I am excited that you've selected to take AP Calculus AB as part of your schedule for the 2023-2024 school year! The first requirement of the course is to complete the summer assignment that I've attached. This will be due the first day of class and will be graded. Please be sure to follow all directions provided in the packet. You may work together on this and the entire point of this assignment is to come to class with these concepts fresh in your mind and be sure you understand how you've gotten your answers. You will have your first quiz within the first few days of the start of school and it will contain the topics completed in your summer assignment.

You will need to purchase the following for the class:

- a 3-ring binder (either one 3" binder or two 1 ½" binders)
- a graphing calculator (TI-84 PLUS or TI-NSpire is recommended)
- a set of index cards.

The index cards may be in tablet form, attached with a ring, or held together by a rubber band. You won't need these the first day of class, but you will shortly thereafter so you may want to get these materials over the summer.

Also, I want to remind you that this class is designed to have students achieve success on the AP Exam that is offered in May. All students taking this course should have the intent to take the exam and possibly earn college credits. **If you have no desire to take the AP exam, you should reconsider your enrollment in this course.**

Have a wonderful summer and I hope to see you on August 24th !

~ Mrs. Grim ~
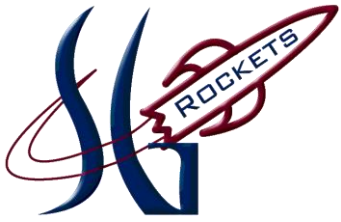
You will need to know the following from memory for AP Calculus:

- All trigonometric values on the unit circle (without constructing the circle)

- Surface Area of common geometric shapes, including cubes, rectangular prisms, spheres, cones, and pyramids

- Volume of common geometric shapes, including cones, spheres, pyramids, rectangular prisms, and cubes.

- Logarithmic properties

- Graphs of parent functions

- Common trigonometric identities, including reciprocal identities and Pythagorean identities.

Actually, you will need to know quite a bit more than this. I've only listed items that I've seen multiple students struggle with in the past. Algebra plays a vital role in calculus success, so it is imperative that you know your algebraic properties and are efficient in simplifying expressions. All of the above listed material may be on your quiz at the beginning of the year.
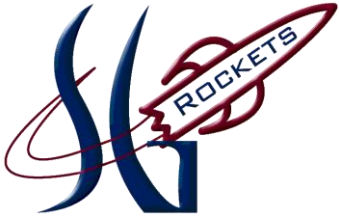
Spring Grove High School
AP Calculus Summer Assignment

Complete the following. Show and attach all work in a clear manner. **Do NOT do any work on this sheet ~ all work must be separate.** Please place your final answers on the sheet provided. Have this assignment completed and ready to turn in on the first day of school.

1. Are the following statements true? If not, explain why not.

   a. $\dfrac{2k}{2x+h} = \dfrac{k}{x+h}$

   b. $\dfrac{1}{p+q} = \dfrac{1}{p} + \dfrac{1}{q}$

   c. $\dfrac{x+y}{2} = \dfrac{x}{2} + \dfrac{y}{2}$

   d. $3\dfrac{a}{b} = \dfrac{3a}{3b}$

   e. $3\dfrac{a}{b} = \dfrac{3a}{b}$

   f. $3\dfrac{a+b}{c} = \dfrac{3a+b}{c}$

2. Simplify:

   a. $\dfrac{x/2}{x/4}$

   b. $h \div \dfrac{(x+h)}{h}$

   c. $\dfrac{\sqrt{x-2}+\dfrac{5}{\sqrt{x-2}}}{x-2}$

3. Solve $x\dfrac{dy}{dx} + y = 1 + \dfrac{dy}{dx}$ for $\dfrac{dy}{dx}$ (note: $\dfrac{dy}{dx}$ is a variable)

4. Solve the equations. List all solutions, even if they are imaginary.

   a. $4x^2 - 21x - 18 = 0$

   b. $2x^2 - 3x + 3 = 0$

   c. $x^4 - 9x^2 + 8 = 0$

5. Write as a single fraction with denominator in factored form: $\dfrac{7x^2+5x}{x^2+1} - \dfrac{5x}{x^2-6}$

6. Simplify the complex fraction: $\dfrac{\dfrac{a}{b} - \dfrac{b}{a}}{a-b}$

7. Solve $\ln y = kt$ for y.

8. Simplify each expression:

a. $\dfrac{(x^2)^3 x}{x^7}$

b. $(\sqrt{x})(\sqrt[3]{x})(x^{\frac{1}{6}})$

c. $\dfrac{5(x+h)^3 - 5x^3}{h}$

d. $\dfrac{3(x+h)^2 - 3x^2}{h}$

e. $\dfrac{\frac{x^2-1}{x}}{\frac{x+1}{x^3}}$

f. $\dfrac{\frac{1}{x} + \frac{4}{x^2}}{3 - \frac{1}{x}}$

g. $\dfrac{\frac{a}{2x+h} - \frac{a}{2x}}{h}$

h. $\dfrac{1}{1-2a} - \dfrac{2}{1+2a} + \dfrac{6a+2}{4a^2-1}$

i. $\sqrt{2x}\sqrt{3x}\sqrt{8y^3}$

For the following problems, simplify using factoring of binomial expressions. An example has been provided below:

$$\text{Example: } \dfrac{(x+1)^3(4x-9)-(16x+9)(x+1)^2}{(x-6)(x+1)} = \dfrac{(x+1)^2[(x+1)(4x-9)-(16x+9)]}{(x-6)(x+1)}$$

$$= \dfrac{(x+1)^2[4x^2-5x-9-16x-9]}{(x-6)(x+1)}$$

$$= \dfrac{(x+1)^2(4x^2-21x-18)}{(x-6)(x+1)}$$

$$= \dfrac{(x+1)^2(4x+3)(x-6)}{(x-6)(x+1)}$$

$$= (x+1)(4x+3)$$

9. $(x-1)^3(2x-3) - (2x+12)(x-1)^2$

10. $\dfrac{(x-1)^2(3x-1) - 2(x-1)\cdot 3}{(x-1)^4}$

11. $\dfrac{(x-1)^3(2x-3) - (4x-1)(x-1)^2}{(x-1)^2(2x-1)}$

Solve each equation for x over the set of real numbers.

12. $\dfrac{2x-7}{x+1} = \dfrac{2x}{x+4}$

13. $\sqrt{x^2 - 9} = x - 1$

14. $2x^4 + 3x^3 - 2x^2 = 0$

15. Given $f(x) = x^2 + 3x + 4$, find $f(x + 2) - f(2)$

16. Find the surface area of a box of height h whose base dimensions are p and q, and that satisfies the following condition:

    a. The box is closed
    b. The box has an open top
    c. The box has an open top and a square base with side length p

Use your knowledge of the unit circle to evaluate each of the following. Leave your answers in radical form. Please do not list the general term, only the specific term.

17. $\sin 30°$

18. $\cos \dfrac{2}{3}\pi$

19. $\csc \dfrac{5}{6}\pi$

20. $\tan\left(-\dfrac{\pi}{6}\right)$

21. $\sin^{-1}\left(\dfrac{\sqrt{2}}{2}\right)$

22. $\tan^{-1}(1)$

Solve each trigonometric equation for $0 \leq x \leq 2\pi$.

23. $tan^2 x = 1$

24. $\cos\frac{x}{2} = \frac{\sqrt{2}}{2}$

25. $2sin^2 x + sinx - 1 = 0$

Expand each of the following using the laws of logs.

26. $log_3 5x^2$

27. $\ln\frac{5x}{y^2}$

Solve each exponential or logarithmic equation:

28. $\ln x = 2 + \ln 2$

29. $8^{\frac{-2}{3}} = 2x$

30. $log_x \frac{1}{9} = -2$

Solve the following for x: Exact answers only (no calculators)

31. $e^{e^x} = 3$

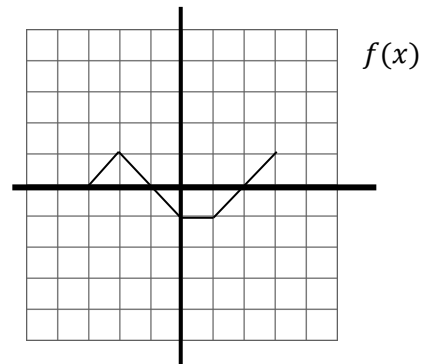32. $\ln(e^{3x}) = 7$

33. Sketch the graph of the function: $f(x) = \begin{cases} 1 & x < 0 \\ 2 & x = 0 \\ -x & x > 0 \end{cases}$

34. What is the domain of the following function? $f(x) = \frac{x^2-1}{x+1}$

35. Simplify $\frac{x-4}{\sqrt{x-4}}$

36. Use the graph of $f(x)$ to answer the following:

    Scale: 1 unit

    $f(x)$

    a. On what interval(s) is $f(x)$ increasing?
    b. On what interval(s) is $f(x)$ decreasing?
    c. On what interval(s) is $f(x)$ constant?
    d. Sketch $|f(x)|$

37. Sketch $y = |\cos x|$

38. Make a conjecture as to what the absolute value bars do to a standard graph problem.

39. Write an equation of the vertical line passing through the point $(7, \pi)$.

40. Write an equation for the line perpendicular to $2x - 4y = 8$ passing through the point $(1, -2)$.

41. Find all points in which the following graphs intersect: $x^2 + y = 6$ *and* $x + y = 4$

Answer Sheet: Name: _____

   1. a. _____

        b. _____

        c. _____

        d. _____

        e. _____

        f. _____

   2. a.   b.   c.

   3.

   4. a.   b.   c.

   5.

   6.

    7.

   8. a.   b.   c.   d.

      e.   f.   g.   h.   i.
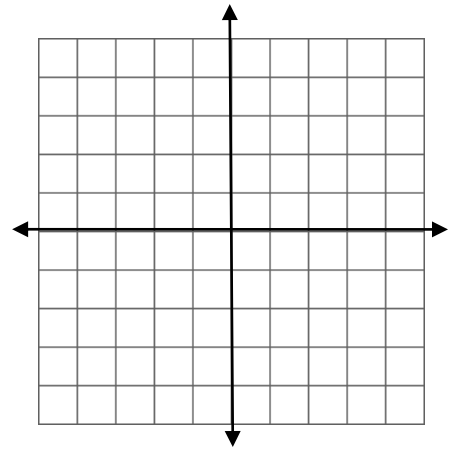
9.

10.

11.

12.

13.

14.

15.

16. a.   b.   c.

17.   29.

18.   30.

19.   31.

20.   32.
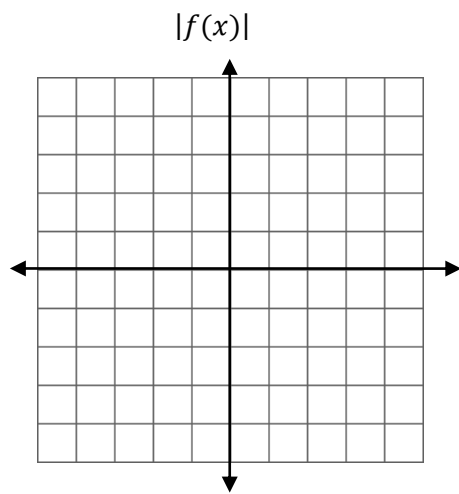
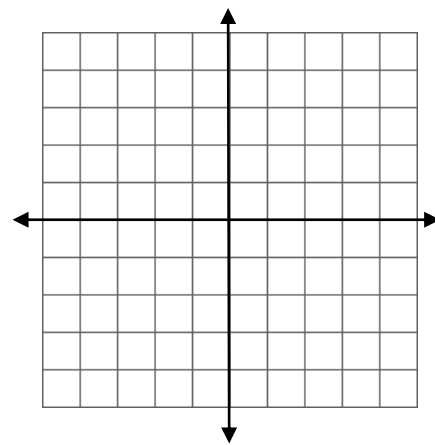21.   33.

22.

23.

24.

25.   34.

26.

27.   35.

28.

36. a.

b.

c.

d. $|f(x)|$

37. $y = |\cos x|$

38.

39.

40.

41.