May 2022

Dear Students,

Welcome to AP Calculus! I can't wait to start the year with all of you and have my eye on the prize; the first two weeks of May! It seems like a lifetime from now, but it will be here before we know it. You will be sitting for the AP exam, well rested, well prepared and ready to take on the world.

Looking toward our year together, I am sending a small packet of problems for you to do before school begins. I hope the problems will help us all hit the ground running in September. Please do NOT attempt to do all of the work on the night before school begins. You won't have enough time to ask questions or complete the work carefully and late work is unacceptable. As will be the policy next year, you will not have the opportunity to correct assignments, so please submit the good work that I know you are capable of doing. You would not be signed up for this course if someone did not think you could do it. I have faith in you!

The problems will be **due on the first day of class** and these assignments will be part of your first grades of the quarter. If you need any guidance, please contact me via e-mail or speak with a classmate. You must submit your own work, as you will all year, but you may benefit from discussing the material with your peers. Discussing problems and strategies does NOT mean copying each other's work. This is NEVER acceptable! Yes I will be grading these.

Calculus may be my favorite course to teach and I am looking forward to walking through many doors with you.

Please feel free to contact me with any questions or concerns and get ready for an exciting year!

Sincerely,

Mr. Titcomb
granger.titcomb@gbwl.org

Directions/Expectations:

- In the header please write your name, my name, and the title of the assignment (summer work 1, 2, etc…).
- You **WILL NOT BE ABLE TO COMPLETE THEM ALL IN ONE NIGHT!**
- I also wouldn't do them all right away. It is good to see what you remember after a little break from school.
- Please do the problems in order and number them. Do **NOT** try to do the problems on these sheets.
- Keep each assignment separate as they may be graded and returned separately.
- Staple your sheets for each assignment together. No other method of attaching sheets is acceptable.
- Arriving at class without stapled and labeled work is arriving **UNPREPARED**.
- Clearly identify answers, unless the answer is to show or verify something.
- **Show all of your work** and simplify your answers.
- All graphs must be labeled. This includes axes, scale and any other important features.
- **Do not use a calculator** for any of these problems. You are on your honor. You will be expected to be able to work without one on many quizzes and exams and large portions of the AP exam.
- Submit neat work that another human being can read easily. Illegible = no credit = not good for you. Write big enough to read!!!!!!
- Do not cramp your work so that comments cannot be made. No room = no comments = not good for you.
- Write the problem so that this serves as a reference. Answers out of context will be of no use to you. The AP graders have a name for this: bald answers. They receive NO credit!
- Submit your best work.

Assignment 1

1. Simplify the following: (no negative or zero exponents in final answer)

a. $\dfrac{x^3}{x^{-5}}$	b. $\dfrac{2x^3}{y^{-5}} \cdot \dfrac{y^2}{3x^7}$	c. $x^{\frac{1}{3}} \cdot x^{\frac{3}{5}}$

2. Multiply $(x+2)^2$

3. Simplify $\dfrac{x-4}{4-x}$

4. Simplify $\dfrac{x^2-4x-5}{x^2+2x+1}$

5. Given the point $P\left(-1, \dfrac{4}{3}\right)$
   a. Find an equation for the vertical line through *P*.
   b. Find an equation for the horizontal line through *P*.

6. Write the point-slope equation for the line through $P(0,3)$ with slope, $m = 2$.

7. Write the slope-intercept equation for the line with slope $m = \dfrac{1}{3}$ and *y*-intercept $b = -1$.

8. Write a general linear equation for the line through the two points (-2, 1) and (2, -2).

9. Use the x- and y-intercepts to graph the line $3x + 4y = 12$. Label the graph, including the intercepts.

10. Given $P(-2,4)$ and the line *L*: $x = 5$
    a. Write an equation for the line through *P* that is parallel to *L*
    b. Write an equation for the line through *P* that is perpendicular to *L*

11. Write an equation for the line with *x*-intercept 3 and *y*-intercept -5.

12. Write an equation for the line $y = f(x)$, where *f* has the following values

x	-2	2	4
f(x)	4	2	1

Assignment 2

Solve each equation for all real values of x. (check for extraneous solutions in # 1, 4, and 5)

1. $\dfrac{2}{x+1}=\dfrac{x-2}{2}$

2. $x^2-9x+9=0$

3. $\dfrac{1}{x}+x=4$

4. $\dfrac{5}{e^x+1}=1$

5. $\sqrt{x-1}-\dfrac{5}{\sqrt{x-1}}=0$

6. Given $f(x)=3x^2-x-1$, find $f(0)$ and $f(-2)$.

7. Is x = -1 a zero of the function $p(x)=x^3-3x^2-x+3$? Why or why not?

8. The sides of a rectangle are x and $3-2x$.
   a. Express the rectangle's area as a function of x.
   b. Express the rectangle's perimeter as a function of x.
   c. Explain why x cannot equal 2.

9. The height and diameter of a cylinder are equal. Express the volume of the cylinder as a function of its radius.

10. Find the average rate of change of $f(x)=3\sqrt{x}$ (or if you prefer to think of it as the slope of the secant line) over the interval [4, 25]

11. A car travels 297 miles in a period of 270 minutes. Find the average velocity of the car in miles per hour over this time period. (Observe that your answer should be in miles/hour and you are given information in units of minutes. A change of units will be necessary. Also recall that the average velocity is the average rate of change in position with respect to time, that is, change in distance divided by time elapsed.)

Assignment 3

1. Determine if the function is even or odd algebraically. That means look at $f(-x)$.
   a. $f(x)=x^4$
   b. $f(x)=x+2$

Use interval notation to express the domain and range.

2. Given $y=4-x^2$
   a. Find the domain
   b. Find the range
   c. Sketch the graph

3. Given $y=\sqrt{x-1}$
   a. Find the domain
   b. Find the range
   c. Sketch the graph

4. Given $y=\dfrac{1}{x+3}$
   a. Find the domain
   b. Find the range
   c. Sketch the graph

5. Given $y=|x+4|-3$
   a. Find the domain
   b. Find the range
   c. Sketch the graph

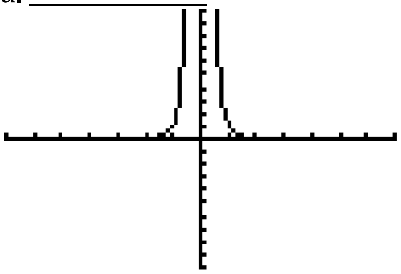
6. Graph both functions $f(x)=\dfrac{x^2-9}{x-3}$ and $g(x)=x+3$
   a. Are the domains equal?
   b. Does *f* have a vertical asymptote? Explain.
   c. Explain why the graphs appear to be identical. Describe their differences.
   d. Are the functions identical? Explain why.

7. Sketch the graph of the piecewise function

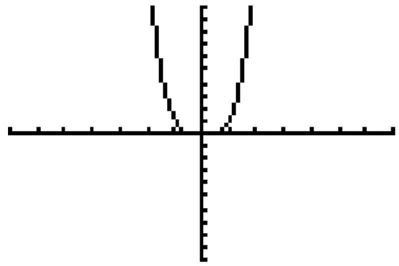
$$f(x)=\begin{cases} 3-x & , \quad x\le 1 \\ 2x & , \quad 1<x \end{cases}$$

8. Without using a graphing calculator, match the graphs with their functions listed below and right *i* – *v*. Each viewing window is [-7,7] by [-10, 10]
(You don't need to reproduce the graphs, this time, and this time ONLY; just write the answers.)

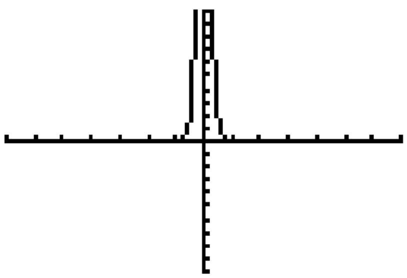
a. ____________



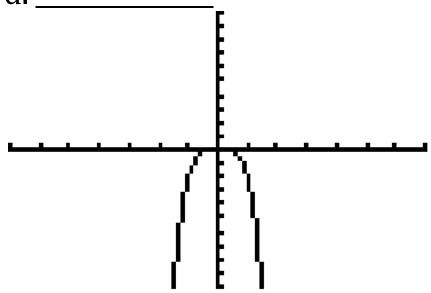
b. ____________



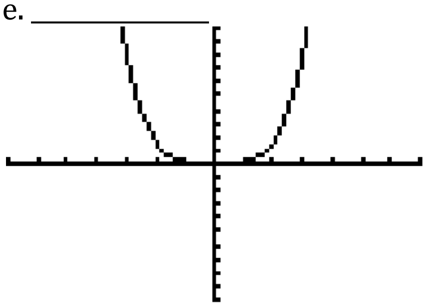
c. ____________



d. ____________



e. ____________



i. $f(x) = x^{-4}$

ii. $f(x) = -2x^{4}$

iii. $f(x) = \left(\frac{1}{10}\right)x^{-4}$

iv. $f(x) = x^{4}$

v. $f(x) = \left(\frac{1}{10}\right)x^{4}$

Assignment 4

1. Sketch the graphs of $y = 2^x$ and $y = \log_2 x$. Label your graphs clearly including asymptotes and at least two points on EACH graph.
2. Find the domain of $y = -3\log(x+2)$. Tell what the "parent" function is and how the graph of this function relates to it in terms of shifts, stretches and reflections. You need NOT graph it, just describe the graph.
3. Use properties of exponents to decide which pair of functions are identical: $y_1 = 3^{2x+4}$, $y_2 = 3^{2x} + 4$, $y_3 = 9^{x+2}$
4. Complete the statement to illustrate the property of logarithms
   a. Product rule: $\log_3 5x =$ ____________________
   b. Quotient rule: ____________________ $= \log y - \log 17$
   c. Power rule: $\ln 2^{-5} =$ ____________________
5. If possible, find a pair of numbers x and y such that xy = 6 but it is not true that $\ln 6 = \ln x + \ln y$
6. Use properties of logarithms to expand $\log_3\left(a^2\sqrt{b}\right)^4$
7. Use properties of logarithms to condense $3\log_4 x + \frac{1}{2}\log_4 x^2$. Assume $x > 0$
8. Solve each equation

a. $4^{1-2x} = 2$	b. $\log_x 64 = -3$	c. $\log_3\sqrt{x-2} = 2$
d. $25^{2x} = 5^{x^2-12}$	e. $9^{2x} = 27^{3x-4}$	f. $2^{x-1}\cdot 8^{-x} = 4$

9. Given $f(x) = x^3 - 1$, find $f^{-1}(x)$ and verify that $(f^{-1}\circ f)(x) = (f\circ f^{-1})(x) = x$

Assignment 5

1. Draw a 30^0-60^0-90^0 triangle. Let the hypotenuse have length 2. Find the lengths of the other two sides.

2. Draw a 45^0-45^0-90^0 triangle. Let the hypotenuse have length $\sqrt{2}$. Find the lengths of the other two sides.

3. Convert each angle in degrees to radians. Express your answer as a multiple of π.

   135^o $\quad$ 210^o $\quad$ 18^o $\quad$ 15^o

4. Convert each angle in radians to degrees.

   $\frac{5\pi}{4}$ $\quad$ $\frac{2\pi}{3}$ $\quad$ $-\frac{5\pi}{2}$ $\quad$ $-\frac{3\pi}{2}$

5. $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) =$

6. $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) =$

7. $\tan^{-1}(1) =$

Solve each equation on the interval $0 \le \theta < 2\pi$

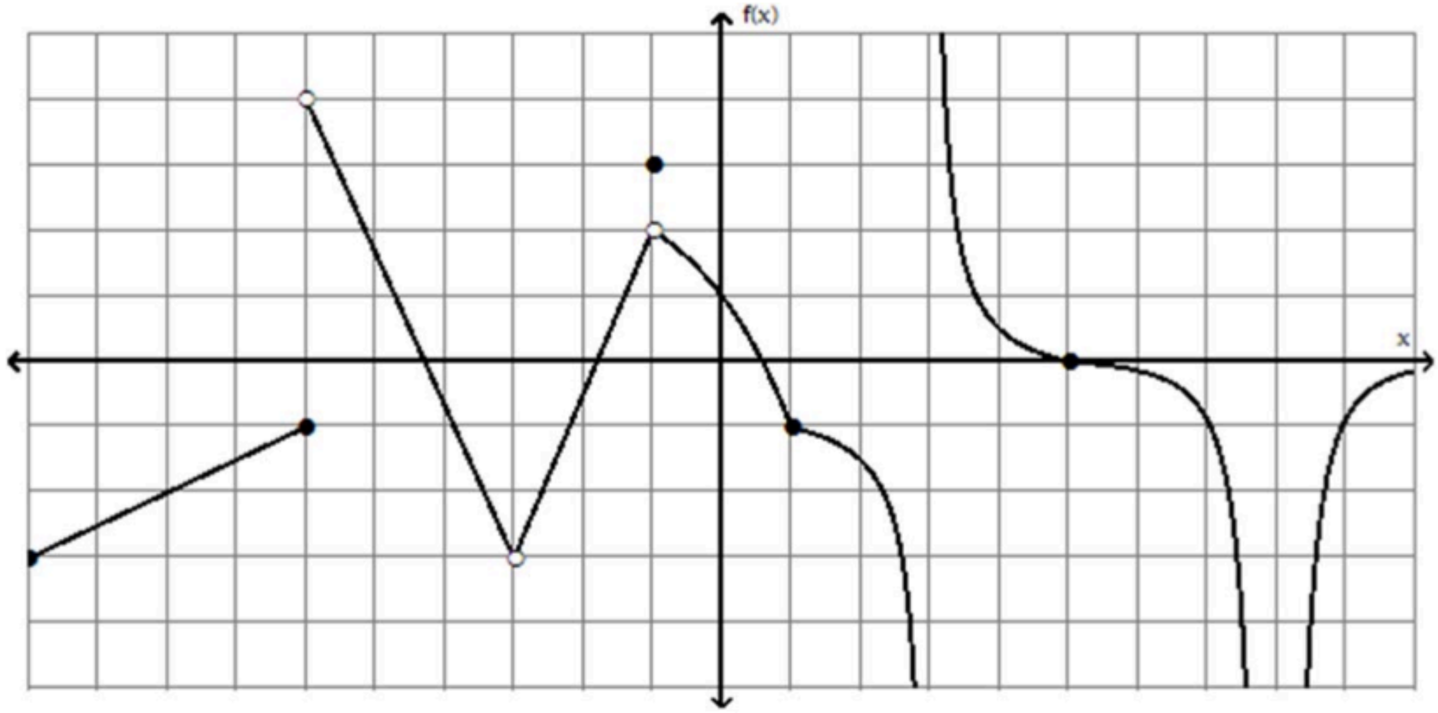
8. $\cos\theta = \frac{1}{2}$

9. $\sin(2\theta) + 1 = 0$

10. $2\cos\theta + \sqrt{2} = 0$

11. Sketch one period of the graph of $y = \sin(2x)$

12. Sketch two periods of the graph of $y = 2\tan x$



For 13-17, use the graph above.

13. $\lim\limits_{x \to 0} f(x) =$

14. $\lim\limits_{x \to -6^+} f(x) =$

15. $\lim\limits_{x \to -1} f(x) =$

16. For what values of x would the limit of f(x) not exist?

17. What value for f(-3) would make f continuous at x = -3

18. Determine where f is discontinuous. Be sure to support your answer with work.

$$f(x) = \begin{cases} -4, & x \le 3 \\ x - 7, & 3 < x < 5 \\ x^2 - 10, & x \ge 5 \end{cases}$$

19. $\lim\limits_{x \to 2^-} \dfrac{x+2}{x-2}$

20. $\lim\limits_{x \to 0} \dfrac{x^2 - 3x}{x}$

Assignment 6

1. Graph the polar coordinate $\left(-3,\ -\frac{\pi}{3}\right)$

2. Graph the polar coordinate $\left(3,\ -\frac{3\pi}{2}\right)$

3. Change the given rectangular coordinates into polar coordinates. $(-3,\ 3)$

4. Change the given polar coordinates into rectangular coordinates. $(0,-1)$

For 5-8, convert each rectangular equation to polar equation that expresses r in terms of θ.

5. $y = -x$

6. $y = -2$

7. $x + 5y = 8$

8. $x^2 + (y+3)^2 = 9$

For 9-11, convert each polar equation to a rectangular equation.

9. r = 9

10. $r = \frac{-6}{\cos\theta}$

11. $r = 3\sin\theta$

For 12-15, graph the polar equation.

12. $r = -4\sin\theta$

13. $r = 1 - \cos\theta$

14. $r = 3\sin 2\theta$

15. $r = 2 + 3\sin\theta$

16. Sketch the vector as a position vector $\vec{v} = 4\vec{i} - 2\vec{j}$

17. Eliminate the parameter t. Write the equation on the line given. Then sketch the parametric equation using arrows to show increasing values of t. $x = t - 3$ $y = t^2$

Assignment 7

For 1-2, write the first four terms of the given sequence given the general or recursive formula.

1. $a_n = \dfrac{2n-3}{n+1}$

2. $a_n = \dfrac{-5n!}{(n+1)!}$

For 3-6, evaluate the given sum.

3. $\displaystyle\sum_{i=3}^{8} \pi$

4. $\displaystyle\sum_{k=1}^{4} (-1)^k (k-5)$

5. $\displaystyle\sum_{i=1}^{6} (2i+2)$

6. $\displaystyle\sum_{k=1}^{4} \left(-\frac{1}{4}\right)^k$

For 7-8, express the given sum using sigma notation. Use 1 as the lower limit of summation.

7. $2^2 + 3^4 + 4^6 + \ldots + 10^{18}$

8. $7 - \dfrac{8}{2} + \dfrac{9}{3} - \ldots + \dfrac{15}{9}$

For 9-10, given the first four terms of the given sequence, find the sum of the first 20 terms. You can leave your answer in the formula since you do not have a calculator.

9. $-3,\ 1,\ 5,\ 9, \ldots$

10. $2,\ -6,\ 18,\ -54, \ldots$

11. Find the 30th term of the sequence given in number 10 (You may leave your answer as a formula).

12. Find the sum of the infinite geometric series given. $\displaystyle\sum_{i=1}^{\infty} 8(.1)^i$