Honors Calculus
Summer 2023

Welcome to Honors Calculus. I hope this course proves to be a challenging yet rewarding endeavor for you. Calculus will be unlike any other math class you may have taken, filled with new ideas, concepts, and applications.

While the material may be new, solving the problems that are presented in this course will require a strong foundation in problem solving. This summer assignment focuses on the skills that will be necessary to be successful in Calculus. All the problems in this packet require the tools that you have learned in Algebra and Precalculus.

Please read all directions carefully. All answers are to be placed on the last 3 pages in their designated spots. You are free to write on the packet, but please make sure your work is neat and organized. On some sections of this assignment, it is recommended that you not use a calculator.

This entire packet will be turned in on the first day of class (8/28 for 11th graders and 8/29 for 12th graders), and will be counted for a grade. If you would like to use scrap paper, you may attach all loose-leaf paper to the assignment and include it when you turn in your work.

If there are any questions or concerns that you may have during the summer please feel free to e-mail me at twaltrich@gmahs.org. I would recommend that you do not do the entire packet at one time, but rather, spread out the assignment over the entire summer. And do not what until the last minute to begin your work.

Best of luck to you this summer and I look forward to a great year.

Mr. Waltrich

Simplify the following statements.

1. $\dfrac{x^2 + 4x - 12}{x^2 + 6x - 16}$

2. $\dfrac{x^3 - 7x^2 - 8x}{x^3 - 8x^2 - 2x + 16}$

3. $\dfrac{x^3}{\sqrt{x}}$

4. $\left(125x^{\frac{2}{3}}\right)^{\frac{1}{3}}$

5. $e^{3+\ln x}$

6. $\ln e^{4x}$

Expand the following using the Laws of Logs.

7. $\log \dfrac{\sqrt{a}}{b}$

8. $\log \dfrac{\sqrt[3]{x^2}}{y^4}$

Find the following products.

9. $(3x + 4)(2x - 5)$

10. $(4x - 1)(4x + 1)$

11. $(5x - 3)(5x + 3)$

12. $(a + b)(a - b)$

13. $(x - 5)(x - 5)$

14. $(x + 7)(x + 7)$

15. $(x - 5)^2$

16. $(x + 4)^2$

17. $(2x - 1)^2$

18. $(x + y)^2$

Factor the following statements completely.

19. $2x^2 + x - 15$

20. $12x^2 - 19x - 18$

21. $8x^3 - 26x^2 + 17x + 6$

22. $x^4 - 8x^3 + 18x^2 - 27$

Find the exact values of the following without using a calculator.

23. $\sin\dfrac{\pi}{6}$

24. $\cos\dfrac{7\pi}{4}$

25. $\tan\dfrac{3\pi}{4}$

26. $\cos 3\pi$

27. $\tan\dfrac{5\pi}{3}$

28. $\sec\dfrac{5\pi}{4}$

29. $2\sin 60°$

30. $\cos^2 30°$

31. $\sin 60°\cos 30° + \cos 60°\sin 30°$

32. $(1 + \csc 45°)^2$

33. $-\tan^2 60° + \sec 60°$

34. $\dfrac{\sec 30°}{\csc 30°}$

Verify the following identities.

35. $(\sin x + \cos x)^2 = 1 + 2\sin x \cos x$

36. $\cot 2x = \dfrac{\cot x - \tan x}{2}$

Solve the following equations. Give exact answers only.

37. $6x^2 - 17x + 7 = 0$ 38. $20x^2 + 62x - 15 = 9$

39. $10x^2 - 36x - 9 = 7$ 40. $x^2 - 21x - 60 = 0$

41. $6x^3 - 17x^2 - 5x + 6 = 0$ 42. $x^4 + 4x^3 + 6x^2 + 4x + 1 = 0$

Solve the following Trig equations. Give exact answers in radians on the interval [0, 2π).

43. $3\tan^2 x = 1$ 44. $2\sin^2 x + 3\cos x - 3 = 0$

45. $2\cos(3x) = 0$ 46. $\sin x + \sqrt{2} = -\sin x$

Solve the following equations. Round answers to 4 decimal places.

47. $3\log_4(2x - 3) = 12$ 48. $2 + 5\ln(3x) = 17$

49. $4^{2x-3} = 27$ 50. $3e^{2x} - 11e^x - 4 = 0$

51. A wire 24 inches long is cut into 4 pieces to form a rectangle whose shortest side has length x. Express the area of the rectangle as a function of x. Determine the Domain and Range of the function.

52. The distance a ball travels when thrown vertically upward from ground level is

$$d(t) = -16t^2 + 48t$$

where t is the time in seconds and d is the distance in feet.

   a) Find the time when the ball reaches its maximum.
   b) What is the ball's maximum height?
   c) How long is the ball in the air?

53. Suppose you start driving away from Gwynedd Valley in a car at 12:00 noon. At any time x hours after your trip starts, your distance away from Gwynedd Valley (in miles) is given by the function $f(x) = -x^5 + 12x^4 - 54x^3 + 95x^2$. You drive for 5 hours.

   a) Draw a graph of this function. Use window $0 \le x \le 6$ and $-50 \le y \le 200$.
   b) Create a table, including all integer values of x from 0 to 6.
   c) Find f(2). Give units for the answer and interpret in terms of the problem.
   d) Find f(4.5). Give units for the answer and interpret in terms of the problem.
   e) Find the average rate of change of f(x) from 1 to 2.5. Give units for the answer and interpret in terms of the problem.
   f) Find the average rate of change of f(x) from 1.5 to 2.5. Give units for the answer and interpret in terms of the problem.
   g) Find the average rate of change of f(x) from 1.9 to 2.1. Give units for the answer and interpret in terms of the problem.
   h) Find the average rate of change of f(x) from 1.99 to 2.01. Give units for the answer and interpret in terms of the problem.
   i) Find the average rate of change of f(x) from 1.999 to 2.001. Give units for the answer and interpret in terms of the problem.
   j) Find the average rate of change of f(x) from 1.9999 to 2.0001. Give units for the answer and interpret in terms of the problem.
   k) What do you notice about the values from g to j?

54. Fill in the following charts:

$f(x) = x^2 - 4x + 2$

x =	5	5.5	5.75	5.875	5.99	6.01	6.125	6.25	6.5	7
f(x) =										

a) What is f(6)?

$f(x) = \dfrac{x^2 - x - 12}{x - 4}$

x =	3	3.5	3.75	3.875	3.99	4.01	4.125	4.25	4.5	5
f(x) =										

b) Why does f(4) give an error?

c) When x gets closer to 4, what value does the function approach?

$f(x) = \dfrac{\sin x}{x}$ (use radian mode)

x =	-1	-0.1	-0.01	-0.001	0.001	0.01	0.1	1
f(x) =								

d) As x approaches 0, what does the value of f(x) approach?

$f(x) = \left(1 + \dfrac{1}{x}\right)^x$

x =	-100000	-1000	-100	-10	-1	1	10	100	1000	1000000
f(x) =										

e) As x gets really large, what does the value of f(x) approach?

f) As x gets really small, what does the value of f(x) approach?

Answers:

1. _____   2. _____

3. _____   4. _____

5. _____   6. _____

7. _____   8. _____

9. _____   10. _____

11. _____   12. _____

13. _____   14. _____

15. _____   16. _____

17. _____   18. _____

19. _____   20. _____

21. _____   22. _____

23. _____   24. _____

25. _____   26. _____

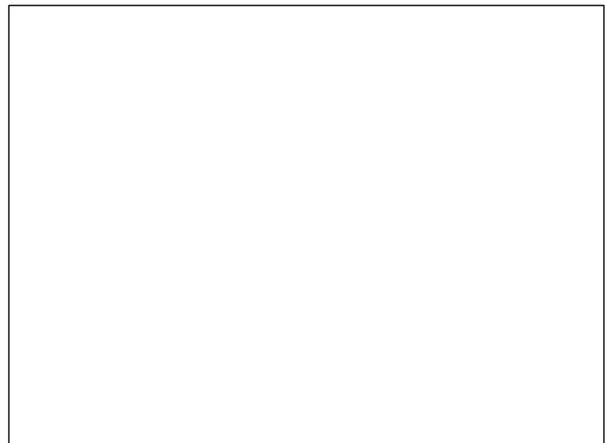27. _____   28. _____

29. _____   30. _____

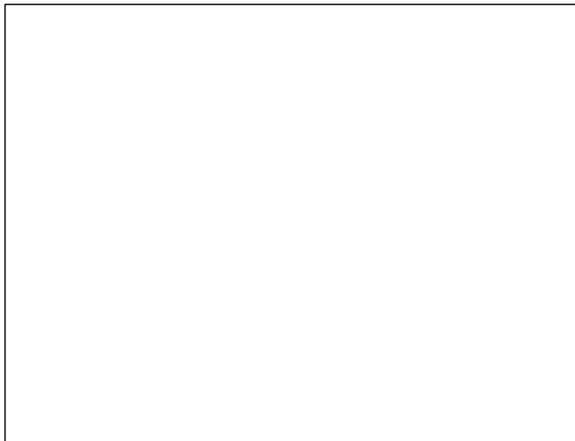31. _____   32. _____

33. _____   34. _____

35.   36.

37. _____

38. _____

39. _____

40. _____

41. _____

42. _____

43. _____

44. _____

45. _____

46. _____

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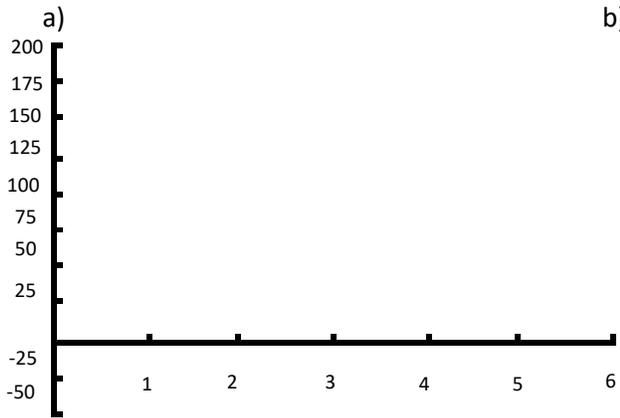
50. _____

Word Problems:

51. Area = _____

52. a) _____

    Domain = _____

    b) _____

    Range = _____

.   c) _____

53.

a)

b)

x	f(x)
0	
1	
2	
3	
4	
5	
6	

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____

j) _____

k) _____

54.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____