

Summer 2021

Dear student,

Welcome to AP Calculus AB! I am so excited that you have decided to take this journey with me into the world of AP Calculus. I hope each one of you is also excepted and perhaps a bit nervous because you do not know what to expect. Part of your summer work is designed to help you become more familiar with AP Calculus.

There are two parts of this summer work. The goal is to help you prepare for AP Calculus when we begin in August. First, I would like you to investigate information about the AP Calculus course and the exam published by the College Board, the organization that writes and grades the exam, so you will have a better understanding about how we will approach the topics we will study. Second, I want you to review some Pre-calculus material to help you keep your math skills from becoming rusty over the summer.

These two assignments will have a corresponding entry in your OnCampus grade book. More about that will be shared when the course is set up in OnCampus in August. For now, please take some time to follow the links in the document, do some exploring on your own, review and keep your math skills sharp and get excited for our AP Calculus adventure. Should you need to contact me, email is the best way to reach me over the summer. I may not check email every day, but I will be checking periodically.

Mr. Krusz <u>kkrusz@ves.org</u>

AP Calculus Scavenger Hunt

Name:

due on/before August 23, 2021

For this objective you will be searching several websites for information and recording your findings in the space provided by each question. Beginning with the end in mind is one way to keep yourself focused when things seem to be more challenging than you might be used to this coming year.

First, we are going to explore the AP Calculus Course, so you know what you are getting yourself into. Click here to access the AP Calculus AB and BC Course and Exam Description booklet (.pdf)...

STARTING ON PAGE 7

1.) What are the three Big Ideas of AP Calculus?

- 1.
- 2.
- 3.
- 2.) AP Calculus features a *multi-representational* approach and students are expected, once they complete the course, to make connections among the four representations. What are the four representations?
- 1.
- 2.
- 3.
- 4.
- 3.) In terms of prerequisites for the class, what does the College Board suggest are three important foundations a student should know before entering an AP Calculus AB class.
 - 1.
 - 2.
 - 3.

- 4.) If you have not written an AP exam before, this may be the first time you have had to communicate on an exam with someone who has not been teaching you on a regular basis. Because of this, communication is a skill we will work on all year. Clear communication of four concepts is *essential* (College Board's term) on the AP exam. List these four concepts below.
 - 1.
 - 2.
 - 3.
 - 4.

Thinking about the first two weeks of May and the AP Exam (page 223)

- 1.) The exam has two parts what are they?
- 2.) How many minutes total can a student work on the exam? _____
- 3.) How many sections are on the exam? _____
- 4.) How many multiply choice questions are on the exam? _____
- 5.) How many "calculator active" multiple Choice questions are on the exam?_____
- 6.) How many free-response questions are on the exam? _____
- 7.) How many "calculator active" free-response questions are on the exam? _____
- 8.) Which *mathematical practice* is given the greatest weight on the Multiple-choice section?
- 9.) Which *mathematical practice(s)* is/are given the greatest weight on the free-response section?

Look at page Free Response question #1, Section II FREE RESPONSE Part A (AB or BC) on page 236.

Learning calculus can seem like learning another language (and similar skills are involved). Understanding the vocabulary used in AP Calculus is very important. Here's an example. Read through the "stem" of the problem and the four sub-parts for question #1 on page 236. Write down all the math vocabulary words that you do not understand. YOU DO NOT HAVE TO FIND OUT THEIR definitions. This is just a preview.

For example, you will see R'(5) in the problem. This is is read "R-prime of 5" and "R-prime" means something in calculus and in the context of this example. At some point in the year, we will come back to this problem, and you will have all the skills and training necessary to solve all four sub-parts of this problem!

Vocabulary words new to you

SPEAKING OF CALCULATORS click here

What Calculator can I use? Review the list of acceptable calculators and confirm that you own an approved calculator. Complete the information below

I own and will bring to class each day a _____

I will be showing you how to maximize the use of a Texas Instrument calculator from the TI-84 family. (TI-83s are okay as well). . I am not fluent in other allowable brands of calculators.

And while we are on the question of technology, list three kinds of technology that a student is NOT permitted to use on the AP exam.

- 1.
- 2.
- 3.

Continue investigating calculator use on the next page \rightarrow

<u>This information</u>, published by Lin McMullen, a long time Calculus teacher and consultant to the College Board, gives you some information about Calculator use (but it might use some language you do not yet understand). However, it is a good starting point.

1) Write down the 4 types of calculations that a student is expected to be able to perform on the exam. (Each is given in **bold type**):

1.

- 2.
- 3.
- 4.

2) How should a student show work when using a calculator to reach the answer for these types of problems? *See also* <u>College Board commentary on Instructions for</u> <u>the Free Response sections of AP Calculus Exams.</u>

3) Finally, the last two-part question about answering questions on the exam. Using the *Commentary on Instructions* resource above, skim through the questions and answers to find the minimal number of decimal places that you should use when writing a free response answer (unless directed otherwise).

4) Should you round your answer to this decimal place or "truncate" (delete the digits) after this decimal place?

Grading and scores

May 2019 was the last year there is <u>data released</u> on an exam that is similar to the one that will be given during May 2022. Clink on the link to answer the following questions:

How many students took the exam that year? _____

What percent of students passed the exam with a 3 or higher? _____

What was the mean score that year? _____

Scores (continued)

The AP exam is graded on a scale of 1 to 5. Now that you have a sense of how many students take the AP calculus exam and the mean score, what does it mean to Colleges and Universities? Many colleges and universities require a score of at least a 3 for an incoming student to place out of an equivalent semester of college calculus. Some will award placement and some both placement and college credit for a 3, 4, or 5. For each of the schools listed below, determine the score required for placement (i.e., you do not have to take that school's calculus course) and the score required for college credit for a calculus course (*note*, it might be the same score). Put the score in the column under the appropriate heading for each school below.

School	Placement AP Score	College Credit AP Score
University of North		
Carolina Chapel		
Washington and Lee		
University		
Kenyon College*		

*Bonus for determining why this college is on the list.

Thanks for taking some time to think about what the end of the year holds in store - the AP exam. Now it is time to focus on the year that just ended by reviewing some Pre-Calculus concepts. You can do this anytime over the summer, (there is actually a learning benefit to waiting a bit rather than doing this right away) but please have this AP Exam scavenger hunt and the Summer Pre-Calculus Review assignment completed before Monday, August 23rd (one week before the first day of classes). Please send it to me as an email attachment **on or before August 23rd**. This will give me a better sense of what we need to review the first couple of weeks of class. I prefer receiving your work as a .pdf (or you can mail a hard copy to VES.) Photos of your work are much harder to grade. There are a few apps for cell phone that turn the photos to .pdfs. Check with your friends or let me know if you need help with this, please. Name: due on/before August 23, 2021

On the graph with the parent function draw and label a sketch of each additional equation in the family. Check your sketch with the graphing calculator.

1) Parent Function:
$$y = x^{2}$$

a) $y = x^{2} - 5$
b) $y = (x - 10)^{2}$
c) $y = -2x^{2}$
d) $y = -(x + 3)^{2} + 6$



2) Parent Function: $y = \sin x$ (set mode to RADIANS) a) $y = \sin x - 2$ b) $y = \sin x - 2$ c) $y = 2\sin x$ d) $y = 2\sin(2x) + 2$ (set mode to RADIANS)

3) Parent Function: $y = \ln(x)$

a)	$y = \ln\left(x+3\right)$
b)	$y = -\ln(x)$
C)	$y = \ln\left(-x\right)$
d)	$y = \ln(x)$



4)	Parent Function:	$y = e^x$
	a) $y = 2e^x$	
	b) $y = e^x + 3$	
	c) $y = e^{-x}$	
	d) $y = 2 - e^x$	



5) Using your calculator (or desmos) set the x "window" to [0,1] and the y "window" to [0,1]. Graph all of the following functions in the same window. List the functions from the highest graph to the lowest graph. a) $y = x^2$

a)	$y = x^2$	b)	$y = x^3$
c)	$y = \sqrt{x}$	d)	$y = x^{\frac{2}{3}}$

e) y = |x| f) $y = x^4$

Highest	Letter
▼	
Lowest	

6) Using your calculator (or desmos) set the x "window" to values greater than 1 [to [0,5] and the y "window" to [0,5]. <u>Graph all of the following functions in the same</u> window. List the functions from the highest graph to the lowest graph when x > 1. a) $y = x^2$ b) $y = x^3$

- c) $y = \sqrt{x}$ d) $y = x^{\frac{2}{3}}$
- e) y = |x|

f) $y = x^4$

Highest	Letter
▼	
Lowest	

More Calculator practice

- 7) Given: $f(x) = x^4 3x^3 + 2x^2 7x 11$ Find all roots to the nearest 0.001
- 8) Given: $f(x) = 3\sin(2x) 4x + 1$ on $[-2\pi, 2\pi]$ Find all roots to the nearest 0.001. Note: All trig functions are radian mode.

Solve the following inequalities.

9) $x^2 - x - 6 > 0$ (this can be calculator or by hand)

- 10) $x^2 2x 5 \ge 3$
- 11) $x^3 4x < 0$
- 12) Where does f(x) = 3x+2 intersect g(x) = -4x-2?
- 13) Given: $f(x) = x^2 5x + 2$ and g(x) = 3 2xFind the coordinates of any points of intersection.

14) If $f(x) = x^4 - 7x^3 + 6x^2 + 8x + 9$

- a) Find the coordinates of the lowest point on the graph.
- b) Find the coordinates of the highest point on the graph.\
- c) Find the interval(s) over which f(x) is increasing

- 15) Given $f(x) = x^2 5x + 4$
- a) Sketch the graph of f(x) on the grid to the right.
- b) By hand, sketch the graph of |f(x)|
- c) By hand sketch the graph of f(x) 2







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- 17) Functions → The ability to work with any type of function is crucial to success in calculus. This section will have you work with functions graphically and analytically, as well as test your knowledge of function notation.
 - A. Determine each of the following using the graph of g(x). Each answer should be in terms of *a*, *b*, *c*, *p*, *q* or *r*.
 - i. $g(q) = _$ iii. $g(g(r)) = _$
 - ii. $-g(p) = _$ vi. $g^{-1}(b) = _$
 - B. Fill in each blank with \langle , \rangle or =.
 - i. g(p) g(0) iii. g(p) g(q) = 0
 - ii. $g^{-1}(c) _ g^{-1}(0)$ vi. $g(0) \cdot g(q) _ 0$
 - C. Given function f(x) such that f(-2) = 5, complete each of the following statements.

p

C

i. One (x, y) coordinate of a point that must be on the graph of $f^{-1}(x)$ is _____.

- ii. If f(x) is an odd function, then the (x, y) coordinates of 2 points that must be on the graph of f(x) are _____ and _____.
- iii. If f(x) is an even function, then the (x, y) coordinates of 2 points that must be on the graph of f(x) are _____ and _____.
- D. Given the function $h(x) = \begin{cases} -2x-4, & x < -2 \\ -(x-1)^2 3, & x \ge 0 \end{cases}$, determine each of the following.
 - i. $h(-2) = _$ ii. $h(0) = _$ iii. $h(5) h(-3) = _$
 - iv. Determine the domain of h(x).
 - v. Determine the range of h(x).
 - vi. If they were defined for all the real numbers, at what point(s) do the two pieces of the function h(x) intersect. i.e. Without using the graphing capabilities of your

calculator, solve the following system of equations $\begin{cases} y = -2x - 4\\ y = -(x - 1)^2 - 3 \end{cases}$