Calculus B/C Syllabus

Course Summary

This course is meant for students ages 15 to 18 who have completed, at a minimum, the Common Core (or equivalent) curriculum for Algebra 2, Geometry and PreCalculus. Students will be exposed to the Focus Areas section listed below with a focus on **Introductory Calculus and Calculus BC** testing, and we expect students to master the skills listed in the Expected Outcomes section listed below.

Important Note: We recommend that this course is done the year before your student plans to take their BC test (or in parallel with their school's Calculus curriculum), since testing is done before the end of this class calendar. This course overlaps with Calculus A/B in a lot of content. Students may find the first half similar to A/B, though we do go deeper.

Focus Areas at this Level

Concepts, skills, and learning tools students see in this course include, but are not limited to:

- Derivatives
- Integrals
- Infinite Series

Expected Outcomes

Students will be **expected to adequately perform in or explain** the following areas after course completion:

- Function continuity and limits
- Understanding and calculating derivatives of common functions
- Applying derivatives to real life situations
- Understanding and performing integrations of common functions including
    - Antiderivatives, Chain Rule
    - Integration by parts, Substitution methods, Partial fractions
- Applying integrals to real life situations
    - Areas and Volumes of planar and 3D figures
    - Length of a curve, Average value of a function
- Limits involving infinity
    - Mean Value Theorem, rational and exponential indeterminate forms, L'Hopital's Rule, improper integrals
- Defining and understanding differential equations including second-order linear d.e.
- Infinite Series including Taylor, MacLaurin, power series, ratio testing and more

Pre Requisites

Students registering for this course should be **comfortable with the following Math**:

- Introductory Geometry for
    - trigonometric functions and identities
- Algebra 2 and Precalculus concepts for
    - graphing, solving equations, and systems of equations with 3 unknowns
    - logarithms and exponential functions

    - polynomials (factoring, finding roots, behavior of graphs)
    - sequences and series
    - radians, polar coordinates and complex numbers

Students should also be **willing and able to**:

- Communicate in English at a beginner's level
- Be respectful of other students in their classes
- Practice writing things down on paper
- Share their thoughts with the instructors to help them discover solutions to their problems
- Take constructive criticism when it comes to their learning habits

Course Materials (Required)

- All classes will be taught online, via **Zoom**. Your student will need a device with a microphone and camera.
- Homework will be assigned via the textbook:
    - Art of Problem Solving's Calculus by David Patrick (2nd Edition)
    - Purchasable here: https://artofproblemsolving.com/store ; **Mandatory purchase** required
    - Physical or eBook contain the same problems
- Parents are expected to have read and understood EMC's policies
    - Parents should review the expectations in class with their student(s)
    - Parents of this age group may need to help their students learn the technology used on the student's end

Students should also have access to:

- **Graphing** Calculator
    - AP Exams Calculator Policy – AP Students | College Board
- Paper, Pencils, Ruler and Erasers
- Colored pencils or markers
- Reliable internet connection and digital device

Homework Expectations

Homework at EMC is set up to be flexible for the needs of your student. Usually we feel students fall into three general categories:

- EMC is **replacing public school or** accelerating my student for **testing out of Math** in the future
    - All Homework is **mandatory**
- EMC is helping **improve my grades** or **skills**
    - Homework is **highly recommended**, we recommend concentrating on school homework first
- EMC is for **interest's sake** and/or for **exposure** to problem solving **before seeing it in school**
    - Homework is **recommended, yet optional**

Homework Delivery

Homework is delivered in a two main ways:

- **Practice Homework**
    - Assigned through Khan Academy

    - PDFs of our lesson slides are posted weekly and include extra questions (those not covered in class)

- **Assessment Homework** (aka Quizzes, Tests)
    - Canvas, set of questions to show instructors a student's understanding of the content
    - Auto-graded upon submission
    - Instructors adjust grades after seeing results to give partial marks where appropriate, and plan to cover certain problem areas in the Homework Check portion of next class

Course Calendar

On yellow dates on the calendar below, no classes are held. Some days of the week (Sat, Sun, Mon) have less classes per year. These courses will have slightly condensed in-class schedules, and your instructor will let you know which homework assignments to do each week.

EMC SCHOOL

2026-2027 School Calendar

August 2026

M	Tu	W	Th	F	Sa	Su
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September 2026

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

October 2026

M	Tu	W	Th	F	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November 2026

M	Tu	W	Th	F	Sa	Su
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

December 2026

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

January 2027

M	Tu	W	Th	F	Sa	Su
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February 2027

M	Tu	W	Th	F	Sa	Su
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March 2027

M	Tu	W	Th	F	Sa	Su
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April 2027

M	Tu	W	Th	F	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May 2027

M	Tu	W	Th	F	Sa	Su
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June 2027

M	Tu	W	Th	F	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

First and Last Day of School
School Holidays & Vacations

Aug 17	First Day of Classes
Sep 5 - 7	Labor Day Weekend - No Classes
Nov 23 - 29	Thanksgiving Week - No Classes
Dec 21 - Jan 3	Winter Break - No Classes
Apr 12 - 18	Spring Break - No Classes
May 29 - 31	Memorial Day - No Classes
Jun 13	Last Day of School

Course Itinerary

Chapter	Lesson	Class Dates	Homework Assigned
Chapter 1: Limits and Continuity	1) What's the Limit?	Aug 17- Aug 23	Estimating limit values from graphs One-sided limits from graphs Connecting limits and graphical behavior Creating tables for approximating limits Estimating limits from tables One-sided limits from tables Limits of combined functions: sums and differences Limits of combined functions: products and quotients Limits by factoring Limits using conjugates Limits using trig identities Limits of composite functions Squeeze theorem
	2) Continuity	Aug 24 - Aug 30	Continuity at a point (graphical) Continuity at a point (algebraic) Continuity over an interval Continuity and common functions Removable discontinuities Infinite limits: graphical Infinite limits: algebraic Limits at infinity of quotients Limits at infinity of quotients with square roots Using the intermediate value theorem Justification with the intermediate value theorem
Chapter 2: Derivatives	3) What's the Derivative?	Aug 31 - Sept 6 OFF Sat Sept 5, Sun Sept 6 Labor Day	Secant lines & average rate of change Derivative as slope of curve The derivative & tangent line equations Derivative as a limit Estimate derivatives Differentiability at a point: graphical Differentiability at a point: algebraic
	4) Common Derivatives	Sept 7 - Sept 13 OFF Mon Sept 7 Labor Day	Power rule (positive integer powers) Power rule (negative & fractional powers) Power rule (with rewriting the expression) Basic derivative rules: find the error Basic derivative rules: table Differentiate polynomials Tangents of polynomials Derivatives of sin(x) and cos(x) Derivatives of e^x and ln(x) Second derivatives *

Chapter 3: Derivatives	**5) Product and Quotient Rules**	Sept 14 - Sept 20	Differentiate products Product rule with tables Differentiate quotients Quotient rule with tables Differentiate rational functions Derivatives of tan(x), cot(x), sec(x), and csc(x)
	6) Chain Rule	Sept 21 - Sept 27	Identify composite functions Chain rule intro Chain rule with tables Derivatives of a^x and $\log_a x$ Chain rule capstone
	7) Inverses	Sept 28 - Oct 4	Derivatives of inverse functions Derivatives of inverse trigonometric functions Differentiating functions: Find the error Manipulating functions before differentiation Differentiating using multiple rules: strategy Differentiating using multiple rules Second derivatives (implicit equations)
Chapter 4: Derivatives in Real Life	**8) Graphs and Derivatives**	Oct 5 - Oct 11	Interpreting the meaning of the derivative in context Interpret motion graphs Motion problems (differential calc) Rates of change in other applied contexts (non-motion problems)
	9) Max / Min Optimization	Oct 12 - Oct 18	Approximation with local linearity Relative minima & maxima * Absolute minima & maxima (closed intervals) * Absolute minima & maxima (entire domain) * Optimization *
	10) Related Rates	Oct 19 - Oct 25	Analyzing related rates problems: expressions Analyzing related rates problems: equations Differentiate related functions Related rates intro Related rates (multiple rates) Related rates (Pythagorean theorem) Related rates (advanced)
	11) Mean Value Theorem	Oct 26 - Nov 1	Using the mean value theorem Justification with the mean value theorem

Chapter 5: Analytical Differentiation	**12) Concavity, Inflection, Asymptotes**	Nov 2 - Nov 8	Find critical points Increasing & decreasing intervals Concavity intro Inflection points intro Analyze concavity Find inflection points Second derivative test
	13) Sketching Functions	Nov 9 - Nov 15	Justification using first derivative Justification using second derivative Connecting f, f', and f'' graphically Tangents to graphs of implicit relations Analyze functions (calculator-active)
Chapter 6: Integrals	**14) Re-intro-gration**	Nov 16 - Nov 22	Accumulation of change Interpreting the behavior of accumulation functions Summation notation Finding definite integrals using area formulas Finding derivative with fundamental theorem of calculus Finding derivative with fundamental theorem of calculus: chain rule Reverse power rule Reverse power rule: negative and fractional powers Reverse power rule: sums & multiples
Holiday	**Thanksgiving**	**OFF** Nov 23 - Nov 29	**Have a great week!**
Chapter 6: Integrals	**15) Riemann Sums**	Nov 30 - Dec 6	Left & right Riemann sums Over- and under-estimation of Riemann sums Midpoint & trapezoidal sums Riemann sums in summation notation Definite integral as the limit of a Riemann sum
	16) Definite vs Indefinite	Dec 7 - Dec 13	Functions defined by definite integrals (accumulation functions) Finding definite integrals using algebraic properties Definite integrals over adjacent intervals The fundamental theorem of calculus and definite integrals Antiderivatives and indefinite integrals Indefinite integrals: e^x & 1/x Indefinite integrals: sin & cos

17) Winter Review		Dec 14 - Dec 20	● Review of Chapters 1 through 4
Holiday	**Winter Break**	**OFF 2 WEEKS** Dec 21 - Jan 3	**Have a great break!**
Chapter 6: Integrals	**18) Integrating by Parts**	Jan 4 - Jan 10	Definite integrals: reverse power rule Definite integrals: common functions Definite integrals of piecewise functions Integration by parts Integration by parts: definite integrals
	19) Integrate by Substitution	Jan 11 - Jan 17	*u*-substitution: defining *u* *u*-substitution: indefinite integrals *u*-substitution: definite integrals Integration using long division Integration using completing the square
	20) Partial Fractions	Jan 18 - Jan 24	Integration with partial fractions
	21) Improper Integrals	Jan 25 - Jan 31	Improper integrals L'Hôpital's rule: 0/0 L'Hôpital's rule: ∞/∞
Chapter 7: Differential Equations	**22) Leibniz and Lagrange Notations**	Feb 1 - Feb 7	Write differential equations Verify solutions to differential equations Implicit differentiation
	23) Slope Fields	Feb 8 - Feb 14	Slope fields & equations Reasoning using slope fields
	24) Approximation	Feb 15 - Feb 21	Euler's method **Catch Up Week!**
	25) Logistical Models	Feb 22 - Feb 28	Particular solutions to differential equations Differential equations: exponential model equations Differential equations: exponential model word problems Differential equations: logistic model word problems
	26) Separable Differential Equations	Mar 1 - Mar 7	Separable differential equations: find the error Separable differential equations Identify separable equations Particular solutions to separable differential equations

27) Spring Review		Mar 8 - Mar 14	• Review of Chapters 5 through 6 • **Math Map** Where does this go?
Chapter 8: Integral Applications	**28) Area, Particle Motion**	Mar 15 - Mar 21	Area between a curve and the x-axis Area between two curves given end points Area between two curves Horizontal areas between curves Area between curves that intersect at more than two points (calculator-active) Average value of a function Analyzing motion problems (integral calculus) Motion problems (with integrals) Arc length
	29) Volume	Mar 22 - Mar 28	Volumes with cross sections: squares and rectangles (intro) Volumes with cross sections: squares and rectangles Volumes with cross sections: triangles and semicircles Disc method: revolving around x- or y-axis Disc method: revolving around other axes Washer method: revolving around x- or y-axis Washer method: revolving around other axes
	30) Numerical Analysis	Mar 29 - Apr 4	Interpreting definite integrals in context Analyzing problems involving definite integrals Problems involving definite integrals (algebraic) Contextual and analytical applications of integration (calculator-active)
Chapter 9: Para- and Geo- metric	**31) Parametric / Polar Functions**	Apr 5 - Apr 11	Parametric equations differentiation Second derivatives (parametric functions) Parametric curve arc length Differentiate polar functions Tangents to polar curves Area bounded by polar curves intro Area between two polar curves Area with polar functions (calculator-active)
Holiday	**Spring Break**	**OFF** **Apr 12 - Apr 18**	**Have a great week!**
Chapter 9: Para- and Geo- metric	**32) Vector Valued Functions**	Apr 19 - Apr 25	Vector-valued functions differentiation Second derivatives (vector-valued functions) Planar motion (differential calc) Motion along a curve (differential calc) Planar motion (with integrals)

Chapter 10: Sequences and Series	**33) Ratio, Root, P-Series**	Apr 26 - May 2	Sequence convergence/divergence Partial sums intro Partial sums & series Infinite geometric series
	34) Convergence Tests	May 3 - May 9	n^{th} term test Integral test p-series Direct comparison test Limit comparison test Alternating series test Ratio test Determine absolute or conditional convergence Alternating series remainder
	35) Taylor, MacLaurin and more...	May 10 - May 16	Taylor & Maclaurin polynomials Lagrange error bound Interval of convergence Function as a geometric series Maclaurin series of sin(x), cos(x), and e^x Integrate & differentiate power series Integrals & derivatives of functions with known power series
Chapter 9: BC Prep	**36) Advanced Differentiation Review**	May 17 - May 23	**Unit Tests for Khan Unit #1, 2, 3, 4, 5**
	37) Advanced Integration Review	May 24 - May 30 OFF Sat Sun May 29 and 30 Memorial Day	**Unit Tests for Khan Unit #6, 7, 8**
	38) Chapter 9 and 10 Review	May 31 - June 6 OFF Mon May 31 Memorial Day	**Unit Tests for Khan Unit #9, 10** Unit 11 Solved Exams
39) Mock AP Calc BC Final		June 7 - June 13	In-class **live** AP Calculus AB test Solo, quiet, proctored by the instructor.