurately.	Students can apply the technique of improper integrals as limits of definite integrals.	Students can recognize the technique of improper integrals as limits of definite integrals	Students make no attempt or limited attempt to apply the technique of improper integrals as limits of definite integrals.

# Calculus BC Infinite Series

Standard	5	4	3	2	1	0
Understand the	Students can understand	Students can understand	Students can	Students can understand	Students can	Students make no
concept of series as	the concept of series as	the concept of series as	understand the	the concept of series as	recognize the concept	attempt or limited
a sequence of	a sequence of partial	a sequence of partial	concept of series as a	a sequence of partial	of series as a	attempt to understand
partial sum as	sum as converging or	sum as converging or	sequence of partial	sum as converging or	sequence of partial	the concept of series as a
•	diverging with	diverging with	sum as converging or	diverging with	sum as converging or	sequence of partial sum
converging or	motivating examples	motivating examples	diverging with	motivating examples.	diverging with	as converging or
diverging with	accurately and justify	accurately and justify.	motivating examples		motivating examples	diverging with motivating
motivating	with perfect notation.		accurately.			examples.
examples						
Use Taylor	Students can use Taylor	Students can use Taylor	Students can use Taylor	Students can use Taylor	Students can	Students make no
polynomial	polynomial	polynomial	polynomial	polynomial	recognize Taylor	attempt or limited
approximation with	approximation with	approximation with	approximation with	approximation with	polynomial	attempt to use Taylor
graphical	graphical demonstration	graphical demonstration	graphical	graphical demonstration	approximation with	polynomial
demonstration of	of convergence	of convergence	demonstration of	of convergence.	graphical	approximation with
	accurately and justify	accurately and justify.	convergence		demonstration of	graphical demonstration
convergence	with perfect notation.		accurately.		convergence.	of convergence.
Manipulate Taylor	Students can manipulate	Students can manipulate	Students can	Students can manipulate	Students can	Students make no
series centered at	Taylor series centered at	Taylor series centered at	manipulate Taylor	Taylor series centered at	manipulate Taylor	attempt or limited
<i>x=a</i> including	<i>x=a</i> including	<i>x=a</i> including	series centered at x=a	<i>x=a</i> including	series centered at x=a	attempt to manipulate
substitution,	substitution,	substitution,	including substitution,	substitution,	including substitution,	Taylor series centered at
differentiation,	differentiation,	differentiation,	differentiation,	differentiation,	differentiation,	<i>x=a</i> including
antidifferentiation,	antidifferentiation, and	antidifferentiation, and	antidifferentiation, and	antidifferentiation, and	antidifferentiation, or	substitution,
and the formation	the formation of new	the formation of new	differentiation,			
	series from known series	series from known series	series from known	series from known	series from known	antidifferentiation, and
of new series from	accurately and justify	accurately and justify.	series accurately.	series.	series.	the formation of new
known series	with perfect notation.					series from known series.
Identify and use	Students can identify	Students can identify	Students can identify	Students can identify	Students can identify	Students make no
the Maclaurin	and use the Maclaurin	and use the Maclaurin	and use the Maclaurin	and use the Maclaurin	and use the Maclaurin	attempt or limited
Series centered at	Series centered at <i>x=a</i>	Series centered at x=a	Series centered at x=a	Series centered at x=a	Series centered at x=a	attempt to identify and
x=a for the	for the functions e <sup>x</sup> , sin	for the functions e <sup>x</sup> ,	use the Maclaurin Series			
functions e <sup>x</sup> , sin x,	1	1	1	1	. 1	centered at <i>x=a</i> for the
	x, cos x and $\frac{1}{1-x}$	x, cos x and $\frac{1}{1-x}$	x, cos x and $\frac{1}{1-x}$	x, cos x and $\frac{1}{1-x}$ .	sin x, cos x or $\frac{1}{1-x}$ .	functions e <sup>x</sup> , sin x, cos x
$\cos x$ and $\frac{1}{}$	accurately and justify	accurately and justify.	accurately.	1 10	1 //	1
1-x	with proper notation.	accuracely and justify.	accuracely.			and $\frac{1-x}{1-x}$ .
	Students can use	Students can use	Students can use	Students can use	Students can	Students make no
Use Lagrange error	Lagrange error bound	Lagrange error bound	Lagrange error bound	Lagrange error bound	recognize Lagrange	attempt or limited
bound for Taylor	for Taylor polynomials	for Taylor polynomials	for Taylor polynomials	for Taylor polynomials.	error bound for Taylor	attempt to use Lagrange
polynomials	accurately and justify	accurately and justify.	accurately.		polynomials.	error bound for Taylor
porynomiais	with proper notation.				P /	polynomials.

Determine radius	Students can determine radius and interval of	Students can determine radius and interval of	Students can determine radius and	Students can determine radius and interval of	Students can determine radius or	Students make no attempt or limited
and interval of	convergence of power	convergence of power	interval of convergence	convergence of power	interval of	attempt to determine
convergence of	series accurately and	series accurately and	of power series	series.	convergence of power	radius and interval of
power series	justify with proper	justify.	accurately.		series.	convergence of power
	notation.					series.
Understand the	Students can understand	Students can understand	Students can	Students can understand	Students can	Students make no
convergence of	the convergence of	the convergence of	understand the	the convergence of	understand the	attempt or limited
geometric,	geometric, harmonic,	geometric, harmonic,	convergence of	geometric, harmonic,	convergence of	attempt to understand
harmonic, and	and alternating series	and alternating series	geometric, harmonic,	and alternating series.	geometric, harmonic,	the convergence of
,	accurately and justify	accurately and justify.	and alternating series		or alternating series.	geometric, harmonic, and
alternating series	with proper notation.		accurately.			alternating series.
Determine the	Students can determine	Students can determine	Students can	Students can determine	Students can	Students make no
appropriate tests	the appropriate tests for	the appropriate tests for	determine the	the appropriate tests for	determine the	attempt or limited
for convergence,	convergence, including	convergence, including	appropriate tests for	convergence, including	appropriate tests for	attempt to determine the
including ratio, n <sup>th</sup>	ratio, n <sup>th</sup> term, integral,	ratio, n <sup>th</sup> term, integral,	convergence, including	ratio, n <sup>th</sup> term, integral,	convergence,	appropriate tests for
	and comparison tests	and comparison tests	ratio, n <sup>th</sup> term, integral,	and comparison tests	including ratio, n <sup>th</sup>	convergence, including
term, integral, and	accurately and justify	accurately and justify.	and comparison tests		term, integral, or	ratio, n <sup>th</sup> term, integral,
comparison tests	with proper notation.		accurately.		comparison tests	and comparison tests.