Calculus AB for New AP Teachers
July 10-13, 2018 – George Washington High School, Charleston, WV
Instructor: Paul Gruber
30 Contact hours

As an introduction, this workshop is a way to try and make a Calculus Teacher become a better Calculus teacher.   The discussions will be about what happens when grading the AP Calculus exam and how to better prepare your students in the learning of Calculus.   Please note that your input as to what works in your classroom is important in the overall success of this workshop so please share ideas of what works in your classroom (and what doesn't). If there are any specific topics that you, as a participant, want covered, please email me at P_Gruber@yahoo.com, I will try to accommodate your needs.

For the workshop:

Please bring the graphing calculator that you use in your school.   While I know how to use the TI-84, for those of you that use a different one, it behooves you to work with what your students will be using

Please bring a copy of the textbook that you use in your school. When setting up a calendar, it is most beneficial that you reference your textbook.

Please send me an email on any questions that you may have –

When time allows, I will try to also infuse additional multiple choice questions into the workshop as well as reference internet sites that are great. For those of you that want a head start, go to

DAY ONE

Introduction of self and all in group to introduce themselves. Give a brief overview of the week.

Simulating a day of grading the AP exam – the intensity, the pressure, the fun. – Describing what goes on at the AP reading. Share the layout, etc.

Introduce question # 3 or 4 – May 2018. Going through every single minute detail of the exam.

 Reviewing the grading process of 3-4 sample questions on the exam as done at the AP reading.

Rationale: New teachers will get to see the intensity of how detail oriented graders are when grading an exam

BREAK

Have teacher's grade exams in 35 minutes from question reviewed .   Afterwards, review the scores of what they see.

Simulate a table reader by looking at two people's grading – simulate discussion between the table reader and the table leader for all to see and to see the mechanics involved. Share the consensus scores

Looking at Understanding By Design and the Takeaways

A look at equity and research on why ALL students should have the opportunity to take the AP exam.

Looking at the curriculum. Discussion and samples of networking.

Setting up your course with equity in mind. When discussing equity, it is not just race, but also gender and socioeconomics.

Taking it to the Limit….. An investigation of Limits. To include looking at the Squeeze Theorem.   Looking at limits and continuity:

Review of limit approaching K

Review of limit approach zero

Look at Squeeze Theorem   Trigonometric limits.

Limit as x approaches infinity

Developing a timeline/ Calendar for the school year to be better organized and prepared

Look at multiple choice / FRQ limit questions.

 Homework: 2014 FRQ Q 4 , 5 and 6.   2004B Q 6

DAY TWO

Review HW and look at the nuances of where students made errors

Share discussion of the "look fors" in correcting these errors and of how one error can compound into a second and third error, which means losing points.

Review of some Limits. Looking at Indeterminate Forms

Introduce the recent changes on the AP Calculus exam AB from 2016-17

Give samples of the types of questions that will be asked – Introduction to L'Hopital's Rule.

Working with several examples that are 0/0

developing the derivative from the definition.

Proving the product rule and the quotient rule through Algebraic manipulation

Chain rule

Implicit differentiation

Proof of finding the derivative of $y = e^x$

Proof of $y = 2^x$ and $y = \ln X$ as well as $\log X$ Please note that I NEVER teach these three, I allow for discovery learning and for students to figure out the answer through prodding. Discussion on discovery learning and discussion of "flipping" the classroom……i.e Derivative of tan X

Making connections when sketching f(x), f'(x) and using f"(x).

Making connections between s(t), v(t) = s'(t) and a(t) = v'(t) = s"(t).

'Introduction of Brain-Based learning of understanding how students learn and what should be incorporated for student's to retain and understand what thy learn versus memorization of techniques.

Discuss "transfer" and give an example of transfer ----connecting prior knowledge to new knowledge. Also share information on TIMSS while connecting it to the Core content Standards and how it is connected to the teaching of Calculus.   Understanding Primacy Recency Theory.

Do ANOTHER QUESTION FROM AN OLD AP EXAM -

2:15 Looking at Related Rates: "Being a sucker" and activity that simulates related rates and gives students a hands-on activity.

3:30: discussion of what went well in the given activity and what can be improved. Also included in the discussion is for input of what the experienced teachers in the room does. Sharing of ideas.

Homework: Look at questions 2014: question 2 (page 243) 2008 released multiple choice calculator q (page 157 – 167) 2008 Q 1, 2, 3 (p 171 – 173)

DAY THREE

Review of Homework problems.

Begin the Trigonometric Derivatives – do several proofs –

Work on stage two of the annual calendar. – when to teach what in derivatives, how to teach it and what homework should you assign

Introduction to Calculator activities ---using the calculator on the AP exam.

Graphing a function and using the STO key to store the point of intersection (versus rounding too early)

Graphing the derivative and the integral

Finding the zeros / the turning point/ the point of inflection

Numerically calculate the derivative. Looking at specific examples

Hand out a circuit to practice

Do AP CALCULUS QUESTION 1 or 2. Review and Grade

<u>Lunch</u>

Go through proof. Use <u>module Curriculum Module: Integration, Problem Solving, and Multiple Representation </u>Handout 1, 2 and 3 (page 43).

Developing the Riemann Sums –

Making connection of the definition using Summation.

Discovering the first fundamental theorem of Calculus.

Looking at FTC Part 2:   Lesson 3: Accumulation. Discussion of the word "displacement"

Differentiate between net distance and total distance and "look" at the area under the curve.

AP Question with Riemann Sum, Tabular, Graphing Calculator,

Introduction of Volume.

   Developing the summation of volumes

Looking at volume questions and how to best organize it for students

Homework: 2008 NON-Calculator released questions: pages 139-167.

                 2008 FRQ Question 4-6 (page 174-175)   2009B Question 5

DAY FOUR

8:00 Review of homework.

More volume and developing rotation around Y = K as well as X = K. Do the BBM activity.

Introduction to cross sections. This is a hands-on activity that will take 40minu – 1 hour

"You Take the Cake". Looking at volume and developing a cross section. This is a hands-on activity that will take 40minu – 1 hour

Begin X-Sectional project – developing accuracy – a hands-on activity.

Developing the Calendar for Integrals.

Look at FRQ additional volume questions: use Calculus in Motion for demonstration purposes to visualize the question, AFTER you first draw it by hand!

Looking at the College Board Website – getting modules, secure tests, etc.

Ending the way we began. This piece can be modified, depending on what the participants want – meaning, I could develop several related rate problems.

Introduce question # 5 or 6– May 2018. Going through every single minute detail of the exam. Reviewing the grading process of sample questions on the exam.

Have teacher's grade exams in 35 minutes from question not yet graded. Afterwards, review the scores of what they see.

Closing discussion. Rehash the importance of equity/opportunity for all.

Rehash Good techniques" to further enhance student learning. i.e.. Brain-Based Learning, use of transfer in the classroom, changing the paradigm of expectations, redefining student capacity, Use of Primacy-Recency Theory. Developing pedagogy for the kinesthetic and visual learners versus only the auditory learners. And of course WRITING in the Calculus classroom.

Again, Encourage teachers to apply for this wonderful opportunity of grading the AP exam. This is the BEST professional development opportunity for any Calculus teacher.

While exhausted, participants will fill out evaluation

Graduate Credit Requirements

Paul Gruber, Instructor

West Virginia

July 2018

Teachers who desire graduate credit, will need to do an additional fifteen hours of contact time:

To that end, they will need to:

- Meet with teacher to discuss mini lesson that will be presented (on the last day) of the teaching of calculus.   (4-5 hours prep time)
- Grade two additional questions, aside from the ones to be done in class, from the 2018 exam. (3-4 hours of prep time)
- Develop a 12 question circuit on a specific Calculus subject --- to be shared with all participants
- Before class begins:
- Watch two AP Calculus or Calculus videos and create 10 multiple choice questions for each video that are imbedded into the video through the use of https://edpuzzle.com/
   if additional information is needed, please email me at P_Gruber@yahoo.com   Please have the knowledge that you will use this in your classroom while sharing with everyone else. (4-5 hours of prep time)
- View videos on TIMSS to discuss with classmates on the implication of Math Education in this country and towards creating equity in the teaching of AP Calculus.