Welcome to AP Calculus BC!
Erie High School
Anna Panakhyo
Panakhyo_anna@svvsd.org

Introduction to AP Calculus:

AP Calculus is a rigorous course in which we will be covering all topics included on the AP Calculus BC Course Exam (more information at https://apstudent.collegeboard.org/apcourse/ap-calculus-bc). This course will cover the concepts of Calculus AB and the additional topics of Calculus BC, therefore we will have a very busy year! The major textbook is the 10th edition of Larson Calculus of a Single Variable AP Edition. My goal is to prepare you to do well on the AP exam, but also to become better problem solvers, critical thinkers and further develop your study skills. All of these are crucial for the transition into college.

All students are expected to take the AP exam at the end of the year. The cost was $93.00 for the 2016 exam. The AP exams are graded on a scale from 1 to 5. A score of 3 (qualified) may or may not earn you credit at colleges you are interested in. You will need to check with your particular college of interest to see what score you will need to be given credit. The AP Calculus BC exam will give you a AP Calculus AB sub-score, which may give you credit for Calculus 1 at your college. You will also get an AP Calculus BC score, which may give you credit for Calculus 2 at your college. Some colleges and programs may require you to re-take Calculus 1 and 2 at their school. The exposure here will be helpful, but you never know what topic your college/school will want you to know.

We will be using graphing calculators in this course and you can use graphing calculators on part of the AP Exam. The calculator I use and recommend is a TI-84. You are expected to bring your calculator everyday to class whether we use it that day or not. You are expected to know how to use certain functions of the graphing calculator including finding the intersection of two functions, finding the maximum and minimum of a function, using SOLVER to solve equations, fitting a window of a graph, changing graphing settings, and adjusting a table. If you need help using or learning these functions I will be available Thursday, May 19 after school for a graphing calculator training. I highly suggest anyone who does not know how to use these functions of the graphing calculator come to the calculator training as there is very little time in class to teach these graphing calculator functions.

Additionally, I suggest you get an AP Calculus review book to supplement the practice in class and from our textbook. On Schoology (schoology.svvsd.org), I will have a list of books that I suggest. This is not a requirement, but HIGHLY recommended.

Schoology (schoology.svvsd.org) will be used for the class website. On Schoology, I will post calendars, homework assignments, study aides, online resources and important information. Class notes will be posted on the website and students will be expected to print notes before class. The website is schoology.svvsd.org.

Summer Homework:

In order to get through all of the material by May, you have been assigned a summer assignment. In this assignment you will be reviewing concepts from previous math courses, practicing graphing using your calculator, and introducing yourself to the course material.

This summer assignment will count for a major portion of your semester homework grade; therefore, this is not an optional assignment. Your summer assignment will be due the first
day of class. Students who do not, or cannot complete this assignment should definitely ask themselves if they should be taking AP Calculus BC.

I suggest you complete the assignment in parts over the summer to avoid cramming the entire assignment until August. All of these problems were chosen to help students review and prepare over the summer, as well as familiarize you with the AP exam. Students are encouraged to work together, but any final work must be that of the individual student. You are encouraged to review and use your notes from previous math courses to help with the assignment.

Legibility and understandability are important. If your work is illegible, I cannot find your answer, or there is not support (work) for your answer, you will receive not credit for the problem. You can use your calculator to complete the summer homework, but please keep in mind that more than half of the AP exam is non-calculator. Therefore, do not rely too much on your calculator.

**Schoology:**

You will be added to a Schoology (schoology.svvsd.org) course for the summer. Most likely this will be a different Schoology course than we will use during the school year. I will use this Schoology site to share important information and resources throughout the summer. There will also be a discussion board where you can post questions for your peers and the teacher throughout the summer. It is an expectation that you check Schoology on a regular basis over the summer.

**Calculus Readiness Test for student who have NOT taken Calculus AB:**

Please use the Fresno State University Calculus Readiness Test (http://www.fresnostate.edu/csm/math/students/placement-exams/calc-readiness.html) to prepare for the upcoming year of calculus. There are two practice test available, and you will get immediate feedback. The problems on this readiness test are similar to the summer homework. This readiness test can help you determine any pre-requisite skills you need to revisit.

**Calc Camp:**

Calc Camp will be August 1-4 in T109 from 1-3 pm.

August 1 - Reviewing Precalculus skills and calculator tips
August 2 - Continued review of Pre-Calculus skills and limits
August 3 - Limits and Derivatives
August 4 - Parametric Equations

All students in Calculus BC are highly recommended to attend the August 4th session, as parametric equations may not have been covered in your Pre-Calculus class and will be included in Calculus BC.

Calc Camp is not required, but highly suggested.

**Other Online Resources:**

- [www.purplemath.com](http://www.purplemath.com)
- [www.kahnacademy.com](http://www.kahnacademy.com)
- [http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx](http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx)
- [http://www.mastermathmentor.com/calc/Ready.ashx](http://www.mastermathmentor.com/calc/Ready.ashx)
- [https://www.wolframalpha.com/](https://www.wolframalpha.com/)
If you have any questions, you can contact me over the summer at panakhyo_anna@svvsd.org. I will be out of town part of the summer, but generally check this e-mail every 2-3 days. Please send me a brief e-mail introducing yourself and so I have a way of contacting you over the summer.

I am looking forward to an exciting year in AP Calculus BC next year and getting to know all of you!

Have a good summer and see you in the fall,

Anna Panakhyo

**Summer Homework Part 1: Kahn Academy**

1. Go to kahnacademy.com

2. Create an account with your school e-mail address.

3. Once you log-in, you will see your name in the upper right corner. Click on the arrow next to your name. Click on “Profile.”
4. Your Dashboard will now be open. Click on “Coaches.”

5. Under “Add a Coach,” enter the AP Calculus BC 2016-2017 code ________. You will now be part of the course and Ms. Panakhyo can recommend you the following skills for you practice. It is suggested that you practice the skills in this order, as they may not be in this order on your screen. This is the most logical order. There are 20 skills you must practice.

- Finding limits numerically
- One sided limits from graphs
- Two-sided limits from graphs
- Two sided limits using algebra
- Continuity
- Limits at infinity where $f(x)$ is unbounded
- The formal and alternate form of the derivative
- Recognizing slope of curves
- Graphs of functions and their derivative
- Visualizing derivatives
- Power rule (basic)
- Special derivatives
- Chain rule on two functions
- Product Rule
- Quotient Rule
- Application of derivatives: tangent and normal lines
- Application of derivatives: motion along a line
- Extreme values from graphs
- Concavity and the second derivative
- Local linearization

You are not limited to only practicing these skills. You are welcome to practice additional Calculus skills as well. These will be the skills I will check for in August.
6. On the Dashboard bar, click on “Progress.” Then click on “Coach Recommendations.” At first you will see a grey/empty box under the “Mastery Status” column. Once you answer 5 questions in a row correctly you will reach the “Practiced” level. You will need to meet the at least the “Practiced” level for these 20 skills by the first day of school. Every so often you will get a Mastery Mission, where you can move up a level or reach the Mastery level. Complete these Mastery Missions.

7. For each skill, you will complete the exercises indicated with a star on the timeline on the left side of the screen. For the exercises, you can get a hint by clicking the “I’d like a hint.” You can also watch a video pertaining to the question’s topic. If this is a new topic or concept for you, I suggest you watch the videos and tutorials before the exercise indicated by an arrow on the timeline on the left-side of the screen.

8. If it has been a while since you logged into Kahn Academy to check your progress, make sure on your Progress screen on the top right of the chart you change “Activity from” to “Last 30 days” or “All time.” The automatic default is “Last 7 days.”
<table>
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<tr>
<th>Skills</th>
<th>Videos</th>
<th>Activity</th>
<th>Focus</th>
<th>Mastery Status</th>
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<tbody>
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<td>Applications of derivatives: Tangent and normal lines</td>
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<td>Continuity</td>
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Activity from: Last 7 days

- Needs Practice
- 0
- 5 in a row
Summer Homework Part 2: Problem Set

You will find an attached problem set that reviews limits, derivatives and applications. These problems are due the first day of class. Use your notes from previous math classes and Calculus AB to help you complete these problems. You may also work with others, but remember each person must turn in their own work. All work must be shown. If you use a calculator, you must set-up the problem on your paper and indicate what the calculator produced.

NOTE: Problems with an asterisks (**) are required for students who have taken AP Calculus AB. Students who have not taken AP Calculus AB may need to research how to complete theses problems. These problems are not required for students who have not taken AP Calculus AB, but recommended to try.

For #1-17, consider the graph of \( f \) below.

1) \( \lim_{{x \to 3^-}} f(x) = \) 
2) \( \lim_{{x \to 3^+}} f(x) = \) 
3) \( \lim_{{x \to 3}} f(x) = \)
4) \( \lim_{{x \to 6^-}} f(x) = \) 
5) \( \lim_{{x \to 6^+}} f(x) = \) 
6) \( \lim_{{x \to 6}} f(x) = \)
7) \( \lim_{{x \to 2^-}} f(x) = \)
8) \( \lim_{{x \to 2^+}} f(x) = \)
9) \( \lim_{{x \to 2}} f(x) = \)
10) \( \lim_{{x \to 4^-}} f(x) = \)
11) \( \lim_{{x \to 4^+}} f(x) = \)
12) \( \lim_{{x \to 4}} f(x) = \)
13) \( \lim_{{x \to \infty}} f(x) = \)
14) \( \lim_{{x \to -\infty}} f(x) = \)
15) \( f(2) = \)
16) \( f(3) = \)
Evaluate the following limits algebraically:

17) \( \lim_{x \to 1} \frac{x-1}{x^2-1} \)

18) \( \lim_{x \to 5} (2x^2 - 3x + 4) = \)

19) \( \lim_{x \to -2} \frac{x^2+2x-1}{5-3x} = \)

20) \( \lim_{x \to -3} \frac{x^2+x-6}{x^2-9} = \)

21) \( \lim_{t \to \infty} \frac{6t^2+5t}{(1-t)(2t-3)} = \)

22) \( \lim_{x \to \infty} \cos x = \)

23) \( \lim_{x \to \infty} \frac{2x^2}{5x^2-9x-2} = \)

24) \( \lim_{x \to \infty} \frac{x^2+x}{3-x} = \)

25) **Let \( f(x) = \begin{cases} x^2 - a^2x & \text{if } x < 2 \\ 4 - 2x^2 & \text{if } x \geq 2 \end{cases} \)

a) Find the \( \lim_{x \to 2^-} f(x) \)

b) Find the \( \lim_{x \to 2^+} f(x) \)

c) Find all values of \( a \) that make \( f \) continuous at 2. Justify your answer.

Find the derivative of the following

26) \( f(x) = x^{-2/5} \)

27) \( f(x) = x^3 - x^2 + 2x \)

28) **\( f(x) = 5e^x + 3 \)

29) \( f(x) = \sqrt[3]{x} \)

30) \( f(x) = \frac{\sqrt{10}}{x^7} \)

31) \( f(x) = \frac{x^2+4x+3}{\sqrt{x}} \)

32) **\( f(x) = x^2e^x \)

33) **\( f(x) = \frac{e^x}{x^2} \)

34) \( f(x) = \frac{x}{8-3x} \)

35) \( f(x) = \sin x + \cos x \)

36) \( f(x) = x^2 \cos x \)

37) \( f(x) = 2 \cot x - \sqrt{x} \sec x \)

38) **\( f(x) = (x^3 - 1)^{100} \)

39) **\( f(x) = \sqrt{x^2 - 7x} \)
40) ** If \( f(x) = x^2 - 2e^x \), find the value of \( f'(1) \)

41) If \( f(x) = 2x^2 - x^3 \), find \( f'(x) \), \( f''(x) \), and \( f'''(x) \)

42) Find the slope of the tangent line to the graph of \( g(x) = x^2 - 4 \) at the point \((1, -3)\).

43) Find the equation of the tangent line to the hyperbola \( y = \frac{3}{x} \) at the point \((3, 1)\).

44) ** Find \( \frac{dy}{dx} \) by implicit differentiation: \( x^2 + y^2 = 25 \)

45) ** Find \( \frac{dy}{dx} \) by implicit differentiation: \( x^2 - xy + y^3 = 8 \)
46) ** A particle moves according to a law of motion $s = f(t) = t^3 - 12t^2 + 36t$, $t \geq 0$, where $t$ is measured in seconds and $s$ in meters.
   
   a) Find the average velocity on the interval $[2, 7]$.
   
   b) Find the velocity at time $t$.
   
   c) What is the velocity after 3 seconds?
   
   d) When is the particle at rest?
   
   e) Find the total distance traveled during the first 8 seconds.
   
   f) Find the acceleration at time $t$.
   
   g) Find the acceleration after 3 seconds.
47) Suppose that a function \( f \) and its first derivative have the following values at \( x = 0 \) and \( x = 1 \).

<table>
<thead>
<tr>
<th></th>
<th>( f(x) )</th>
<th>( f'(x) )</th>
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<tbody>
<tr>
<td>0</td>
<td>9</td>
<td>-2</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>4</td>
</tr>
</tbody>
</table>

Find the first derivative of the following functions at the given values at \( x \).

a) \( 3f(x), x = 1 \)

b) \( xf(x), x = 1 \)

c) \( x^2f(x), x = 1 \)

d) \( \frac{f(x)}{x}, x = 1 \)

e) \( \frac{f(x)}{x^2+2}, x = 0 \)

f) \( f(x) \cdot f(x), x = 0 \)

48) The accompanying figure shows the graph of the derivative of a function \( f \). The domain of \( f \) is the closed interval \([-3, 3]\).

a) For what values of \( x \) in the open interval \((-3, 3)\) does \( f \) have a relative minimum? Justify your answer.

b) For what values of \( x \) in the open interval \((-3, 3)\) does \( f \) have a relative maximum? Justify your answer.

c) ** For what values of \( x \) is the graph of \( f \) concave up? Justify your answer.

d) ** Suppose \( f(-3) = 0 \). Sketch a possible graph of \( f \) on the domain \([-3, 3]\).